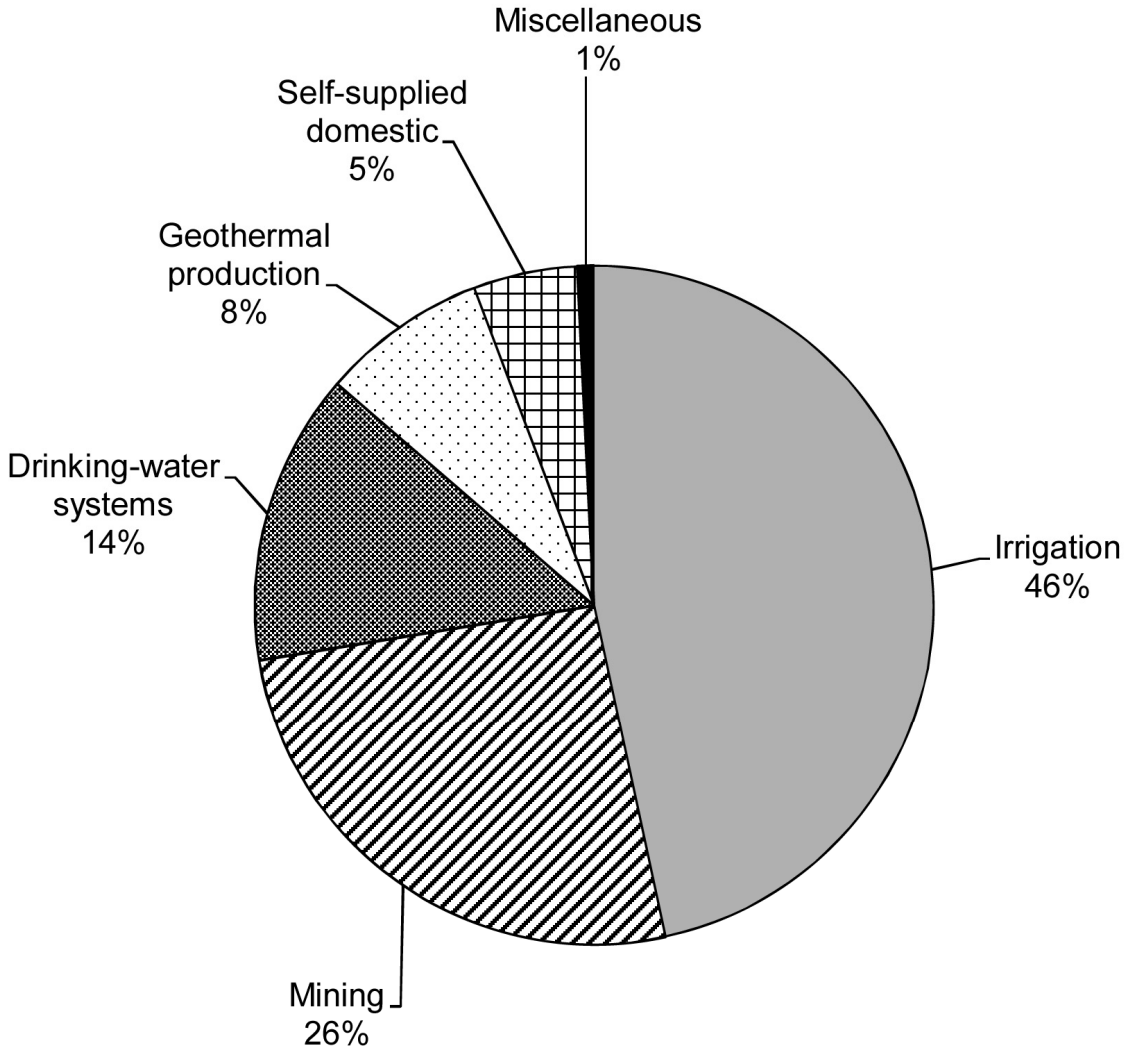


Figure 3-72. Groundwater usage in Nevada in 2000.
(Source: DIRS 175964-Lopes and Evetts 2004, p. 7.)

There are a number of published estimates of perennial yield for many of the hydrographic areas in Nevada, and those estimates often differ by large amounts. The perennial-yield values listed in Table 3-35 predominantly come from a single source, the Nevada Division of Water Planning (DIRS 103406-Nevada Division of Water Planning 1992, for Hydrographic Regions 10, 13, and 14); therefore, the table does not show a range of values for each hydrographic area. In the Yucca Mountain area, the Nevada Division of Water Planning identifies a combined perennial yield for hydrographic areas 225 through 230. DOE obtained perennial yields from *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel 1999, pp. 6 to 12) to provide estimates for hydrographic areas the Caliente rail alignment would cross: 227A, 228, and 229. That 1999 document presents perennial-yield estimates from several sources. Table 3-35 lists the lowest (that is, the most conservative) values cited in that document, which is consistent with the approach DOE used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-136).

Table 3-35 also summarizes existing annual ***committed groundwater resources*** for each hydrographic area along the Caliente rail alignment. However, all committed groundwater resources within a hydrographic area might not be in use at the same time. Table 3-35 also includes information on pending annual duties within each of these hydrographic areas. A ***pending annual duty*** represents the amount of water for which an appropriation application has been submitted to the State Engineer for consideration and that the State Engineer has classified as a pending annual duty value within a hydrographic area in accordance with applicable state statutes. Unless otherwise noted, the source of data for pending annual duties in the hydrographic areas the alignment would cross is the Water Rights Data Update (DIRS 183992-Luellen 2007, all). These data were acquired on May 30, 2007.

As part of an effort to assess water resources in the vicinity of the Caliente rail alignment, DOE performed studies to identify groundwater conditions, the locations of springs, seeps, and other surface-water-right locations, and the locations, use, and water-rights status of groundwater-supply wells within 32 kilometers (20 miles) of either side of the centerline of the rail alignment. Information on groundwater characteristics in hydrographic areas the rail alignment would cross and identified groundwater uses and use types within the 62-kilometer (39-mile) search area are compiled in the *Water Resources Assessment Report, Caliente Rail Corridor, Yucca Mountain Project, Nevada, Task 3.4, Rev. 0* (the Water Resources Assessment Report, Caliente Rail Corridor) (DIRS 182821-Converse Consultants 2007, all). DOE reviewed several other published reports and maps providing information regarding hydrogeologic and groundwater characteristics in hydrographic areas the rail alignment would cross to obtain information to support the groundwater resources impacts assessment.

DOE reviewed several well, water-rights, and spring databases, including Nevada Division of Water Resources (NDWR) and U.S. Geological Survey National Water Information System (USGS NWIS) databases to identify existing wells with certificated water rights, permitted (PER) wells, domestic wells, springs, seeps, and other surface-water-right locations within the potential region of influence of proposed new groundwater withdrawal wells. Unless noted otherwise, the sources for the spring, seep, other surface-water-right location, and well data in this section are as follows: DIRS 176325-USGS 2006, all; DIRS 177712-MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all; DIRS 183992-Luellen 2007, all; DIRS 184045-Luellen 2007, all; DIRS 177293-MO0607PWMAR06D.000, all; DIRS 177294-MO0607USGSWNVD.000, all; DIRS 182821-Converse Consultants 2007, all; and DIRS 176979-MO0605GISGNISN.000, all. An initial screening process identified existing wells within 1.6 kilometers (1 mile) of the centerlines of the respective alternative segments, or within 1.6 kilometers of DOE-proposed new wells. As described later in this section, before analyzing potential impacts to groundwater resources, DOE extended the search radius for identifying existing beneficial-use wells, springs, seeps, or other surface-water-right locations up to 2.8 kilometers (1.75 miles) away from a proposed new well if the initial search for such wells or springs within 1.6 kilometers did not reveal the presence of any such wells, springs, seeps, or other surface-water-right locations. Additional well locations identified for consideration included PER wells. Also considered were proposed future wells for which water-rights applications had been submitted to the State Engineer and that had been assigned a status of "Ready for Action (RFA)" or "Ready for Action, Protested (RFP)" by the State Engineer at the time the data were acquired (Section 5.2.1.3.2). Additionally, on a case-by-case basis (see Section 4.2.6 and Appendix G), for a selected set of new groundwater withdrawal wells specifically targeted for installation within a fault zone or an extensive fracture zone, DOE identified the locations of existing wells and springs, seeps, or other surface-water-right locations up to 10 kilometers (6 miles) away from each such proposed well (to address the possibility of fault zones or extensive fracture zones acting as conduits for groundwater flow). The Department derived information for completing this compilation through a review of well-log data and water-rights information obtained from the NDWR. NDWR well-log database entries include a general and legal description of the location of existing wells, along with ***borehole*** and well completion information and well testing data (if available). The NDWR water-rights database includes data on the locations, manner of use, and appropriations status of wells having

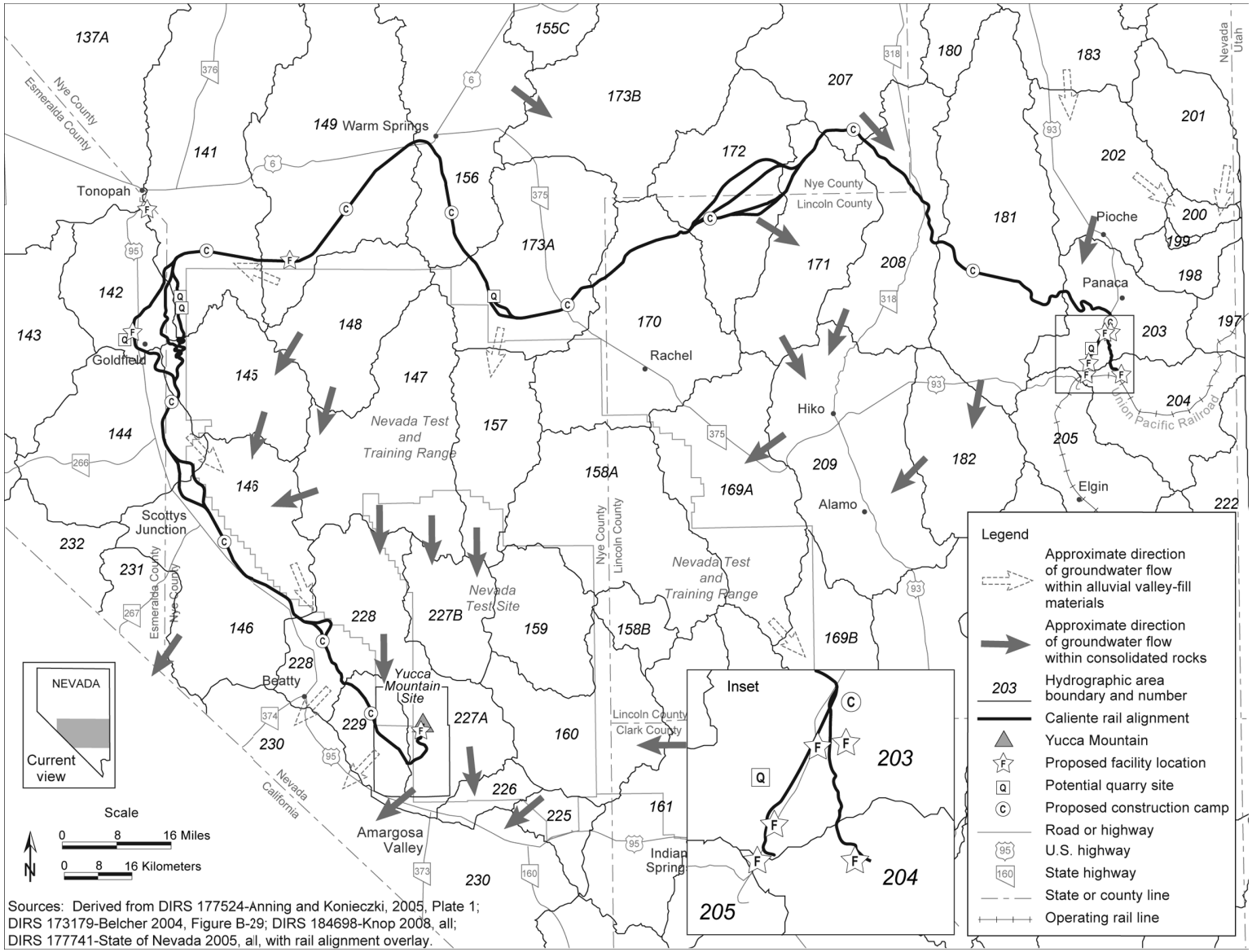


Figure 3-73. Generalized groundwater flow direction through alluvial valley-fill and consolidated rock aquifers in the vicinity of the Caliente rail alignment.

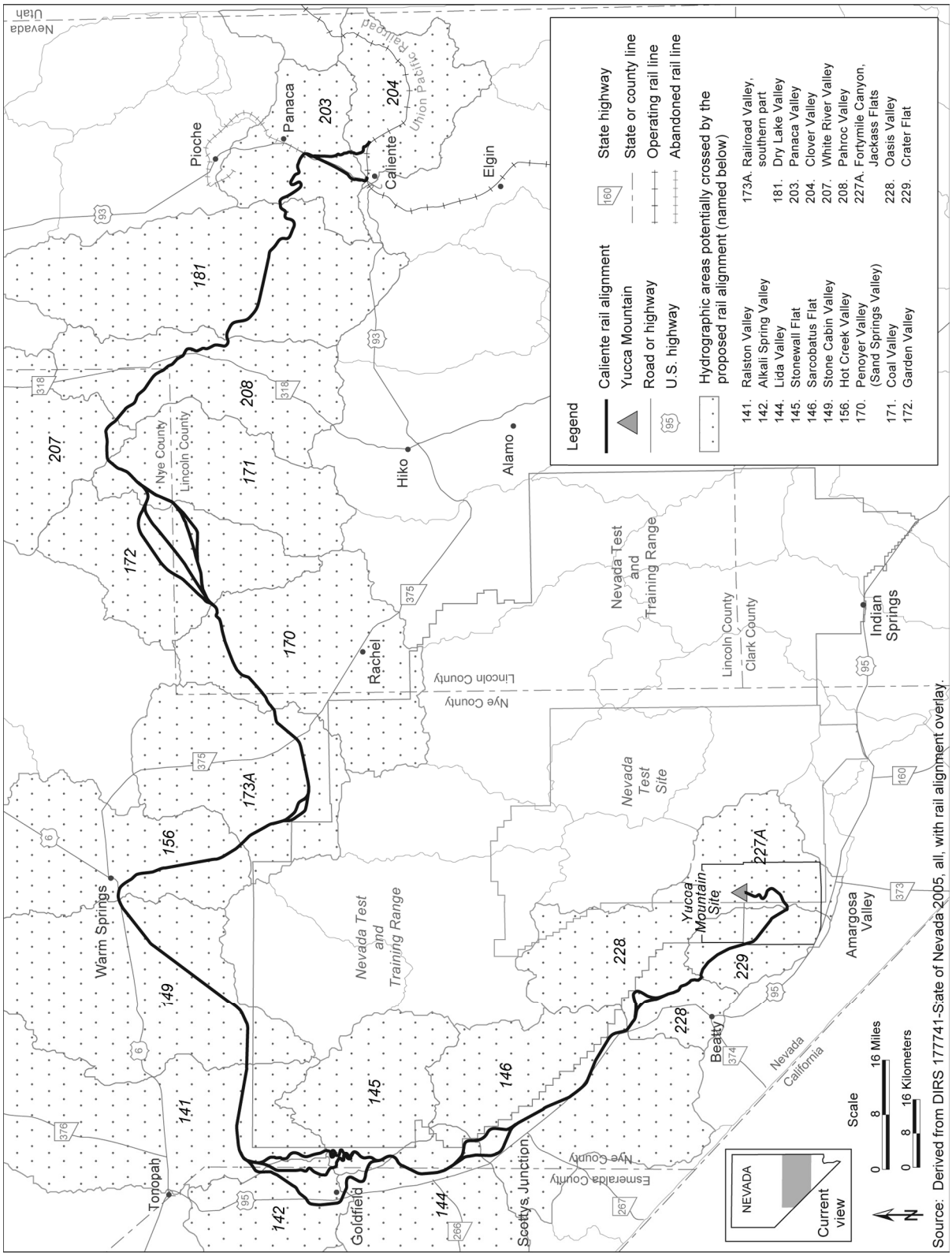


Figure 3-74. Hydrographic areas the Caliente rail alignment would cross.

Table 3-35. Perennial yield and annual committed groundwater resources of hydrographic areas the Caliente rail alignment would cross (page 1 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e]
Caliente alternative segment, Eccles alternative segment	204	Clover Valley	1,000	3,787/0	No
Caliente alternative segment, Eccles alternative segment, Caliente common segment 1	203	Panaca Valley	9,000	31,367/0	Yes
Caliente common segment 1	181	Dry Lake Valley	2,500	57/21,824	No
Caliente common segment 1	208	Pahroc Valley	21,000	30/0	No
Caliente common segment 1	207	White River Valley	37,000	31,819/42,512	No
Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8	171	Coal Valley	6,000	38/33,071	No
Garden Valley alternative segments 1, 2, 3, and 8; Caliente common segment 2	172	Garden Valley	6,000	559/12,224	No
Caliente common segment 2	170	Penoyer Valley (Sand Spring Valley)	4,000	14,461/11,888	Yes
Caliente common segment 2; South Reveille alternative segments 2 and 3; Caliente common segment 3	173A	Railroad Valley, southern part	2,800	3,867/0	No
Caliente common segment 3	156	Hot Creek Valley	5,500	4,231/0	No
Caliente common segment 3	149	Stone Cabin Valley	2,000	11,532/6,400	Yes
Caliente common segment 3; Goldfield alternative segments 1, 3, and 4	141	Ralston Valley	6,000	4,330/1	Yes
Goldfield alternative segments 1 and 4	142	Alkali Spring Valley	3,000	2,596/0	No
Goldfield alternative segments 1 and 3	145	Stonewall Flat	100	12/0	No

Table 3-35. Perennial yield and annual committed groundwater resources of hydrographic areas the Caliente rail alignment would cross (page 2 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e]
Goldfield alternative segments 1, 3, and 4; Caliente common segment 4; Bonnie Claire alternative segments 2 and 3	144	Lida Valley	350	72/0	No
Bonnie Claire alternative segments 2, 3, and 5	146	Sarcobatus Flat	3,000	3,591/0	Yes
Common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6	228	Oasis Valley	1,000	1,299/0	Yes
Common segment 6	229	Crater Flat	220	1,147/82	No
Common segment 6	227A	Fortymile Canyon, Jackass Flats	880[f]	58[f]/5	No

a. Source: DIRS 106094-Harrill, Gates, and Thomas 1988, Summary, Figure 3, with the proposed rail alignment map overlay.
b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.
c. To convert acre-feet to cubic meters, multiply by 1,233.49. To convert acre-feet to gallons, multiply by 3.259×10^5.
d. Data for committed groundwater resources are current as of May 30, 2007 (DIRS 183992-Luellen 2007, all). Data for pending groundwater resources include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.
e. Sources: DIRS 176488-State of Nevada 2006, Regions 10, 13, and 14; DIRS 177741-State of Nevada 2005, all.
f. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the Nevada Department of Water Resources indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 182821-Converse Consultants 2005, p. 29 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel 1999, p. 8) for the entirety of this hydrographic area. The perennial-yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

appropriated water rights in Nevada. The USGS website generally includes site information (for example, well location coordinates, elevation, depth) and water-level data. DOE eliminated from consideration in the impacts analysis wells in the NDWR well-log database and the NDWR water-rights database that did not have an appropriated water right or were not domestic wells (such as abandoned or plugged wells, monitoring wells, thermal gradient test wells, oil or gas exploration wells, or groundwater investigation wells). DOE considered all USGS-identified wells.

The compiled well locations had varying levels of accuracy. For example, well locations recorded in the NDWR water-rights database are generally considered to be at the center of each 0.16-square-kilometer (40-acre) parcel representing each quarter-quarter section. Additionally, the well driller might have mapped the well incorrectly, or a well might have been inadvertently recorded in the NDWR water-rights database in the wrong hydrographic area (for example, for wells very near a hydrographic area boundary). Figures 3-75 through 3-82 identify well locations within 1.6 kilometers (1 mile) of the centerline of the Caliente rail alignment or proposed wells. As a result of the characteristics of the well location specifications, there might be more than one existing well at some locations on these figures. Table 3-36 lists hydrographic areas the Caliente rail alignment would cross (or for which a small portion of the hydrographic area would lie within the region of influence of the alignment) and the corresponding number of wells within 1.6 kilometers of the centerline of the rail alignment, as recorded by the NDWR and the USGS NWIS. Table 3-36 identifies the associated proposed use category of the NDWR-catalogued wells (as defined in the State of Nevada well-log database). The USGS NWIS database does not categorize wells according to their use.

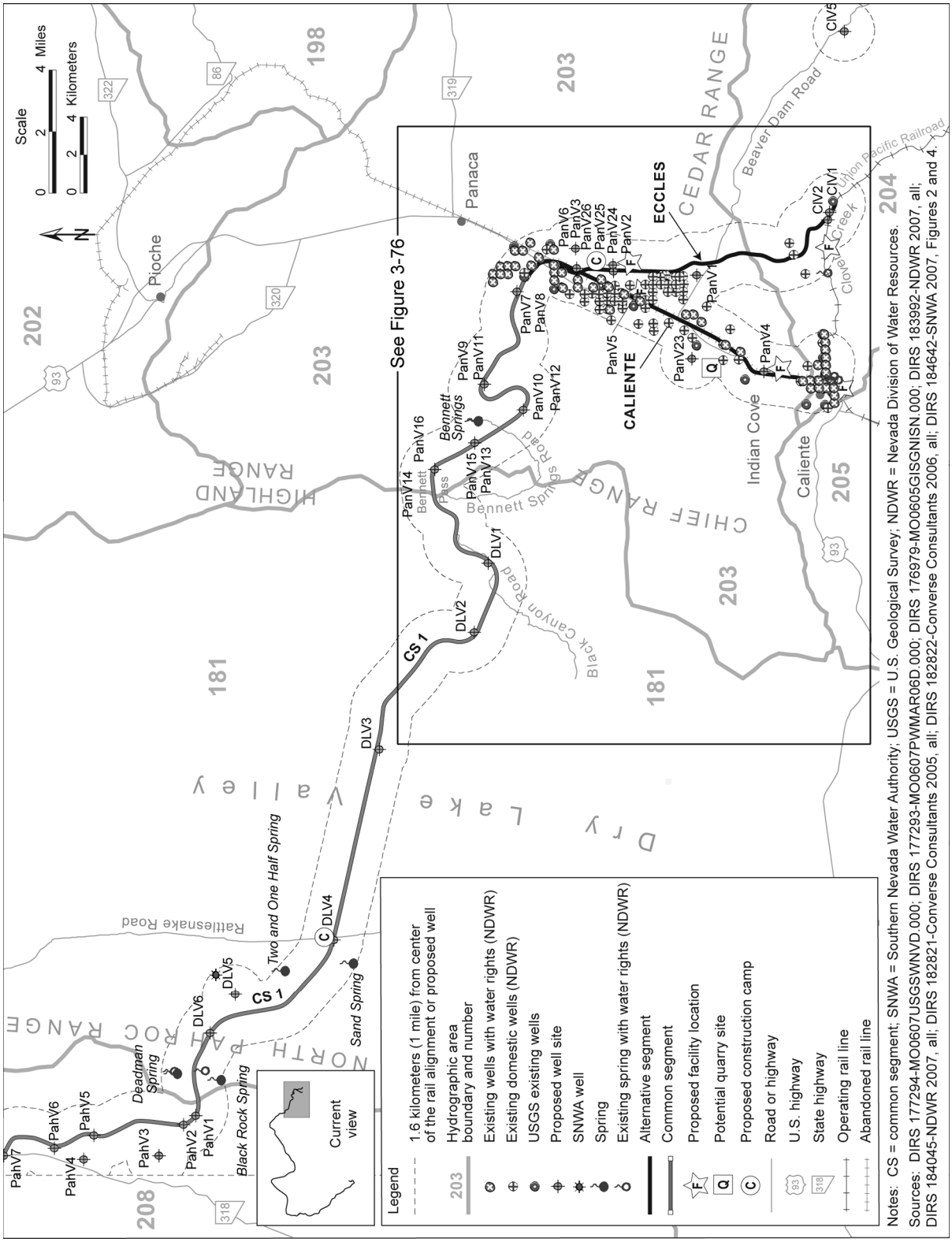
The distance of 1.6 kilometers (1 mile) reflects the first two of three aspects considered in establishing the groundwater region of influence, as described in Section 3.2.6.1. Most of the wells shown in Figures 3-75 through 3-80 are along the easternmost extent of the Caliente rail alignment; a smaller number of wells are clustered in several groups along the western portion. Few existing wells are present elsewhere along the rail alignment. The wells identified in these figures were compiled from information in *Water Resources Assessment Report, Caliente Corridor* (DIRS 182821-Converse Consultants 2005, all) and databases administered by the NDWR and the USGS NWIS. DOE would field-verify the locations of wells that could be affected during rail line construction before starting construction activities.

DOE-compiled well data include data on well locations and uses as documented in the *Water Resources Assessment Report, Caliente Corridor*, and include well records coded as "new" or "replacement" wells in the Nevada well-log database. Because each entry in the well-log database represents an event at a well site (for example, installation, redrilling, abandonment), there is a possibility that there is more than one record to represent a particular well. To preclude duplication, DOE summarized only records that identified wells as new or replacement.

As shown in Table 3-36, there are a total of 306 NDWR wells with water rights, NDWR domestic wells, and USGS NWIS wells within 1.6 kilometers (1 mile) of the centerline of the Caliente rail alignment or within 1 mile of proposed new wells. Most of these wells are in areas 203 and 204. Table 3-36 lists domestic wells (104 wells total; no formal water-rights appropriations associated with these wells) and irrigation (49 of the 115 total number of NDWR-listed wells that have water rights as the predominant use categories for those NDWR-listed wells that are within 1.6 kilometers of the centerline of the proposed Caliente rail alignment or within 1.6 kilometers of any proposed new well.

3.2.6.2.2 Groundwater-Quality Characteristics

Water quality in aquifers in Nevada varies with location (DIRS 106094-Harrill, Gates, and Thomas 1988, all). In the Basin and Range, total dissolved solids concentrations can range from less than 500 to more than 10,000 milligrams per liter (DIRS 172905-USGS 1995, all). In general, at hydrographic area



Notes: CS = common segment; SNWA = Southern Nevada Water Authority; USGS = U.S. Geological Survey; NDWR = Nevada Division of Water Resources.
Sources: DIRS 177294-MO0607USGSWNVD.000; DIRS 177293-MO0607PWMAR06D.000; DIRS 176979-MO0605GISGNISN.000; DIRS 183992-NDWR 2007, all; DIRS 184045-NDWR 2007, all; DIRS 182821-Converse Consultants 2005, all; DIRS 182822-Converse Consultants 2006, all; DIRS 184642-SNWA 2007, Figures 2 and 4.

Figure 3-75. Proposed wells and existing USGS and NDWR wells and springs within map area 1.

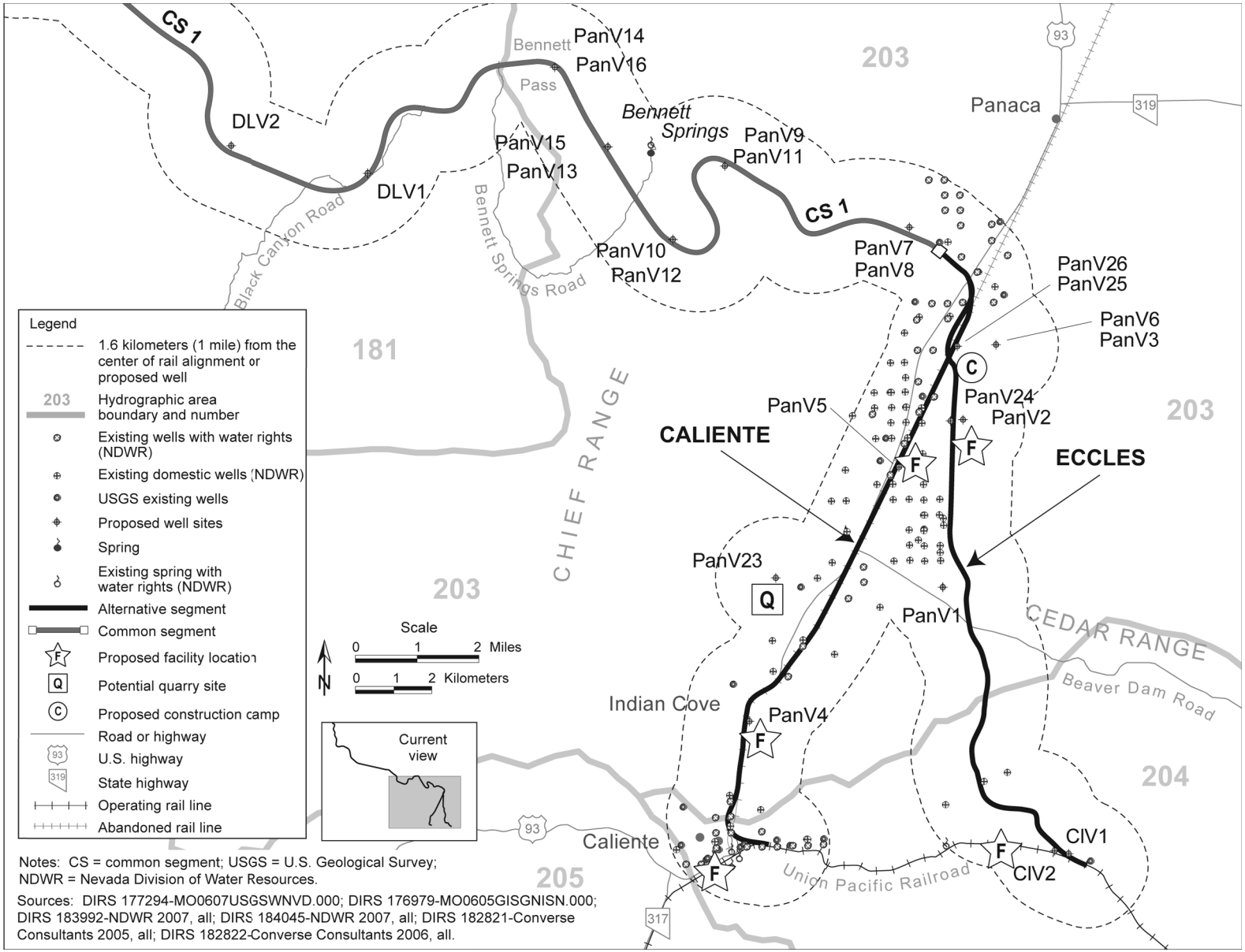


Figure 3-76. Proposed wells and existing USGS and NDWR wells and springs within map area 1 - INSET.

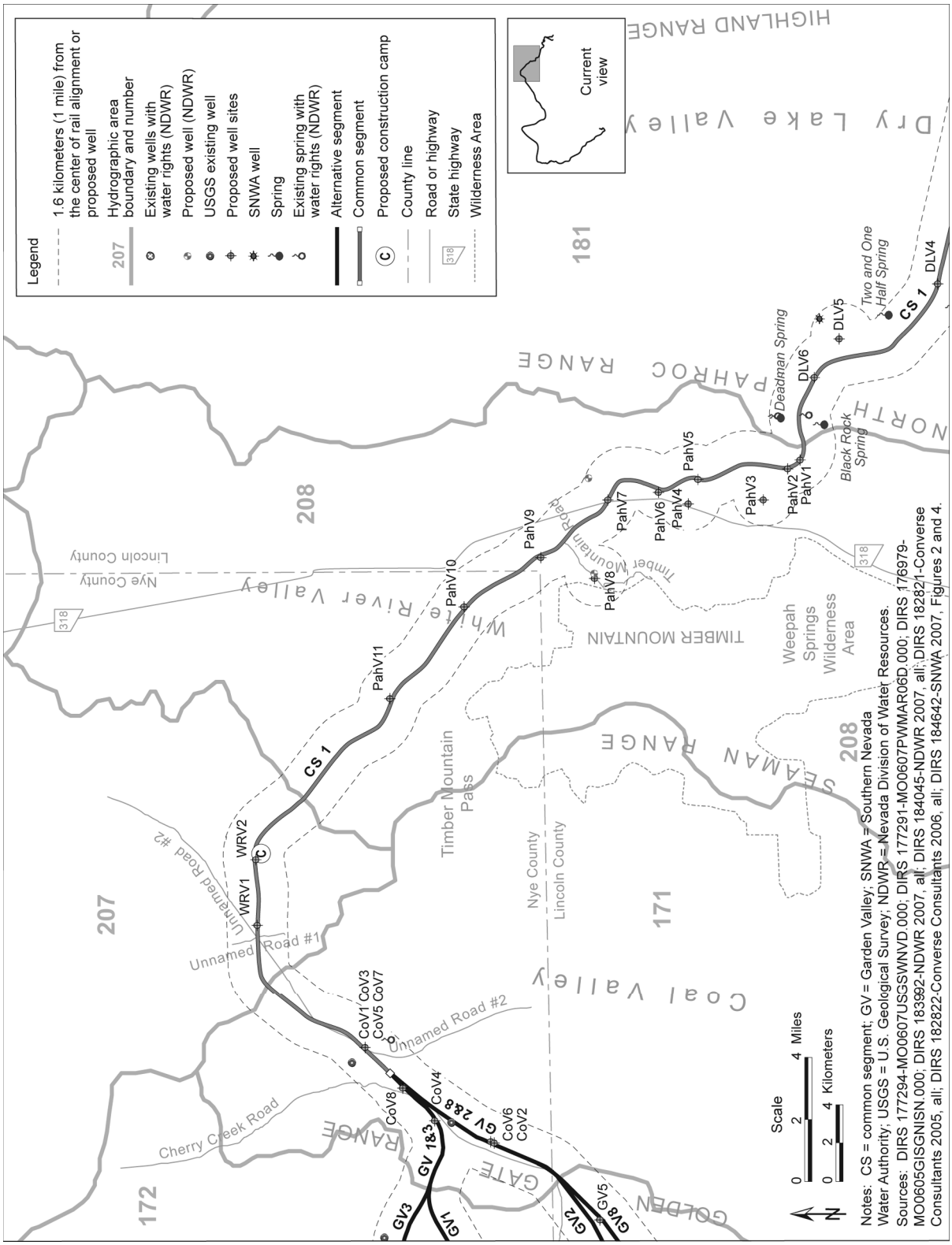


Figure 3-77. Proposed wells and existing USGS and NDWR wells and springs within map area 2.

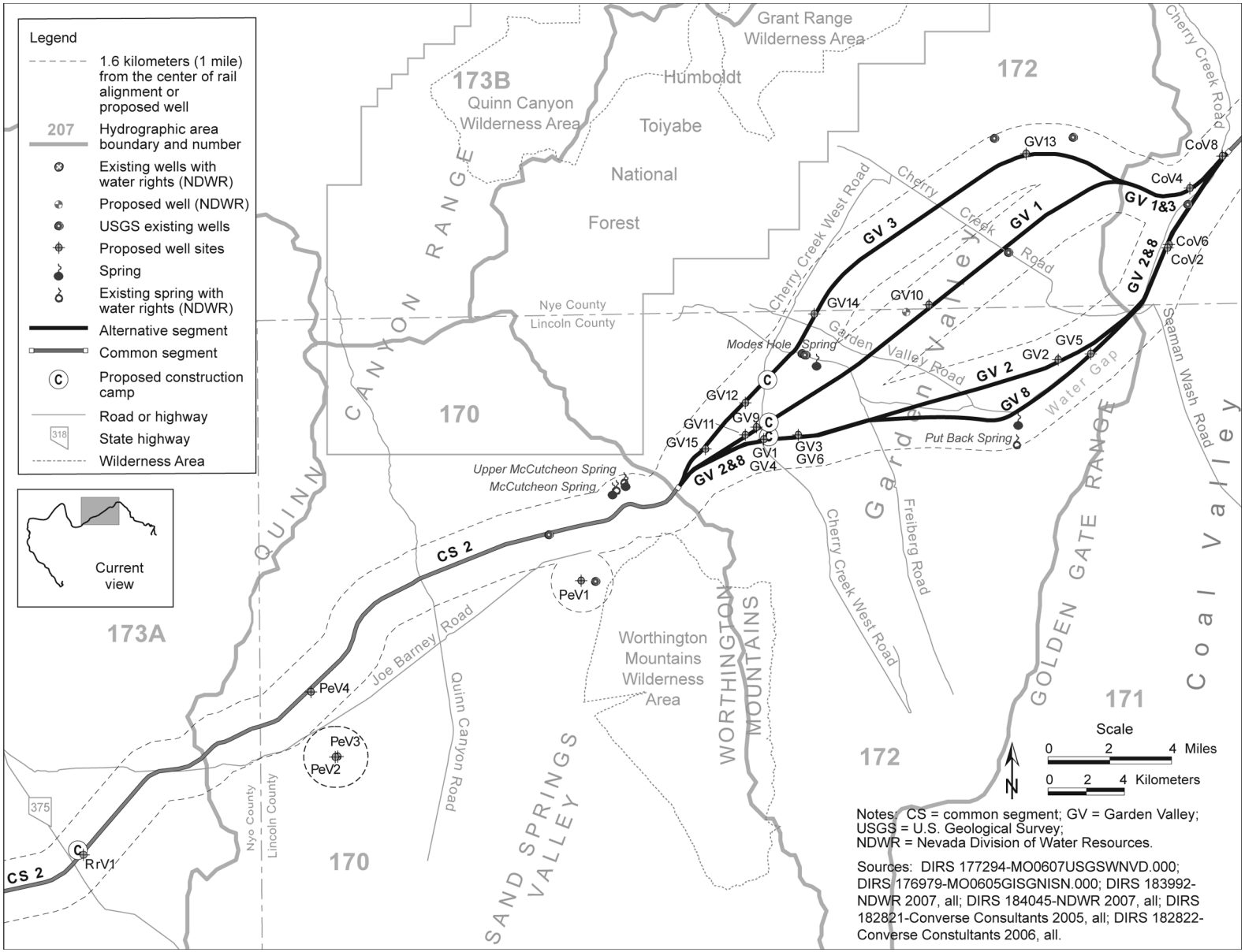


Figure 3-78. Proposed wells and existing USGS and NDWR wells and springs within map area 3.

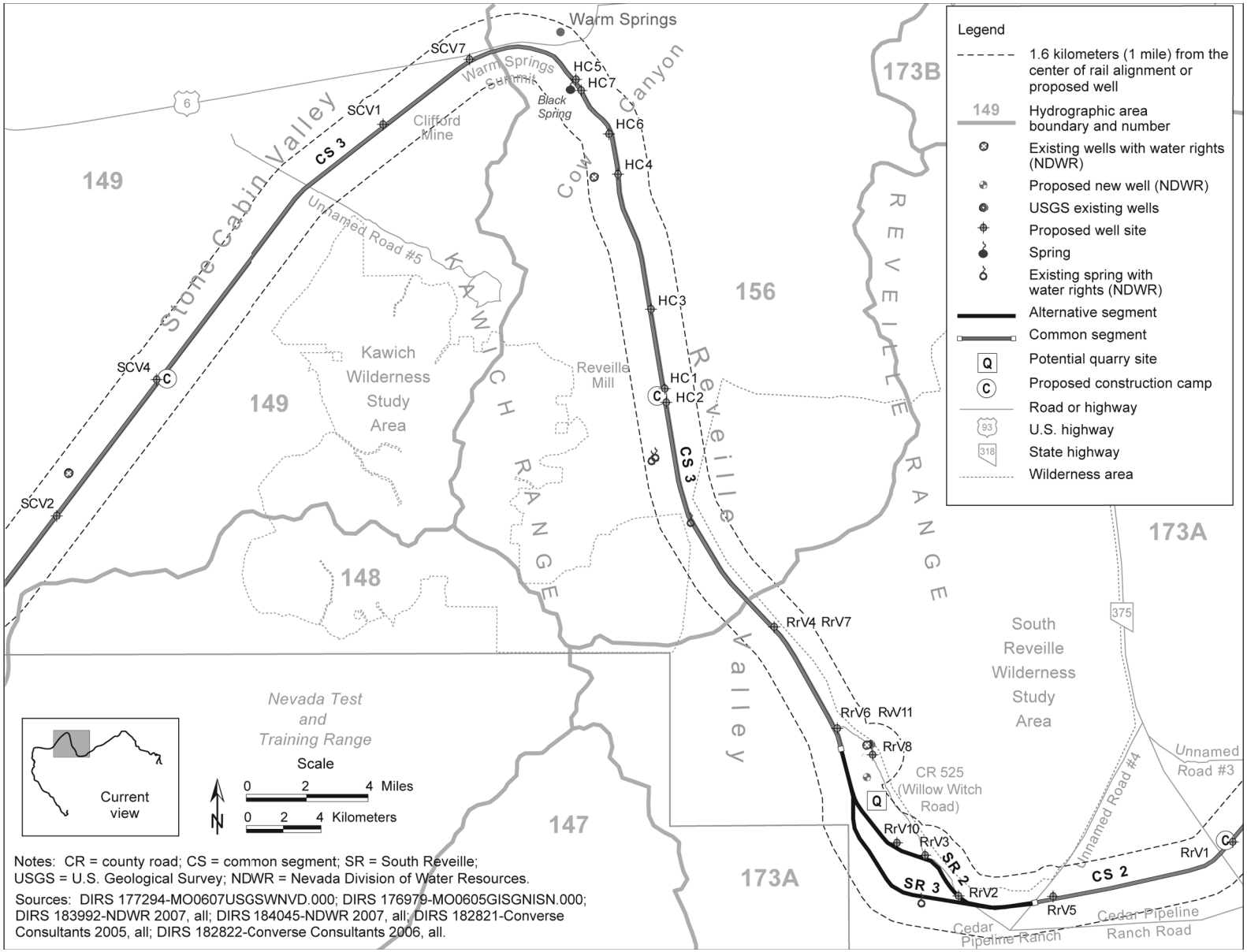


Figure 3-79. Proposed wells and existing USGS and NDWR wells and springs within map area 4.

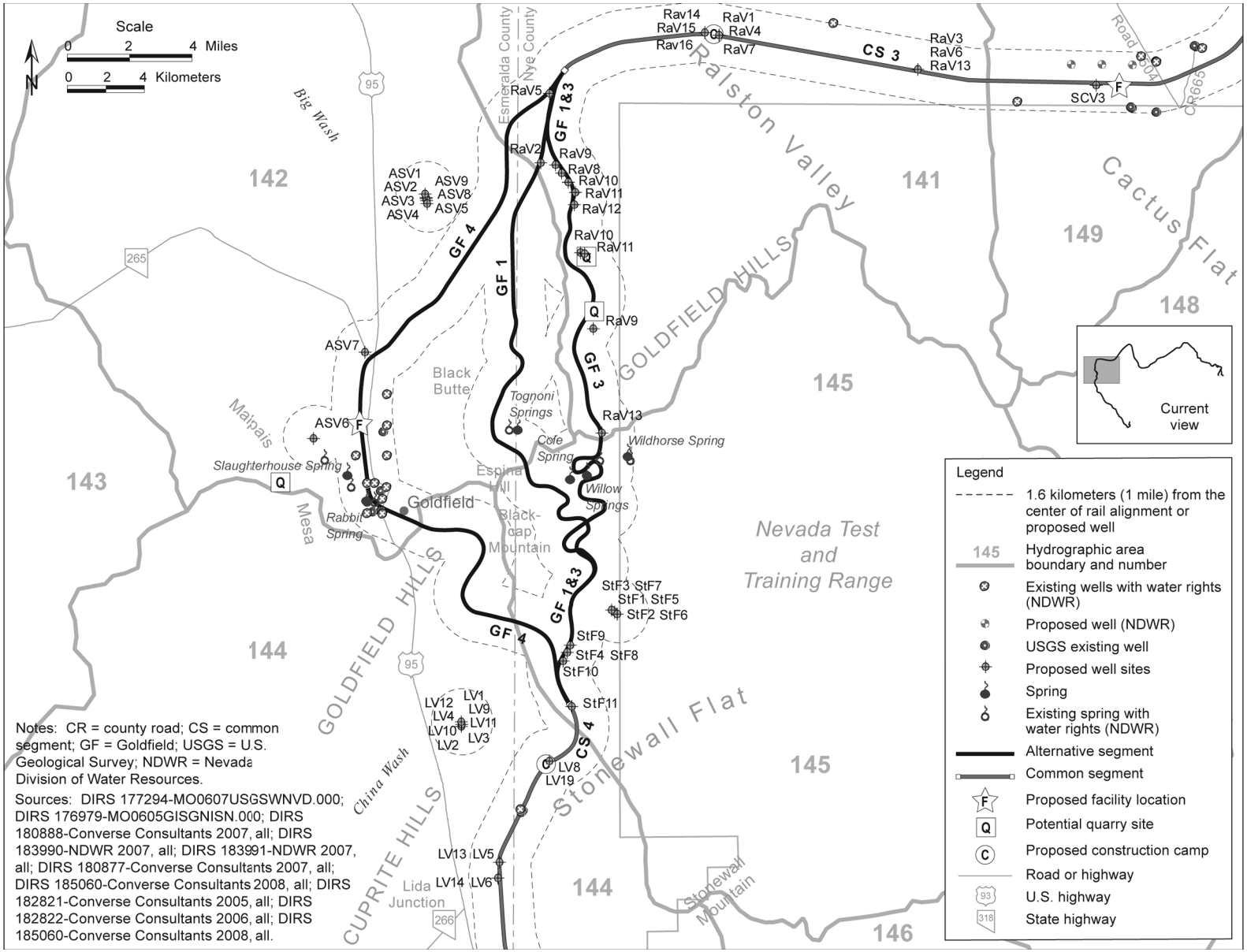


Figure 3-80. Proposed wells and existing USGS and NDWR wells and springs within map area 5.

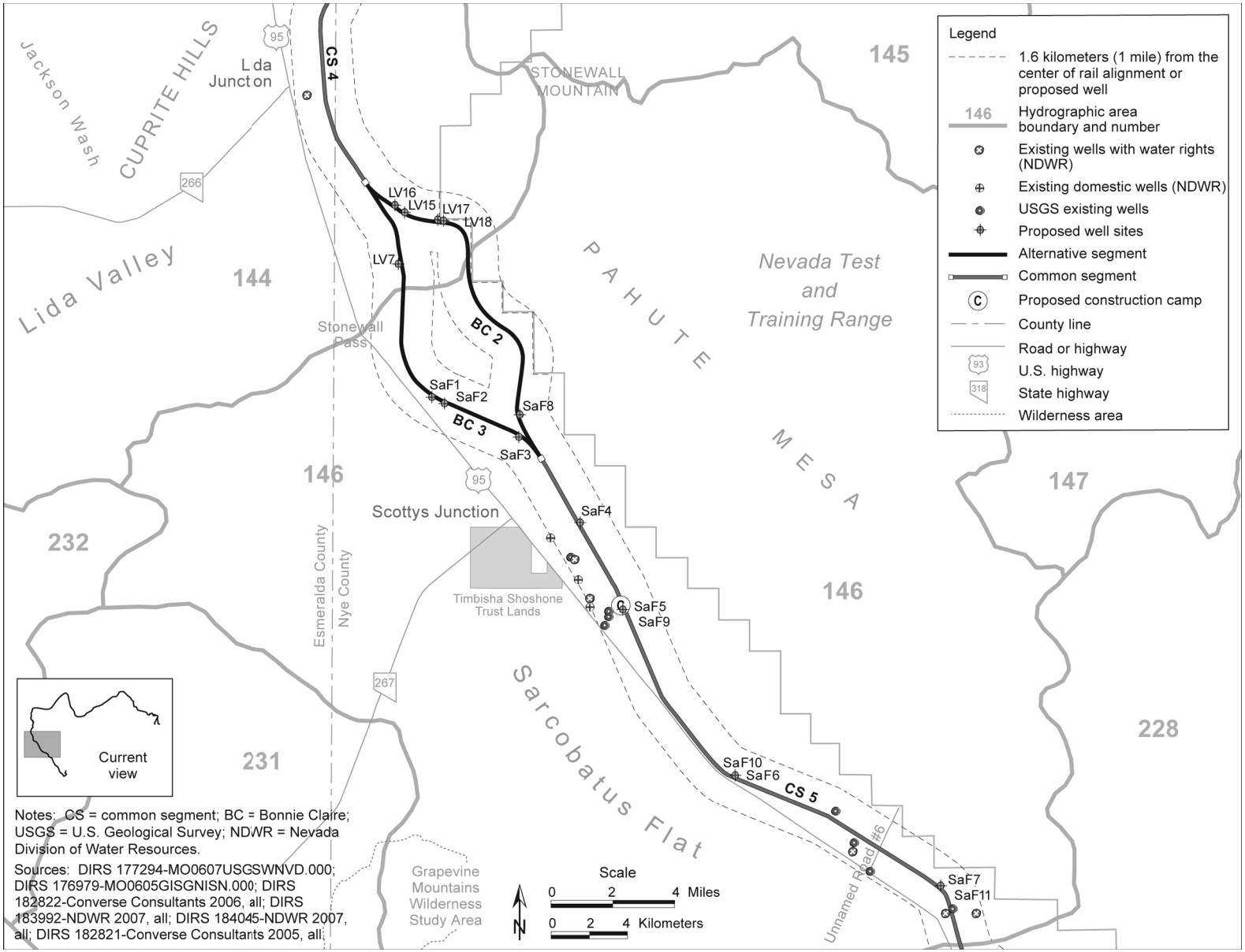


Figure 3-81. Proposed wells and existing USGS and NDWR wells and springs within map area 6.

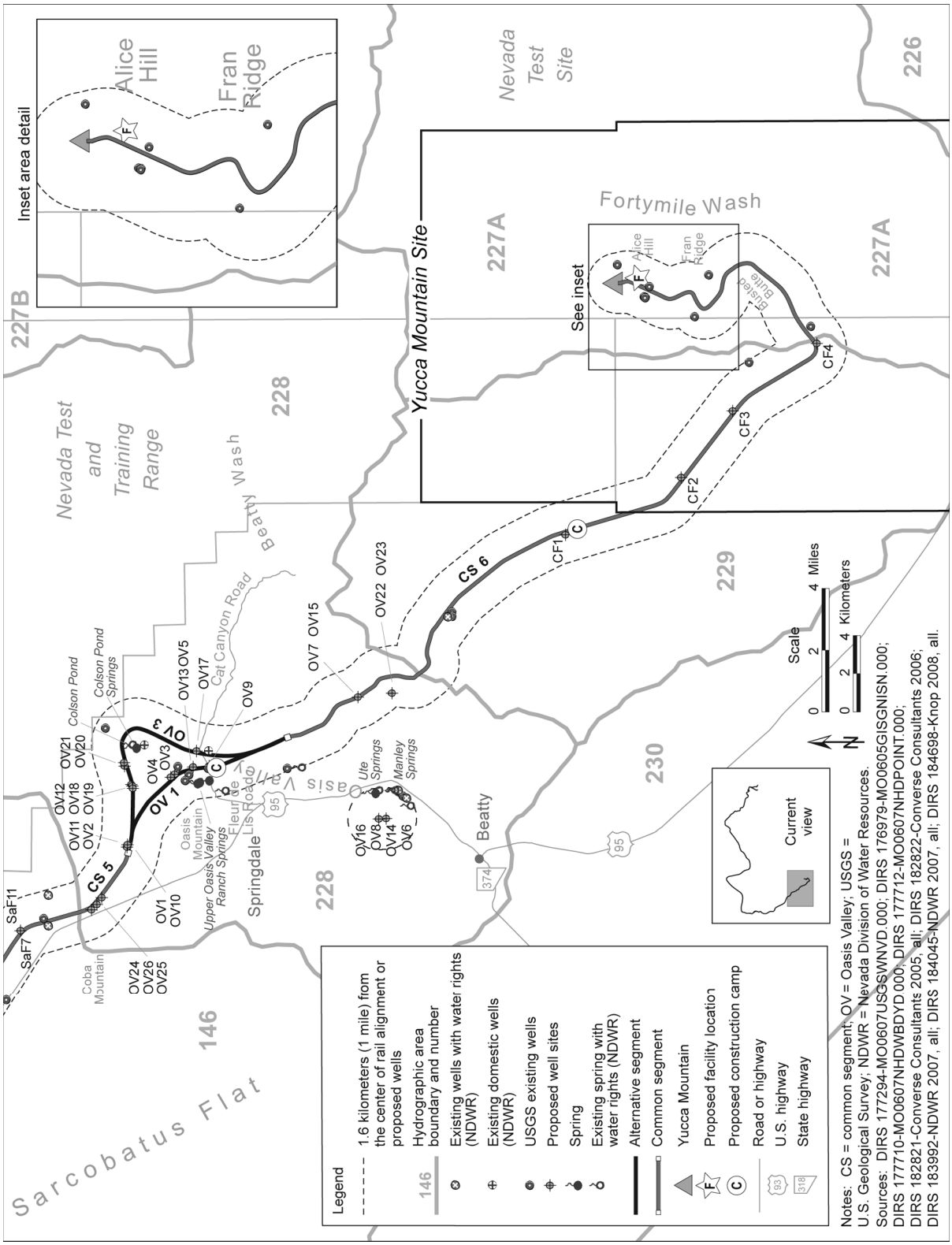


Figure 3-82. Proposed wells and existing USGS and NDWR wells and springs within map area 7.

Table 3-36. Existing wells within 1 mile[a] of the centerline of the Caliente rail alignment by hydrographic area and/or within 1 mile of proposed new wells outside the rail line construction right-of-way.[b]

Hydrographic area		Total number of wells and number of NDWR[c] wells by proposed-use category[d,e]										
Name	Area number	Number of wells[f,g]	C	G	H	I	K	N	P	S	X	Z
Lower Meadow Valley Wash	205	19	0	0	5	2	0	0	6	0	0	2
Clover Valley	204	29	1	0	1	6	0	0	1	1	0	6
Panaca Valley	203	155	4	0	92	38	0	0	5	1	0	5
Dry Lake Valley	181	1[h]	0	0	0	0	0	0	0	0	0	0
Pahroc Valley	208	0	0	0	0	0	0	0	0	0	0	0
White River Valley	207	0	0	0	0	0	0	0	0	0	0	0
Coal Valley	171	2	0	0	0	0	0	0	0	0	0	0
Garden Valley	172	6	0	0	0	0	0	0	0	0	0	0
Penoyer (Sand Spring) Valley	170	2	0	0	0	0	0	0	0	0	0	0
Railroad Valley, Southern Part	173A	2	0	0	0	0	0	0	0	1	0	0
Hot Creek Valley	156	1	0	0	0	0	0	0	0	1	0	0
Stone Cabin Valley	149	13	0	0	0	2	0	0	1	4	0	0
Ralston Valley	141	0	0	0	0	0	0	0	0	0	0	0
Alkali Spring Valley	142	19	0	0	0	0	0	0	12	2	0	0
Stonewall Flat	145	0	0	0	0	0	0	0	0	0	0	0
Lida Valley	144	5	0	0	0	0	1	0	0	1	0	0
Sarcobatus Flat	146	17	0	0	3	1	0	0	1	4	0	0
Oasis Valley	228	14	0	0	3	0	1	0	0	0	0	0
Crater Flat	229	7	0	0	0	0	4	0	0	0	0	0
Fortymile Canyon, Jackass Flats	227A	14	0	0	0	0	0	0	0	0	0	0
Totals		306	5	0	104	49	6	0	26	15	0	13

a. To convert miles to kilometers, multiply by 1.60934.
b. Includes existing wells listed as USGS NWIS wells, Nevada Division of Water Resources (NDWR) wells with water rights, and NDWR domestic wells.
c. NDWR=Nevada Division of Water Resources.
d. C = commercial; G = monitoring wells; H = domestic; I = irrigation; K = mining and milling; N = industrial (includes those designated in the database as N for "industrial" and as J for "industrial-cooling"); P = municipal or quasi-municipal; S = stock; X = test wells; Z = other (includes those designated in the database as R for "recreation," U for "unused," and other uses not included in the uses previously listed in this table).
e. Proposed-use categories are tabulated only for wells (218 of the 306 wells) listed as NDWR wells with water rights or NDWR domestic wells.
f. Includes total number of NDWR-documented existing wells with water rights, plus NDWR domestic wells, plus U.S. Geological Survey National Water Information System-listed wells within 1 mile from the centerline of the rail alignment or within 1 mile of any DOE-proposed new well. The number of NDWR wells listed by proposed use category applies only to NDWR wells with water rights and NDWR wells. U.S. Geological Survey wells are not included in the well counts done of NDWR wells by use category because the Geological Survey database does not provide information regarding well use category.
g. Well locations have not been field-verified. Therefore, some of the identified wells might be farther than 1 mile from the centerline of the rail alignment or proposed new wells.
h. Source: DIRS 177293-DTN MO0607PWMAR06D.000, all.

margins and on the slopes of alluvial fans, groundwater quality is good. In discharge areas (such as playas) and other selected areas, groundwater quality can be brackish. However, groundwater in deeper alluvial valley-fill units underlying some playa areas can be of better quality (DIRS 172905-USGS 1995, all). Groundwater quality in the carbonate aquifers in southern and central Nevada, including total dissolved solids concentrations, is generally more uniform in character and with depth within the aquifer (DIRS 101167-Winograd and Thordarson 1975, p. C103). Total dissolved solids concentrations in alluvial valley fill underlying the Caliente rail alignment generally range from less than 500 to 1,000 milligrams per liter, or approximately 500 to 1,000 parts per million, but a few locations might be in the 1,000 to 3,000 milligrams per liter (approximately 1,000 to 3,000 parts per million) range (DIRS 172905-USGS 1995, Figure 7, with overlay of hydrographic area boundaries). The U.S. Environmental Protection Agency has set an aesthetic standard of 500 milligrams per liter of total dissolved solids for drinking water (40 CFR Part 143). Water with a total dissolved solids concentration of 500 milligrams per liter or less is regarded as acceptable and pleasing for general consumption. A secondary preferred drinking water standard for total dissolved solids concentrations of 500 milligrams per liter for public water supplies has been adopted for Nevada. If water supplies that meet the preferred standard are not available, the Maximum Contaminant Level of 1,000 milligrams per liter is enforceable by the State of Nevada. At higher concentrations, general consumption issues (pertaining to hardness, deposits, color, staining, and salty taste) could develop, but the water could be used for other purposes (for example, agriculture or earthwork compaction as part of embankment construction). Another parameter of interest for gauging the quality of groundwater in Nevada is arsenic. A revised drinking water standard for arsenic (for water systems meeting certain specified criteria) of 0.010 milligrams per liter became enforceable in January of 2006 (40 CFR 141.23).

3.2.6.3 Hydrogeologic Setting and Characteristics along Alternative Segments and Common Segments

3.2.6.3.1 Interface with the Union Pacific Railroad Mainline

The Caliente alternative segment and the Eccles alternative segment would both overlie a small portion of Clover Valley (hydrographic area 204) and would cross Panaca Valley (hydrographic area 203) (see Figure 3-75). The Caliente and Eccles alternative segments would predominately overlie alluvial valley fill (Table 3-37).

Groundwater quality underlying the areas of the Caliente and Eccles alternative segments varies according to location within the hydrographic areas the segments would cross. Table 3-37 summarizes the general groundwater-quality and aquifer characteristics of this area.

Hydrographic area 204, Clover Valley, is not a designated groundwater basin (see Table 3-35). Committed groundwater resources exceed estimated perennial yield of 1.2 million cubic meters (1,000 acre-feet). However, as noted previously, all committed resources within a hydrographic area might not be in use at the same time. Groundwater depth throughout Clover Valley varies from less than 1 meter to 60 meters (2.5 to 200 feet). The depth at which groundwater occurs varies from 6 meters (20 feet) to 20 meters (60 feet) below ground along the short segments of the Caliente and Eccles alternative segments that would lie within area 204 (see Table 3-37). Groundwater is primarily produced from the alluvial valley fill. Geologic units encountered in boreholes drilled in the Clover Valley area include alluvial valley fill and volcanic rocks.

DOE determined that there are a total of 29 combined existing NDWR wells with water rights, NDWR domestic wells, and USGS NWIS wells in hydrographic area 204 within 1.6 kilometers (1 mile) of the centerlines of the Caliente and Eccles alternative segments (Table 3-36). Figures 3-75 and 3-76 show the locations of these wells. The locations of existing wells are based on data on well locations as available in NDWR and USGS NWIS databases. Not all existing wells in area 204 that lie within 1.6 kilometers of

Table 3-37. General groundwater-quality and aquifer characteristics – Interface with the Union Pacific Railroad Mainline, Caliente and Eccles alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
204 Clover Valley	Quaternary-age alluvial valley fill and volcanic rocks[e]	10 to 50	650,000[e]	Total dissolved solids: 30 to 350 ppm[f]
203 Panaca Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks and other crystalline rocks, with some terraced areas comprised of fine-grained lakebed deposits[e]	Less than 10 to 60	1.4 million[f]	Total dissolved solids: 230 to 770 ppm[e]

a. Source: DIRS 182821-Converse Consultants 2005, Plates 4-13a and 4-15. The listed depth ranges generally apply to areas underlying the alternative segments; groundwater is deeper in the southern part of area 204 beneath the Clover Mountains (DIRS 182821-Converse Consultants 2005, p. 94) and in some other parts of area 203 (DIRS 182821-Converse Consultants 2007, p. 89). Depth ranges are derived from groundwater depth contours depicted on Plates 4-13a and 4-15, DIRS 182821-Converse Consultants 2005.
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. Many reference sources list a concentration value in mg/L (= milligrams per liter), which, for materials or contaminants in water, is equivalent to parts per million (ppm).
e. Source: DIRS 182821-Converse Consultants 2005, pp. 87, 88, 93, and 94, and Plates 4-13a and 4-13b.
f. Source: DIRS 180754-Rush et al. 1971, all.

the centerlines of the Caliente and Eccles alternative segments may be depicted on Figures 3-75 and 3-76 because some wells are at very nearly the same locations and cannot be shown at the scale used in these figures. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 204.

Hydrographic area 203, Panaca Valley, is a designated groundwater basin. Committed groundwater resources exceed the estimated annual perennial yield of 11.1 million cubic meters (9,000 acre-feet) (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. The depth at which groundwater occurs ranges from above the ground surface to about 60 meters (200 feet) below ground, although in most areas, it is generally less than approximately 20 meters (60 feet) below ground. Along the Caliente alternative segment, the shallowest depth to groundwater in this basin is in its central portion, along U.S. Highway 93, where depth to groundwater ranges from less than 3 to 30 meters (less than 10 to 100 feet) (see Table 3-37) (DIRS 182821-Converse Consultants 2005, Plate 4-13a). Groundwater is primarily produced from the alluvial valley fill, although some low-yielding wells have produced groundwater from thin sand beds in lakebed deposits of the Panaca Formation. Groundwater also occurs in fractured volcanic rocks and carbonate rocks (DIRS 182821-Converse Consultants 2005, pp. 87 and 88).

There are a total of 155 combined existing NDWR wells with water rights, NDWR domestic wells, and USGS NWIS wells) in hydrographic area 203 within 1.6 kilometers (1 mile) of the centerlines of the Caliente and Eccles alternative segments (Table 3-36). Figures 3-75 and 3-76 show the locations of these wells. As described above for the case of hydrographic area 204, not all existing wells in area 203 that lie within 1.6 kilometers of the centerlines of the proposed Caliente and Eccles alternative segments may be depicted on Figures 3-75 and 3-76 because some wells are at very nearly the same locations and cannot be shown at the scale used in these figures.

The predominant use categories for the NDWR wells within 1.6 kilometers (1 mile) of the centerlines of the Caliente and Eccles alternative segments in area 203 are domestic, irrigation, or municipal or quasi-municipal. Based on the information in Table 3-36, groundwater use associated with about 58 percent of

NDWR wells in hydrographic areas 203 and 204 (combined) that are located within 1.6 kilometers of the centerlines of those two alternative segments is categorized as domestic, about 27 percent as irrigation; about 4 percent of those wells are listed as municipal or quasi-municipal water-supply wells; and about 3 percent are listed as commercial-use wells. Listed other water-use types from other wells represent about 7 percent of the total well use in wells in these two hydrographic areas.

The Panaca Valley area is underlain by alluvial valley fill, volcanic rocks and other crystalline rocks, and older carbonate and clastic rocks, with some terraced areas comprised of fine-grained lakebed deposits (DIRS 176519-Rowley and Shroba 1991, all; DIRS 182821-Converse Consultants 2005, pp. 87 and 88). Geologic materials present in the vicinity of the potential quarry site northwest of Caliente (west of proposed new well location PanV23) include lava flows; mudflow breccias; ash-flow tuffs; alluvium and alluvial fan materials; limestone and dolomite; and sandstone, mudstone, and conglomeratic rocks (DIRS 176947-Rowley et al. 1994, all; DIRS 176519-Rowley and Shroba 1991, all).

Groundwater occurs under both confined and unconfined conditions in the Meadow Valley Wash area (DIRS 176502-Rush 1964, p. 18), which generally includes the area between Caliente and Panaca. Groundwater storage values for the alluvial aquifers within the uppermost 30 meters (100 feet) of saturated material in Panaca Valley and Clover Creek Valley were previously estimated at 1.75 billion cubic meters (1.4 million acre-feet) and 802 million cubic meters (650,000 acre-feet), respectively (Table 3-37). Because most wells are no deeper than approximately 46 meters (150 feet), the total thickness of the alluvial aquifer groundwater reservoir is not known in many parts of the Meadow Valley Wash area (DIRS 176502-Rush 1964, p. 18). In this area, well-pumping rates on the order of 40 to 190 liters per minute (10 to 50 gallons per minute) to more than 4,000 liters per minute (1,000 gallons per minute) have been reported (DIRS 176502-Rush 1964, Table 15). NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 203.

Figures 3-75 and 3-76 show DOE-proposed wells for supplying water to support construction of the Caliente or Eccles alternative segment. In addition to construction within the nominal width of the rail line construction right-of-way, a potential quarry in this area would also require up to two new wells. Quarry wells proposed for the Caliente and Eccles alternative segments would be outside the nominal width of the construction right-of-way of either alignment. Although the potential quarry location and its associated new well(s) would be outside the construction right-of-way, they are described in this Rail Alignment EIS in the context of the rail alignment segment(s) with which they are most closely associated, because each quarry would be accessed in a generally perpendicular direction from the rail line. A well proposed to provide water to potential quarry CA-8B (PanV23 on Figures 3-75 and 3-76) is approximately 1.6 kilometers (1 mile) northwest of the proposed Caliente alternative segment, and would overlie hydrographic area 203.

3.2.6.3.2 Caliente Common Segment 1 (Dry Lake Valley Area)

Crossing from east to west, Caliente common segment 1 would overlie hydrographic areas Panaca Valley (203), Dry Lake Valley (181), Pahroc Valley (208), White River Valley (207), and Coal Valley (171) (see Figures 3-75 to 3-77). Caliente common segment 1 would predominantly overlie alluvial valley fill (DIRS 182821-Converse Consultants 2005, Plates 4-13a and 4-13b). The depth to groundwater underlying common segment 1 varies according to locale. Groundwater quality underlying common segment 1 varies according to location within the hydrographic areas the rail line would cross. Table 3-38 summarizes the groundwater-quality and aquifer characteristics in the hydrographic areas common segment 1 would cross.

Section 3.2.6.3.1 discusses hydrographic area 203, Panaca Valley, in detail. Two existing wells in areas 203, one NDWR well with a water right, and one USGS NWIS well are within 1.6 kilometers (1 mile) of the

centerline of the rail alignment in area 203. One existing spring (Bennett Springs) is within 1.6 kilometers of the centerline of common segment 1. Figure 3-75 shows the locations of these wells and the spring.

Hydrographic area 181, Dry Lake Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 3.08 million cubic meters (2,500 acre-feet) (see Table 3-35).

The depth to groundwater in most parts of Dry Lake Valley generally exceeds 60 meters (200 feet), and in many places exceeds 240 meters (800 feet). Depth to groundwater underlying the common segment varies from 50 to 160 meters (160 to 520 feet) (Table 3-38). Groundwater is generally calcium-sodium-sulfate type (DIRS 101811-DOE 1996, Section 4.6.5.2). The primary source of groundwater in Dry Lake Valley is mountain front recharge. Geologic units in the Dry Lake Valley area include alluvial valley-fill deposits, volcanic rocks, clastic rocks, and older carbonate rocks.

Table 3-38. General groundwater-quality and aquifer characteristics – Caliente common segment 1.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
203 Panaca Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks and other crystalline rocks, with some terraced areas comprised of fine-grained lakebed deposits[e]	Less than 200	1.4 million[f]	Total dissolved solids: 230 to 8,770 ppm
181 Dry Lake Valley	Alluvial valley-fill deposits, volcanic rocks, and older carbonate rocks[e]	160 to 520	*Alluvial valley fill*: 2.8 million[f] *Carbonate rock aquifer*: 800,000[f]	Total dissolved solids: 377 ppm[e] Sulfate: 30 ppm[e] Fluoride: Less than 1 ppm[e]
208 Pahroc Valley	Alluvial sediments, carbonate rocks, quartzite, volcanics, and a clastic aquitard[e]	More than 200	*Alluvial valley fill*: 1.3 million[f] *Carbonate rock aquifer*: 325,000[f]	Total dissolved solids: 475 ppm[e] Sulfate: Less than 30 ppm[e]
207 White River Valley	Alluvial valley fill and older carbonate rocks[e]	80	4.9 million[f]	Total dissolved solids: 257 to 470 ppm[e]
171 Coal Valley	Alluvial valley fill, volcanic rocks, clastic rocks, and older carbonate rocks[e]	160 to 280	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000[f]	Total dissolved solids: 200 to 300 ppm[e]

a. The listed depth ranges generally apply to areas underlying Caliente common segment 1. Depth ranges are derived from groundwater depth contours depicted on Plates 4-10 through 4-13a, and pp. 76, 78, 79, 83, and 88 (DIRS 182821-Converse Consultants 2005). Groundwater can vary over a wide range of depth depending on location in each hydrographic area.
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Source: DIRS 182821-Converse Consultants 2005, pp. 76 to 90.
f. Sources: DIRS 180754-Rush et al. 1971, all; DIRS 176883-Brothers, Katzer, and Johnson 1996, pp. 27 and 28; DIRS 176851-Brothers, Buqo, and Tracy 1993, pp. 17 to 30; DIRS 176852-Drici, Garey, and Buqo 1993, p. 36.

Unconsolidated alluvial materials and older carbonate rock comprise the best aquifers in area 181 (DIRS 182821-Converse Consultants 2005, p. 84). Beneath Dry Lake Valley, the thickness of the alluvial materials varies from a few meters to more than 300 meters (1,000 feet) (DIRS 176883-Brothers, Katzer, and Johnson 1996, p. 15). There is an estimated 3.5 billion cubic meters (2.8 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within this basin, and there might be an additional 990 million cubic meters (800,000 acre-feet) of recoverable groundwater in the carbonate aquifer underlying the basin. There is one existing well (181M-1) and four springs in hydrographic area 181 within 1.6 kilometers (1 mile) of the centerline of common segment 1. Figures 3-75 and 3-77 identify the locations of this well and the springs. The approximate location of well 181M-1 is shown on Figures 3-75 and 3-77 as the "SNWA well." This well is a monitoring well drilled by the Southern Nevada Water Authority.

In addition to existing groundwater wells in hydrographic area 181 that have water-rights appropriations, NDWR data indicate that there are approximately 26.9 million cubic meters (22,000 acre-feet) of documented pending annual duties (see Table 3-35) in area 181. These total pending annual duties include 14.3 million cubic meters (12,000 acre-feet) for water-rights applications originally filed by the Las Vegas Valley Water District in 1989 to appropriate water at some future time from a series of proposed new wells in Dry Lake Valley (DIRS 177516-SNWA 2006, p. 3). Ownership of these water-rights applications was subsequently transferred to the Southern Nevada Water Authority. Caliente rail alignment common segment 1 would cross one of five different proposed groundwater exploration areas the Water Authority identified in area 181 (DIRS 176469-SNWA [n.d.], all) from which groundwater might be developed. The additional water-rights applications comprise pending annual duties of 12.6 million cubic meters (10,000 acre-feet) and were filed with the Nevada State Engineer by the Lincoln County Water District to appropriate water at some future time from a series of proposed new wells in Dry Lake Valley. Until the outcomes of agency and public scoping and the water-rights application process are known and the Nevada State Engineer makes permitting decisions, details about the specific future groundwater development in this valley pursuant to these applications (including final locations of any proposed new wells, or the precise timing of such development) are not known. However, according to the NDWR Water Rights Database, an application has been filed for a future irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of a proposed new well location (DLV3) in Dry Lake Valley. This water-rights application is under protest (has had a "Ready for Action, Protested [RFP])" status assigned to it by the State Engineer. This RFP water-rights application and the potential for a cumulative impact associated with this proposed well location, if it were to be approved and the well installed and used at the same time as proposed well location DLV3, are discussed in Sections 5.2.1.3 and 5.2.2.6 in Chapter 5, Cumulative Impacts. Chapter 5 includes additional information pertaining to proposed future groundwater well locations and proposed well development projects in eastern Nevada.

Hydrographic area 208, Pahroc Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 25.9 million cubic meters (21,000 acre-feet) (see Table 3-35). In addition to existing wells with water rights in area 208, Lincoln County and two other entities have filed water-rights applications with the Nevada State Engineer to possibly appropriate water at some future time from a series of proposed new wells in Pahroc Valley (DIRS 175909-Hafen et al. 2003, pp. 1 and 2, and Exhibit B). Pending the outcome of agency and public scoping and water rights permitted by the Nevada State Engineer, details pertaining to the specific future groundwater development in this valley pursuant to these applications (including final locations of any proposed new wells, or the precise timing of such development) are not known. However, according to the NDWR Water Rights Database, there are NDWR water-rights applications with "Ready for Action (RFA)" or "Ready for Action, Protested (RFP)" status on file. These RFA or RFP water-rights applications, and the potential for cumulative impacts associated with these proposed well locations, are discussed in Sections 5.2.1.3 and 5.2.2.6 of Chapter 5, which includes additional information pertaining to proposed future groundwater well locations and proposed well development projects in eastern Nevada.

The depth to groundwater beneath the Pahroc Valley hydrographic area generally exceeds 61 meters (200 feet). Depth to groundwater underlying the rail alignment in Pahroc Valley ranges from more than 60 meters (more than 200 feet) (see Table 3-38). Available data regarding characteristics of the aquifers underlying area 208 indicate that approximately 1.6 billion cubic meters (1.3 million acre-feet) of recoverable groundwater might exist within the upper 30 meters (100 feet) of saturated aquifer material within this basin. It is also estimated that there could be an additional 400 million cubic meters (320,000 acre-feet) of recoverable groundwater in the carbonate aquifer underlying this area (Table 3-38). NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 208.

Geologic units underlying the Pahroc Valley hydrographic area include alluvial sediments, carbonate rocks, quartzite, volcanics, and an older clastic rock (rock formed from fragments of pre-existing rock) aquitard. Mountain front precipitation and inflow from adjacent valleys (primarily White River Valley to the north) provide most of the flow to Pahroc Valley.

There are no NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no springs, seeps, or other surface-water-right locations in hydrographic area 208 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1 (see Table 3-36).

Hydrographic area 207, White River Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 45.6 million cubic meters (37,000 acre-feet) (see Table 3-35). In addition to existing groundwater wells in hydrographic area 207 with water-rights appropriations, preliminary NDWR data indicate that that there are approximately 52.4 million cubic meters (42,500 acre-feet) of pending annual duties in area 207. None of the pending water-rights locations are within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1.

Groundwater depth throughout White River Valley varies from above surface to 120 meters (–1 to 400 feet). In the portion of hydrographic area 207 the rail line would cross, groundwater is approximately 20 meters (60 feet) below ground surface (Table 3-38). Available data regarding characteristics of the aquifer underlying area 207 indicate that approximately 6.04 billion cubic meters (4.9 million acre-feet) of recoverable groundwater might exist within the upper 30 meters (100 feet) of saturated aquifer material within this basin. Groundwater is a calcium-bicarbonate type. Groundwater is primarily obtained from alluvial valley fill, but water does occur in carbonate rocks. The primary geologic units comprising White River Valley include alluvial valley fill and older carbonate rocks. There are no NDWR wells with water rights, USGS NWIS wells, springs, seeps, or other surface-water-right locations in hydrographic area 207 within 1.6 kilometers (1 mile) of the centerline of common segment 1 (see Table 3-36 and Figure 3-77).

Hydrographic area 171, Coal Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Table 3-35). Groundwater is primarily obtained from alluvial valley fill, but water does occur in fractured volcanic rocks and carbonate rocks. An oil exploration well in north-central Coal Valley penetrated 820 meters (2,700 feet) of alluvium. Depth to groundwater throughout Coal Valley varies from 30 meters to more than 240 meters (100 to more than 800 feet). Depth to groundwater along the rail alignment beneath area 171 varies from 50 to 90 meters (160 to 280 feet) (Table 3-38). It is estimated that there could be approximately 1.9 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 171. It is estimated that there could be an additional 740 million cubic meters (600,000 acre-feet) of recoverable groundwater in the carbonate aquifer underlying these two areas combined (DIRS 176851-Brothers, Buqo, and Tracy 1993, p. 29). NDWR data indicate that there are approximately 40.8 million cubic meters (33,100 acre-feet) of pending annual duties (see Table 3-35) in area 171.

There is one USGS NWIS well, one spring, and no seeps or other surface-water-right locations in hydrographic area 171 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1. Figure 3-77 shows the location of the well.

The predominant proposed use category for the existing NDWR wells with water rights that are within approximately 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1 is irrigation. Table 3-36 (columns 4 through 13) summarizes the proposed use categories of these wells. Figures 3-75 and 3-77 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of common segment 1. In addition to a series of new wells proposed for installation within the rail line construction right-of-way, DOE might install a series of additional wells at selected locations outside the construction right-of-way, either as alternative water wells or as alternative wells used in combination with other water wells installed within the construction right-of-way. These wells would be drilled in areas where groundwater resources within the construction right-of-way were not adequate to meet railroad construction or operations needs. No potential quarry sites have been identified along Caliente common segment 1. Proposed new wells that might be required outside the nominal width of the rail line construction right-of-way not related to water-supply requirements for potential quarries include:

- Location DLV5 (Figures 3-75 and 3-77) in the western part of Dry Lake Valley 1.1 kilometers (0.7 mile) northeast of the centerline of the rail alignment
- Locations PahV3, PahV4, and PahV8 (Figure 3-77) in southern, central, and western Pahroc Valley approximately 1.3 to 2.7 kilometers (0.8 to 1.7 miles) west to southwest of the centerline of the rail alignment

There are no known existing wells within 1.6 kilometers (1 mile) of proposed well site DLV5, and the closest existing springs, seeps, or other surface-water-right locations are Deadman Spring and Black Rock Spring, about 2.4 kilometers (1.5 miles) northwest or west of this location (DIRS 182822-Converse Consultants 2006, Appendices A and B). There are no known existing wells, springs, seeps, or other surface-water-right locations within 1.6 kilometers of the proposed well locations at PahV3, PahV4, and PahV8.

3.2.6.3.3 Garden Valley Alternative Segments

Crossing from east to west, alternative segments Garden Valley 1, Garden Valley 2, Garden Valley 3, and Garden Valley 8 would overlie hydrographic areas 171 (Coal Valley) and 172 (Garden Valley) (see Figure 3-78). Areas 171 and 172 each have a perennial yield of 7.40 million cubic meters (6,000 acre-feet), and are not designated groundwater basins (see Table 3-35). Committed groundwater resources in these areas do not exceed estimated perennial yields. In addition to existing groundwater wells in hydrographic area 172 that have water-rights appropriations, NDWR data indicate that there are approximately 15 million cubic meters (12,200 acre-feet) in pending underground annual duties (see Table 3-35) in area 172. These pending annual duties applications correspond to water-rights applications filed with the Nevada State Engineer by the Las Vegas Valley Water District and Lincoln County to appropriate water at some future time from a series of proposed new wells within hydrographic area 172 (DIRS 175909-Hafen et al. 2003, all). According to the NDWR Water Rights Database, an application for a future municipal well has been filed by the Lincoln County Water District and by a private entity to appropriate groundwater from a location approximately 1.2 kilometers (0.8 mile) southwest of a proposed location (GV10) for up to two new withdrawal wells in Garden Valley. The potential for impacts associated with this well application is evaluated in Section 5.2.2.6.

Groundwater quality underlying the areas of the Garden Valley alternative segments varies according to location within the hydrographic areas the rail line would cross. Table 3-39 summarizes general

groundwater-quality and aquifer characteristics in the two hydrographic areas underlying the Garden Valley alternative segments.

Along the Caliente rail alignment, depth to groundwater in Garden Valley varies from approximately 40 to 120 meters (120 to 400 feet) below ground (Table 3-39). Groundwater quality underlying the Garden Valley alternative segments varies according to location. Data from four wells in Garden Valley indicate the groundwater is a calcium-bicarbonate type. Table 3-39 summarizes generalized groundwater-quality characteristics in this area.

Table 3-39. General groundwater-quality and aquifer characteristics – Garden Valley alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
171 Coal Valley	Alluvial valley fill, volcanic rocks, clastic rocks, and carbonate rocks[e]	160 to 280	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000 (total for hydrographic areas 171 and 172)[f]	Total dissolved solids: 200 to 300 ppm[e]
172 Garden Valley	Alluvial valley fill, with surrounding mountain ranges comprised of older carbonate and clastic rocks, and younger volcanic rock units[e]	120 to 400	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000 (total for hydrographic areas 171 and 172)[f]	Total dissolved solids: 200 to 300 ppm[e]

a. Depth ranges are derived from groundwater depth contours depicted on Plate 4-10, DIRS 182821-Converse Consultants 2005, and pp. 74 and 76. Groundwater can vary over a wide range of depth depending on location in the hydrographic area.
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Source: DIRS 182821-Converse Consultants 2005, pp. 74 to 78.
f. Sources: DIRS 180754-Rush et al. 1971, all; DIRS 176851-Brothers, Buqo, and Tracy 1993, pp. 29 and 30.

Geologic units in the Garden Valley area include primarily alluvial valley fill, with surrounding mountain ranges comprised mostly of carbonate rocks, rock units, and clastic rocks (Table 3-39). The Garden Valley alternative segments would predominantly overlie alluvial valley fill. It is estimated that there could be approximately 1.85 billion cubic meters (1.50 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 172. It is estimated that there could be an additional 740 million cubic meters (600,000 acre-feet) of recoverable groundwater (DIRS 176851-Brothers, Buqo, and Tracy 1993, p. 30) in the carbonate aquifer underlying these two areas combined (Table 3-39). Review of available data for existing wells, springs, seeps, and other surface-water-right locations indicates the following (Figure 3-78):

- There is one existing USGS NWIS well and no springs, seeps, or other surface-water-right locations in hydrographic area 171 within 1.6 kilometers (1 mile) of Garden Valley alternative segment 2.
- In hydrographic area 172, there are no NDWR wells with water rights, no NDWR domestic wells, six USGS NWIS wells, and one spring within approximately 1.6 kilometers of the centerline of Garden Valley alternative segment 3; no NDWR well with water rights or NDWR domestic wells,

one USGS NWIS well, and one spring within 1 mile of the centerline of Garden Valley alternative segment 1; no NDWR wells with water rights or NDWR domestic wells, no USGS NWIS wells, and no springs within 1.6 kilometers of Garden Valley alternative segment 2; and no NDWR wells with water rights or NDWR domestic wells, no USGS NWIS wells, and one spring within approximately 1.6 kilometers of the centerline of Garden Valley alternative segment 8.

Figure 3-78 identifies NDWR wells with water rights and USGS NWIS wells within approximately 1.6 kilometers (1 mile) of the centerlines of the Garden Valley alternative segments. As described above for the cases of hydrographic areas 203 and 204, all existing wells in areas 171 and 172 that lie within 1.6 kilometers of the centerlines of the proposed Garden Valley alternative segments may not be depicted on Figure 3-78 because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Figure 3-78 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Garden Valley alternative segments. All proposed water wells would be within the construction right-of-way of the selected alignment alternative. There are no potential quarry sites along the Garden Valley alternative segments.

3.2.6.3.4 Caliente Common Segment 2 (Quinn Canyon Range Area)

Crossing from east to west, Caliente common segment 2 would overlie hydrographic areas 172 (Garden Valley), 170 (Penoyer Valley), and 173A (Railroad Valley) (Figures 3-78 and 3-79). Section 3.2.6.3.3 describes the hydrogeologic characteristics of area 172. Committed groundwater resources in areas 170 and 173A exceed estimated perennial yields, but not in area 172 (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. Caliente common segment 2 would cross over a small portion of hydrographic area 172. Groundwater depth underlying the rail alignment in hydrographic area 172 varies from 50 to 90 meters (180 to 280 feet) (Table 3-40).

Groundwater quality underlying Caliente common segment 2 varies according to location within the hydrographic areas (172, 170, and 173A) the rail alignment would cross (Figures 3-78 and 3-79). Area 173A typically exhibits low dissolved-solids concentrations, with either bicarbonate with sodium or calcium as primary constituents. Table 3-40 summarizes general groundwater-quality and aquifer characteristics in this area.

Hydrographic area 170, Penoyer Valley, is a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of 4.93 million cubic meters (4,000 acre-feet). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. In addition to existing groundwater wells in hydrographic area 170 that have water-rights appropriations, preliminary NDWR data indicate that there are approximately 14.7 million cubic meters (11,900 acre-feet) of pending annual duties (see Table 3-35) in area 170. This pending water-right location is not within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 2.

Groundwater in area 170 is produced primarily from valley fill, although consolidated rocks (including volcanic rocks) underlying and surrounding Railroad Valley and Penoyer Valley transmit water through fractures associated with faulting (DIRS 176848-Van Denburgh and Rush 1974, p. 11). Depth to groundwater throughout Penoyer Valley varies from approximately 5 to 100 meters (10 to 330 feet) (DIRS 182821-Converse Consultants 2005, p. 72). Depth to groundwater varies from 50 to 60 meters (160 to 200 feet) along common segment 2 (Table 3-40). It is estimated that there could be approximately 2.71 billion cubic meters (2.2 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 170. Figures 3-78 and 3-79 show wells within approximately 1.6 kilometers (1 mile) of common segment 2. There are no NDWR wells with water

Table 3-40. General groundwater-quality and aquifer characteristics – Caliente common segment 2.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
172 Garden Valley	Alluvial valley fill, with surrounding mountain ranges comprised of older carbonate and clastic rocks, and younger volcanic rock units[e]	160 to 300	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000 (total for hydrographic areas 171 and 172)[f]	Total dissolved solids: 200 to 300 ppm[e]
170 Penoyer Valley	Alluvial valley fill, volcanic rocks, and older carbonate rocks[e]	160 to 200	2.2 million[f]	Total dissolved solids: 300 to 700 ppm[e]
173A Railroad Valley, southern part	Alluvial valley fill, volcanic rocks, and older carbonate rocks[e]	160 to 180	2.1 million[f]	Total dissolved solids: 253 to 409 ppm; 2,790 ppm in one well[e] Fluoride: More than 4 ppm[e]

a. The listed depth ranges generally apply to areas underlying Caliente common segment 2. Depth ranges are derived from groundwater depth contours depicted on Plates 4-8 and 4-10, DIRS 182821-Converse Consultants 2005, and pp. 64 and 71. Groundwater can vary over a wide range of depth depending on location in the hydrographic area.
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Source: DIRS 182821-Converse Consultants 2005, pp. 64 to 75; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.
f. Sources: DIRS 180754-Rush et al. 1971, all; DIRS 176851-Brothers, Buqo, and Tracy 1993, pp. 29 and 30.

rights, no NDWR domestic wells, two USGS NWIS wells (classified as monitoring wells), and two springs in area 170 within 1.6 kilometers of the centerline of common segment 2 or within 1.6 kilometers of any DOE-proposed new well.

Hydrographic area 173A is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yields of 3.45 million cubic meters (2,800 acre-feet) (see Table 3-35).

Groundwater in area 173A is produced primarily from valley fill, although consolidated rocks (including volcanic rocks) underlying and surrounding Railroad Valley and Penoyer Valley transmit water through fractures associated with faulting (DIRS 176848-Van Denburgh and Rush 1974, p. 11). Depth to groundwater throughout hydrographic area 173A varies from 5 to 120 meters (17 to 400 feet). Depth to groundwater varies from 50 to 55 meters (160 to 180 feet) along common segment 2 (Table 3-40). It is estimated that there could be approximately 2.59 billion cubic meters (2.1 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 173A.

There are no NDWR wells with water rights, one USGS NWIS well, and no springs, seeps, or other surface-water-right locations in area 173A within 1.6 kilometers (1 mile) of the centerline of common segment 2. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 173A.

Geologic units in the Penoyer Valley (area 170) and the Railroad Valley South (area 173A) areas include alluvial valley fill, volcanic rocks, and older carbonate rocks (Table 3-40). Carbonate rocks make up part of the Reveille Range and a portion of the southern Quinn Canyon Range where common segment 2 would cross the east and west perimeters of Railroad Valley. Caliente common segment 2 would predominantly overlie alluvial valley fills.

Figures 3-78 and 3-79 show proposed well locations (see Section 4.2.6) for supplying water to support construction of Caliente common segment 2. New wells are proposed within and outside the rail line construction right-of-way. These wells would be drilled in areas where groundwater resources within the construction right-of-way would not be adequate to meet construction or operations needs. Up to two locations in the north-central portion of Penoyer Valley approximately 2.9 to 3.5 kilometers (1.8 to 2.2 miles) south of the rail alignment (locations PeV1, PeV2, and PeV3 on Figure 3-78) represent potential alternative new well locations. These two alternative well sites are within alluvial valley fill, and are proposed as alternative wells if needed, to allow for wells to be completed a greater distance from a geologic contact between alluvium and bedrock materials. There are no potential quarry sites along Caliente common segment 2.

3.2.6.3.5 South Reveille Alternative Segments

South Reveille alternative segments 2 and 3 would overlie the southern part of Railroad Valley, hydrographic area 173A (Figure 3-79). Section 3.2.6.3.4 describes area 173A in detail. Table 3-41 summarizes generalized groundwater-quality and aquifer characteristics in this area. Committed groundwater resources in this (designated) area exceed the estimated perennial yield (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There is one NDWR well with water rights, no NDWR domestic wells, and no USGS NWIS wells, and no springs, seeps, or other surface-water-right locations in area 173A within 1.6 kilometers (1 mile) of the centerlines of the South Reveille alternative segments.

Geologic units in the general area of South Reveille alternative segments 2 and 3 include alluvial valley fill, with volcanic rocks primarily comprising the Kawich Range and older carbonate rocks and volcanic rocks comprising the Reveille Range adjacent to the alternative segments. About half of the total length of the South Reveille alternative segments would overlie alluvial valley fill. Groundwater is produced primarily from alluvial valley fill, although water does occur in fractured volcanic rocks. Based on data from six wells in the southern part of Railroad Valley, depth to groundwater ranges from approximately 5 to 120 meters (17 to 400 feet) (DIRS 182821-Converse Consultants 2005, p. 65). Near Caliente common segment 2 and the South Reveille alternative segments in the southern part of area 173A, the depth to groundwater could be more than 91 meters (300 feet) in some areas based on data from only two wells. Section 3.2.6.3.4 contains additional information on groundwater characteristics and groundwater availability in area 173A.

3.2.6.3.6 Caliente Common Segment 3 (Stone Cabin Valley Area)

Crossing from east to west, Caliente common segment 3 would overlie hydrographic areas 173A (Railroad Valley South), 156 (Hot Creek Valley), 149 (Stone Cabin Valley), and 141 (Ralston Valley) (Figures 3-79 and 3-80). Caliente common segment 3 would predominantly overlie alluvial valley fill. Depth to groundwater varies from approximately 24 to more than 90 meters (80 to more than 300 feet) along Caliente common segment 3 (Table 3-41). This range includes projected values in those areas where there are few or no wells.

Groundwater quality underlying Caliente common segment 3 varies according to location within the hydrographic areas the rail line would cross. Table 3-41 summarizes general groundwater-quality and aquifer characteristics in the three hydrographic areas underlying Caliente common segment 3.

Table 3-41. General groundwater-quality and aquifer characteristics – Caliente common segment 3 and South Reveille alternative segments 2 and 3.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
173A Railroad Valley, southern part	Alluvial valley fill, volcanic rocks, and older carbonate rocks[e]	More than 300	2.1 million[f]	Total dissolved solids: 253 to 409 ppm; 2,790 ppm in one well[e] Fluoride: More than 4 ppm[e]
156 Hot Creek Valley	Alluvial valley fill, volcanic rocks in the Hot Creek and Kawich Ranges adjacent to common segment 3, and older carbonate rocks comprising part of the Hot Creek Range[e]	80 to 300	2.3 million[f]	Total dissolved solids: 176 to 2,500 ppm[e] Fluoride: 5 to 30 ppm[e]
149 Stone Cabin Valley	Alluvial valley fill, volcanic rocks, and carbonate rocks[e,g]	100 to 120	2.2 million[f]	Total dissolved solids: Less than 500 to 1,000 ppm[h]
141 Ralston Valley	Alluvial valley fill, volcanic rocks, and older carbonate and clastic rocks[e,g]	140 to 220	2.7 million[f]	Total dissolved solids: 290 ppm (in one well 3.2 kilometers [2 miles] northwest of Tonopah airport)[e]

a. Depth ranges are derived from groundwater depth contours depicted on Plates 4-6, 4-7, and 4-8, DIRS 182821-Converse Consultants 2005, and pp. 60, 64, and 65. Groundwater can vary over a wide range of depth depending on location in the hydrographic area.
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Source: DIRS 182821-Converse Consultants 2005, pp. 53 through 67; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Sources: DIRS 182821-Converse Consultants 2005, p. 56; DIRS 173179-Belcher 2004, Figure B-1.
h. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.

Section 3.2.6.3.4 describes the hydrogeologic characteristics of area 173A. There is one USGS NWIS well in area 173A within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3 (Figure 3-79).

An application (NDWR Application Number 53982) has been filed for a proposed municipal and domestic well that would be located in hydrographic area 173A. This proposed well has been assigned a status of "Ready for Action, Protested (RFP)." Section 5.2.1.3.2 provides further discussion, and Section 5.2.2.6 evaluates the potential for cumulative impacts associated with this proposed water-rights location. Area 156, Hot Creek Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 6.8 million cubic meters (5,500 acre-feet). Geologic units in hydrographic area 156 (Hot Creek) include alluvial valley fill, volcanic rocks in the Kawich Range adjacent to Caliente common segment 3, and volcanic and older carbonate rocks comprising part of the Hot Creek Range, north of Warm Springs (see Figure 3-79). Groundwater is produced primarily from alluvial valley fill, although there is water in fractured volcanic rocks and in carbonate rocks in the Hot Creek Range. There is groundwater under both confined and unconfined conditions in area 156 (DIRS 176950-Rush and Everett 1966, p. 16). The thickness of underlying alluvium is not known; however, three wells in the area penetrated between 47 and 97 meters (150 and 320 feet) of alluvial materials (DIRS 176950-Rush and Everett 1966, p. 35). There could be approximately 2.8 billion cubic meters (2.3 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 156.

Groundwater is reported to be a sodium-bicarbonate type. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 156.

There is one NDWR well with water rights, no NDWR domestic wells, and no USGS NWIS wells in area 156 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3. One spring (Black Spring) in area 156 (Figure 3-79) is within 1.6 kilometers of the centerline of Caliente common segment 3.

Area 149, Stone Cabin Valley, is a designated groundwater basin with perennial yields of 2.5 million cubic meters (2,000 acre-feet). Committed groundwater resources in area 149 exceed the estimated perennial yield (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. In addition to existing groundwater wells in hydrographic area 149 with water-rights appropriations, NDWR data indicate that there are approximately 7.9 million cubic meters (6,400 acre-feet) of pending annual duties (see Table 3-35) in area 149.

Groundwater in area 149 is produced primarily from alluvial valley fill, although there is water in fractured volcanic rocks and in carbonate rocks in the Hot Creek Range, north of Warm Springs (see Table 3-41). There could be approximately 2.71 billion cubic meters (2.2 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 149. Table 3-41 summarizes groundwater-quality characteristics in this area. Depth to groundwater throughout hydrographic area 149 varies from 5 to 120 meters (18 to 390 feet). Depth to groundwater underlying the rail alignment in this area ranges from 30 to 40 meters (100 to 120 feet) (Table 3-41). There are seven NDWR wells with water rights, no NDWR domestic wells, six USGS NWIS wells, and no springs, seeps, or other surface-water-right locations in area 149 within approximately 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3 (Figures 3-79 and 3-80). The proposed use categories for the wells include irrigation, stockwatering, and public supply–municipal. Figures 3-79 and 3-80 do not depict all existing wells in area 149 that lie within 1.6 kilometers of the centerline of Caliente common segment 3 because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Area 141, Ralston Valley, is a designated groundwater basin with perennial yields of 7.40 million cubic meters (6,000 acre-feet) (see Table 3-35). Committed groundwater resources do not exceed the estimated perennial yield. The thicknesses of underlying alluvium is not known; however, well logs for wells drilled in the area indicate alluvial materials up to at least 120 meters (380 feet) thick. Geologic units include alluvial valley fill, volcanic rocks in the central and southern parts of the basin, and older carbonate or clastic rocks in the northern part of the basin. Groundwater in area 141 is produced primarily from alluvial valley fill, with limited production from volcanic rocks where they are fractured and minor production from carbonate rocks in the northern part of the valley. Groundwater depths throughout hydrographic area 141 vary from less than 3 to 150 meters (less than 10 to 500 feet). Groundwater depth underlying the common segment 3 alignment in this area varies from 50 to 70 meters (Table 3-41). There could be approximately 3.33 billion cubic meters (2.7 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 141. Table 3-41 summarizes groundwater-quality characteristics in this area. There are no NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no springs, seeps, or other surface-water-right locations in area 141 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3 (see Figure 3-80). NDWR data indicate that there are approximately 1,230 cubic meters (1 acre-foot) of documented pending annual duties (see Table 3-35) in area 141.

Figures 3-79 and 3-80 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of Caliente common segment 3. The potential quarry site east of Caliente common segment 3 in South Reveille Valley (see Figure 3-79) would overlie hydrographic area 173A. Host rock units in the vicinity of this potential quarry include basalt and lava flow rocks (DIRS 183639-Shannon &

Wilson 2007, Plate 2). Depth to groundwater in the area could be between 90 and 150 meters (300 and 500 feet) (DIRS 182822-Converse Consultants 2006, Appendix A).

3.2.6.3.7 Goldfield Alternative Segments

Crossing from north to south, Goldfield alternative segment 1 would overlie hydrographic areas 141 (Ralston Valley), 142 (Alkali Spring Valley), and 145 (Stonewall Flat); Goldfield alternative segment 3 would overlie areas 141 and 145; and Goldfield alternative segment 4 would overlie areas 141, 142, 144 (Lida Valley), and 145 (Figure 3-80).

Section 3.2.6.3.6 describes hydrographic area 141. There are no existing NDWR wells with water rights, USGS NWIS wells, or springs, seeps, or other surface-water-right locations in area 141 within 1.6 kilometers (1 mile) of the centerlines of the proposed Goldfield alternative segments.

Depth to groundwater varies along the Goldfield alternative segments. However, based on projections from nearby areas, depth to groundwater could generally vary between approximately 15 and 90 meters (50 to 300 feet) (Table 3-42), but can locally be shallower, such as in areas where springs occur.

Groundwater quality underlying the Goldfield alternative segments varies according to location within the hydrographic areas the rail line would cross. Table 3-42 summarizes general groundwater-quality and aquifer characteristics in the three hydrographic areas underlying the Goldfield alternative segments.

Area 142, Alkali Spring Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-35). Groundwater depth throughout area 142 varies from 50 to 90 meters (150 to 300 feet). There could be approximately 1.6 billion cubic meters (1.3 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 142. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 142.

Near the western edge of Goldfield, along Goldfield alternative segment 4, the depth to groundwater is approximately 15 to 40 meters (50 to 120 feet) (Table 3-42). Water quality varies in area 142 according to location. Water in Alkali Spring, in the southern portion of area 142 approximately 13 kilometers (8 miles) northwest of Goldfield, is reported to be a sodium-sulfate type that exhibits elevated total dissolved solids concentrations (DIRS 176849-Rush 1968, Plate 1). Analyses have shown that the quality of water from various groundwater wells in the basin is good (Table 3-42).

In area 142 (see Table 3-36), there are 14 NDWR wells with water rights (municipal/quasi-municipal and shockwatering use), no NDWR domestic wells, four USGS NWIS wells, and two springs within approximately 1.6 kilometers (1 mile) of the centerline of Goldfield alternative segment 4, and one spring within approximately 1.6 kilometers of the centerline of Goldfield alternative segment 1. In area 141, there are no existing NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no springs, seeps, or other surface-water-right locations within 1.6 kilometers of the centerline of Goldfield alternative segment 3.

Area 144, Lida Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 430,000 cubic meters (350 acre-feet) (see Table 3-35). There could be approximately 1.85 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 142. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 144.

Depth to groundwater is uncertain along the Goldfield 4 alternative segment where it would cross area 144. However, based on projections from nearby areas, depth to groundwater could range from 50 to

90 meters (160 to 290 feet) (DIRS 182821-Converse Consultants 2005, pp. 47 and 48). There are two existing NDWR wells with water rights, no NDWR domestic wells, no existing USGS NWIS wells, and no springs, seeps, or other surface-water-right locations in area 144 within 1.6 kilometers (1 mile) of the centerline of Goldfield alternative segment 4.

Area 145, Stonewall Flat, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 124,000 cubic meters (100 acre-feet) (see Table 3-35). There could be approximately 1.01 billion cubic meters (820,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 145. Depth to groundwater is uncertain along Goldfield alternative segment 3 where it would cross area 145. However, based on projections from nearby areas, depth to groundwater could be approximately 37 to 60 meters (120 to 200 feet) (Table 3-42). There are no existing NDWR wells with water rights and no NDWR domestic wells, no existing USGS NWIS wells, and one spring in area 145 within 1.6 kilometers (1 mile) of the centerline of Goldfield alternative segment 1, and no existing NDWR wells with water rights and no NDWR domestic wells, no existing USGS NWIS wells, and three springs in area 145 within 1.6 kilometers of Goldfield alternative segment 3. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 145.

There are two potential quarry sites (NS-3A and NS-3B) east of Goldfield alternative segment 3 (Figure 3-80). These potential quarry sites would overlie hydrographic area 141. Host rock units include alluvial fan deposits, and the targeted water production zones for wells at these potential quarry sites, if required, are an alluvial fan or the underlying fractured volcanic rocks. The estimated total depths of these new wells (RaV9/10/11) would be between 120 and 150 meters (400 and 500 feet), and the target aquifer would be an alluvial unit (DIRS 182822-Converse Consultants 2006, Appendices A and B). A potential alternative groundwater-supply well location west of Goldfield alternative segment 4 (AsV6) would be installed if necessary to obtain adequate water to support operation of a quarry (ES-7) west of Goldfield alternative segment 4 and southwest of this proposed well (Figure 3-80). This potential quarry site would overlie the southern portion of hydrographic area 142. Up to two wells that might be installed at this location would have total depths of between about 30 and 60 meters (100 and 200 feet), with the target aquifer being a fractured volcanic rock unit (DIRS 182822-Converse Consultants 2006, Appendices A and B). Host rock units for this potential quarry site include basalt (DIRS 183639-Shannon & Wilson 2007, Plate 2).

Geologic units underlying hydrographic areas 142, 144, and 145 include alluvial valley-fill deposits, volcanic rocks, and older sedimentary rocks (DIRS 173179-Belcher 2004, p. 28). Goldfield alternative segments 1 and 3 would cross alluvial deposits, basalt flows, rhyodacite lava flow deposits, and ash-flow tuff deposits (DIRS 183639-Shannon & Wilson 2005, Figure 2, and Sheets 46 through 55). Goldfield alternative segment 3 would cross near or through a small cinder cone west of Mud Lake Playa (DIRS 183639-Shannon & Wilson 2007, Sheet 47). Portions of the three Goldfield alternative segments would overlie alluvial valley fill (DIRS 182822-Converse Consultants 2006, Maps 11a and 11b). About two-thirds of the total length of Goldfield alternative segment 4 would overlie alluvial valley fill, compared to approximately one-third for Goldfield alternative segments 1 and 3. Goldfield alternative segment 1 and, to a considerably lesser extent, Goldfield alternative segment 3, would pass close to mine shafts at one or more locations (for example, along a section of Goldfield alternative segment 1 north of the community of Goldfield) (DIRS 182854-Shannon & Wilson 2006, Figure 2, and Sheets 47, 48, and 49).

Within area 142 (Alkali Spring Valley), which portions of Goldfield alternative segments 1 and 4 would cross, groundwater production is generally derived from valley-fill alluvium. Groundwater production in area 144 is limited to a few domestic wells, a municipal well at Lida, and stockwater wells. There are a few small stockwater wells near the general area of the rail alignment in area 144. These wells produce

Table 3-42. General groundwater-quality and aquifer characteristics – Goldfield alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
141 Ralston Valley	Alluvial valley fill, volcanic rocks, and older carbonate or clastic rocks[e]	140 to 220	2.7 million[f]	Total dissolved solids: 290 ppm (in one well 3.2 kilometers [2 miles] northwest of Tonopah airport)[g]
142 Alkali Spring Valley	Alluvial valley-fill deposits, volcanic rocks, and older sedimentary rocks[h]	150 to 200	1.3 million[f]	Total dissolved solids: Less than 500 to 1,000 ppm[i]
144 Lida Valley	Alluvial valley fill, rhyolite, volcanic sediments (including tuffs of the Stonewall Flat and tuffs of the Thirsty Canyon Group), older carbonate rocks, and older rock units including claystone, siltstone, and limestone[h]	160 to 290	1.5 million[f]	Total dissolved solids: 400 to 1,100 ppm[g] Sulfate: 61 to 284 ppm[g]
145 Stonewall Flat	Alluvial valley-fill deposits, volcanic rocks, older carbonate rocks, and older sedimentary rocks[h]	120 to 200	820,000[f]	Total dissolved solids: Less than 300 ppm[g]

a. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 182821-Converse Consultants 2007, Plates 4-5 and 4-6); groundwater can vary over a wide range of depths depending on location in the hydrographic area (DIRS 182821-Converse Consultants 2007 pp. 42, 46 through 48, 50, and 52).
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Source: DIRS 182821-Converse Consultants 2007, p. 53.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 182821-Converse Consultants 2005, pp. 43, 48, 50, and 55.
h. Sources: DIRS 183639-Shannon & Wilson 2007, pp. 22 to 35, and Plate 2; DIRS 173179-Belcher 2004, Figure B-1; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.
i. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.

from valley fill materials; however, no aquifer test data are available for these wells (DIRS 182822-Converse Consultants 2006, Appendix B).

Figure 3-80 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Goldfield alternative segments. In addition to a series of new wells proposed for installation within the rail line construction right-of-way of the selected alternative segment, DOE might install a series of additional wells outside the nominal width of the rail line construction right-of-way, either as alternative water wells or as alternative wells used in combination with other water wells installed within the rail line construction right-of-way. These wells would be drilled in areas where groundwater resources within the construction right-of-way would not be adequate to meet construction or operations needs. Possible locations for wells in this category (Figure 3-80) include the following (locations used would depend on the alternative segment):

- Locations ASV1/2/3/4/5/8/9 in hydrographic area 142, approximately 3.5 kilometers (2.2 miles) west of the centerline of Goldfield alternative segment 4. Wells installed at this location would be expected to intercept alluvial valley-fill deposits (alluvial fan), and could encounter groundwater at a depth of approximately 60 to 90 meters (200 to 300 feet) (DIRS 182822-Converse Consultants 2006, Appendices A and B).

- Locations StF1/2/3/5/6/7 in hydrographic area 145, approximately 1.9 to 2.3 kilometers (1.2 to 1.4 miles) east of the centerline of Goldfield alternative segment 3. Wells installed at this location would be expected to intercept alluvial valley-fill deposits, and would have total depths of approximately 180 to 210 meters (600 to 700 feet) (DIRS 182822-Converse Consultants 2006, Appendices A and B, and Maps 12a and 12b).
- Locations LV1/2/3/4/9/10/11/12 in hydrographic area 144, approximately 4.6 to 5.0 kilometers (2.9 to 3.1 miles) west of the centerline of Goldfield alternative segment 4. Wells installed at this location would be expected to intercept alluvial valley fill deposits, and would have total depths of approximately 120 to 150 meters (400 to 500 feet) (DIRS 182822-Converse Consultants 2006, Appendices A and B, and Maps 12e and 12f).

3.2.6.3.8 Caliente Common Segment 4 (Stonewall Flat Area)

Caliente common segment 4 would overlie hydrographic area 144 (Figures 3-80 and 3-81). Section 3.2.6.3.7 describes the hydrogeologic characteristics of area 144. Committed groundwater resources in this area do not exceed the estimated perennial yield (see Table 3-35). As shown on Figures 3-80 and 3-81, there are two NDWR wells with water rights, no NDWR domestic wells, three USGS NWIS wells, and no springs, seeps, or other surface-water-right locations within approximately 1.6 kilometers (1 mile) of the centerline of Caliente common segment 4.

Geologic units that common segment 4 would cross include primarily alluvial valley-fill deposits and some volcanic rocks (DIRS 173179-Belcher 2004, p. 28). Specific volcanic units the segment would cross include Stonewall Flat and tuffs of the Thirsty Canyon Group. The estimated depth to groundwater throughout hydrographic area 144 can vary from 8 to 110 meters (26 to 360 feet) depending on location (DIRS 182821-Converse Consultants 2007, p. 46). The depth to groundwater underlying the alignment varies from 50 to 85 meters (160 to 280 feet) (Table 3-43) (DIRS 182821-Converse Consultants 2005, Plate 4-5). Section 3.2.6.3.7 and Table 3-42 summarize general groundwater-quality and aquifer characteristics in area 144.

Figures 3-80 and 3-81 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of Caliente common segment 4. All proposed water wells would be within the rail alignment construction right-of-way. There are no potential quarry sites along Caliente common segment 4.

3.2.6.3.9 Bonnie Claire Alternative Segments

From north to south, Bonnie Claire alternative segments 2 and 3 would cross hydrographic areas 144 (Lida Valley) and 146 (Sarcobatus Flat) (Figure 3-81). Section 3.2.6.3.7 describes hydrographic area 144. There are no existing NDWR wells with water rights, no NDWR domestic wells, no existing USGS NWIS wells, and no existing springs, seeps, or other surface-water-right locations in area 144 within 1.6 kilometers (1 mile) of the centerlines of the proposed Bonnie Claire alternative segments. There are no NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no existing springs, seeps, or other surface-water-right locations in area 144 within 1.6 kilometers of the centerlines of the proposed Bonnie Claire alternative segments.

The Bonnie Claire alternative segments would predominantly overlie alluvial valley-fill deposits and some volcanic rocks (DIRS 183639-Shannon & Wilson 2007, p. 21, and Plate 2). The primary volcanic unit encountered along Bonnie Claire alternative segments 2 and 3 is tuff of the Timber Mountain Group (DIRS 183639-Shannon & Wilson 2007, pp. 29 and 30, and Plate 2; DIRS 182854-Shannon & Wilson 2006, Figure 2, and Sheets 57, 58, and 59).

Area 146, Sarcobatus Flat, is a designated groundwater basin, and has a perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-35). Committed groundwater resources in area 146 exceed the estimated perennial yield, but as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 3 billion cubic meters (2.4 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 146. While the basin is primarily comprised of alluvial valley-fill deposits, volcanic rocks make up the hills surrounding Sarcobatus Flat (Table 3-43). There are no existing water-supply wells or springs, seeps, or other surface-water-right locations in area 146 within 1.6 kilometers (1 mile) of the centerlines of the Bonnie Claire alternative segments. Section 3.2.6.3.7 and Table 3-42 summarize general groundwater characteristics in area 144. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 146.

Groundwater in hydrographic area 146 contains elevated levels of sodium bicarbonate. Table 3-43 summarizes general groundwater-quality and aquifer characteristics in areas 144 and 146.

Table 3-43. General groundwater-quality and aquifer characteristics – Caliente common segment 4 and Bonnie Claire alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
144 Lida Valley	Alluvial valley fill, rhyolite, volcanic sediments (including tuffs of the Stonewall Flat and tuffs of the Thirsty Canyon Group), older carbonate rocks, and older rock units including claystone, siltstone, and limestone[e]	160 to 290	1.5 million[f]	Total dissolved solids: 400 to 1,100 ppm[g] Sulfate: 61 to 284 ppm[g]
146 Sarcobatus Flat	Alluvial valley-fill deposits, older carbonate rocks, and some volcanic rocks[f] (volcanic units are tuff of the Timber Mountain Group)[h]	Less than 40 to 120	2.4 million[f]	Total dissolved solids: 540 pmm[g]

a. The listed range of groundwater depths applies to the area underlying the proposed rail alignment (DIRS 182821-Converse Consultants 2005, Plates 4-4 and 4-5). The depth to groundwater can vary over a wide range of depths depending on location in a hydrographic area (DIRS 182821-Converse Consultants 2005, pp. 42 and 46 through 48).
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Sources: DIRS 183639-Shannon & Wilson 2007, pp. 22 to 35, and Plate 2; DIRS 173179-Belcher 2004, Figure B-1; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.
f. Source: DIRS 182821-Converse Consultants 2005, pp. 43 and 48.
g. Source: DIRS 182821-Converse Consultants 2005, pp. 41 to 43, and Plates 4-4 and 4-5.
h. Source: DIRS 180754-Rush et al. 1971, all; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.

Most of the existing groundwater wells in area 146 are ***screened*** (installed with the well casing screened interval) in the alluvial valley fill; a few wells in the western portion of the basin are screened in volcanic rocks. The total volume of alluvial valley fill comprising the primary aquifer reservoir in area 146 is not known because of variations in the thickness of valley fill that result in variations in the surface of the underlying bedrock. However, Malmberg and Eakin (DIRS 106695-Malmberg and Eakin 1962, pp. 13 and 19) suggested the maximum thickness of valley fill in area 146 could be as much as thousands of meters (several thousand feet). Figure 3-81 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Bonnie Claire alternative segments. All proposed water wells would

be within the nominal width of the construction right-of-way of the selected alternative segment. There are no potential quarry sites along the Bonnie Claire alternative segments.

3.2.6.3.10 Common Segment 5 (Sarcobatus Flat Area)

Crossing from north to south, common segment 5 would overlie hydrographic area 146 (Sarcobatus Flat) and a small portion of hydrographic area 228 (Oasis Valley) (Figures 3-81 and 3-82). Section 3.2.6.3.9 describes the groundwater-quality and aquifer characteristics of area 146, which are summarized in Table 3-43. There are four NDWR wells with water rights, one NDWR domestic well, eight USGS NWIS wells, and no springs, seeps, or other surface-water-right locations within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5 within area 146. The use categories for the NDWR wells with water rights are irrigation, quasi-municipal, and stock-watering (see Table 3-36). Most wells in area 146 are screened in alluvial valley fill; a few wells are screened in volcanic rocks on the west side of the basin.

Section 3.2.6.3.11 describes the hydrogeologic characteristics of area 228, including groundwater-quality and aquifer characteristics; Table 3-44 summarizes those characteristics. Committed groundwater resources in these areas exceed estimated perennial yields (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There are six NDWR wells with water rights, no domestic wells, seven USGS NWIS wells, and no springs, seeps, or other surface-water-right locations within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5, as shown in Figures 3-81 and 3-82.

Common segment 5 would predominantly overlie alluvial valley fill, with depth to groundwater generally 3 to 55 meters (10 to 180 feet) in those portions of areas 146 and 228 the rail line would cross. Volcanic rocks are the predominant rock type comprising the hills surrounding the basin.

Figures 3-81 and 3-82 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of common segment 5. All proposed water wells would be within the rail line construction right-of-way. There are no potential quarry sites along common segment 5.

3.2.6.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segments 1 and 3 would cross hydrographic area 228 (Oasis Valley) (Figure 3-82). This area is a designated groundwater basin with an estimated perennial yield in the range of 1.2 to 2.5 million cubic meters (1,000 to 2,000 acre-feet) (DIRS 147766-Thiel 1999, pp. 6 to 12, and Table 3-35). Committed groundwater resources in area 228 total 1.6 million cubic meters (1,300 acre-feet) per year (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 490 million cubic meters (400,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 228. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 228.

Geologic units Oasis Valley alternative segments 1 and 3 would cross include sedimentary rocks, small areas underlain by volcanic rocks, and some alluvial valley fill (Table 3-44). Depth to groundwater throughout Oasis Valley is generally less than 3 to 46 meters (less than 10 to 150 feet), with the shallowest groundwater occurring along Oasis Valley alternative segment 1, northeast of Springdale. Depth to groundwater underlying the Oasis Valley alternative segments ranges from 10 to 30 meters (40 to 100 feet).

Oasis Valley has several springs and seeps. The locations of these springs and seeps are dictated by structurally controlled changes in rock unit lithology and thickness and conduits. The springs, seeps, and

Table 3-44. General groundwater-quality and aquifer characteristics – Oasis Valley alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks, clastic rocks, older carbonate rocks, and alluvial valley fill[e]	Less than 10 to 150	400,000[f]	Total dissolved solids: Less than 500 to 1,000 ppm[g] Fluoride: 1 to more than 4 ppm[h]

a. The listed depth to groundwater range applies to the area underlying the proposed Oasis Valley alternative rail alignments (DIRS 182821-Converse Consultants 2005, Plate 4-3 and p. 38). Depth to groundwater is much greater in the central and northern parts of area 228 (DIRS 182821-Converse Consultants 2005, p. 39).
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Sources: DIRS 182821-Converse Consultants 2005, p. 37; DIRS 181909-Fridrich et al. 2007, all; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.
h. Source: DIRS 182821-Converse Consultants 2005, p. 39.

shallow groundwater in the valley are maintained primarily by groundwater flow moving into the area through a regional volcanic rock aquifer system (DIRS 169384-Reiner et al. 2002, p. 8). Most groundwater flowing south-southeastward into Oasis Valley through the ***welded tuff*** aquifer is diverted upward along faults where it either forms springs or flows laterally out of Oasis Valley as underflow, indicating a regional groundwater inflow component to the flow at the springs. Springs and seeps occur where upward diversion coincides with areas where the potentiometric surface is above the ground surface (DIRS 169384-Reiner et al. 2002, pp. 9 and 10). Most historical groundwater resource development in this area has been from springs.

Available information indicates a non-welded confining volcanic tuff unit separates the alluvial aquifer from a regional welded tuff volcanic rock aquifer throughout much of Oasis Valley. This regional welded tuff aquifer has moderate fracture ***permeability*** (DIRS 169384-Reiner et al. 2002, p. 9).

Groundwater in much of Oasis Valley exhibits elevated levels of fluoride, in excess of the 4 milligrams per liter (approximately 4 parts per million) Nevada drinking water standard level (Table 3-44). Dissolved-solids concentrations in the alluvial valley fill are expected to be less than 500 milligrams per liter (approximately 500 parts per million) in the vicinity of the Oasis Valley alternative segments.

Figure 3-82 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Oasis Valley alternative segments. In addition to a series of new wells proposed for installation within the construction right-of-way, DOE might install wells at other locations outside the construction right-of-way, and use them either as principal water wells or in combination with other water wells installed within the construction right-of-way. These wells would be drilled in cases where either groundwater resources within the construction right-of-way would not be adequate for meeting construction or operations needs, or groundwater withdrawals would need to be distributed to reduce potential impacts on existing groundwater resources (see Section 4.2.6). Possible locations for wells in this category that could be used to obtain water for constructing the Oasis Valley alternative segments include the following (Figure 3-82):

- Up to two locations in the Oasis Valley groundwater basin, approximately 5.6 to 5.8 kilometers (3.5 to 3.6 miles) southwest of the centerline of common segment 6 (locations OV6 and OV8, or OV14 and

OV16, depending on alternative segment). The target water source at this location would be alluvial valley fill (DIRS 182822-Converse Consultants 2006, Appendices A and B, and Maps 14a and 14b).

- Locations in the southeastern part of Oasis Valley, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing fault system (DIRS 182822-Converse Consultants 2006, Appendices A and B, and Maps 14a and 14b).

Review of NDWR and USGS database data and other published information (DIRS 169384-Reiner et al. 2002, Plate 2; DIRS 181909-Fridrich et al. 2007, all) on existing wells and springs, seeps, and other surface-water-right locations indicates the following:

- Based on a review of the NDWR and USGS NWIS databases and other published information, there are ten USGS NWIS wells, four springs, and one surface-water body within approximately 1.6 kilometers (1 mile) of the centerlines of the Oasis Valley alternative segments. There are no existing NDWR wells with water rights within 1.6 kilometers of the centerlines of the Oasis Valley alternative segments.
- There is one cluster of three USGS-installed wells within approximately 0.64 kilometer (0.40 mile) of the centerline of Oasis Valley alternative segment 3 (wells ER-OV-01, ER-OV-06a, and ER-OV-06a2), and one USGS-installed well (ER-OV-02) within approximately 0.40 kilometer (0.25 mile) of Oasis Valley alternative segment 1 (DIRS 182821-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000, all; DIRS 169384-Reiner et al. 2002, Plate 2). The use category for these wells is monitoring. There are three additional shallow USGS-installed wells (the OVU-Dune Well, OVU-Middle ET Well, and the OVU-Lower ET Well), used for monitoring groundwater levels, within approximately 0.32 to 0.48 kilometer (0.20 to 0.30 mile) of Oasis Valley alternative segment 1 (DIRS 182821-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 169384-Reiner et al. 2002, Plate 2). Figure 3-82 does not show all existing wells in area 228 that lie within 1.6 kilometers (1 mile) of the centerlines of the Oasis Valley alternative segments because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.
- There is one domestic well within 0.79 kilometer (0.49 mile) and 1.1 kilometers (0.7 mile) of proposed well locations OV9 and OV5, respectively (Figures 3-196)
- There is one domestic well within 1.4 kilometers (0.9 mile) and 1.5 kilometers (0.94 mile) of proposed well locations OV20 and OV2, respectively (Figure 3-196)
- As shown on Figure 3-82, there is a series of springs (Upper Oasis Valley Ranch Springs) southwest of Oasis Valley alternative segment 1 (DIRS 181909-Fridrich et al. 2007, all). Colson Pond and Colson Pond Spring are also near Oasis Valley alternative segment 3 (Figure 3-82). Springs in the Upper Oasis Valley Ranch Springs area southwest of a portion of the OV1 segment lie approximately 0.6 kilometer (0.4 mile) or farther to the west of proposed well location OV9 (DIRS 181909-Fridrich et al. 2007, all; Figure 3-82).
- There two existing NDWR wells with water rights, no NDWR domestic wells, and no USGS NWIS wells within 1.6 kilometers (1 mile) of locations OV6 and OV8, or OV14 and OV16. Two springs (Ute Springs and Manley Springs) lie within approximately 1.3 to 1.4 kilometers (0.8 to 0.9 mile) east of locations OV6 and OV8, or OV14 and OV16.
- There is one (vested) surface-water-right location approximately 1.4 kilometers (0.9 mile) from proposed new well location OV16 (DIRS 183991-NDWR 2007, all).
- There are no known existing wells, springs, seeps, or other surface-water-right locations within 1.6 kilometers (1 mile) of the proposed alternative well location at OV22/OV23.

3.2.6.3.12 Common Segment 6 (Yucca Mountain Approach)

From north to south, common segment 6 would cross a portion of hydrographic area 228 (Oasis Valley), all of hydrographic area 229 (Crater Flat), and a portion of area 227A (Jackass Flats), as shown in Figure 3-82. Section 3.2.6.3.11 describes and Table 3-44 summarizes groundwater-quality and aquifer characteristics of hydrographic area 228.

There are a total of 17 USGS NWIS wells, four NDWR wells with water rights, no NDWR domestic wells, and no springs, seeps, or other surface-water-right locations within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-82. The figure does not show all existing wells in area 227A that lie within 1.6 kilometers of the centerline of common segment 6 because some wells, particularly in area 227A, are at very nearly the same locations and cannot be shown at the scale used in this figure.

Geologic units that common segment 6 would cross include volcanic rocks and basin-fill alluvium (DIRS 173179-Belcher 2004, p. 28; DIRS 182821-Converse Consultants 2005, Plate 4-3). Specific volcanic rock units the segment would cross include volcanic rocks of the Crater Flat and Paintbrush Groups (DIRS 183639-Shannon & Wilson 2007, Plate 2).

Hydrographic area 228, Oasis Valley, is a designated groundwater basin and is described in Section 3.2.6.3.11.

Hydrographic area 229, Crater Flat, is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of about 271,000 cubic meters (220 acre-feet) (see Table 3-35). As previously noted, all committed resources within a hydrographic area might not be in use at the same time. In addition to existing groundwater wells in hydrographic area 229 that have water-rights appropriations, preliminary NDWR data indicate that approximately 101,000 cubic meters (82 acre-feet) of pending annual duties (see Table 3-35) exist in area 229. The pending water-right locations are not within 1.6 kilometers (1 mile) of the centerline of common segment 6. There could be approximately 430 million cubic meters (350,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 229.

Table 3-45 summarizes groundwater-quality and aquifer characteristics of hydrographic area 229. Groundwater is typically very deep in area 229 beneath the rail alignment, generally 180 to 370 meters (600 to 1,200 feet) below ground. In the northwestern portion of area 229 and west of the rail alignment, groundwater occurs within two aquifers and the estimated depth to groundwater varies from 55 to 200 meters (180 to 650 feet). There are three USGS NWIS wells, four NDWR wells with a water right, no domestic, wells and no springs, seeps, or other surface-water-right locations in area 229 within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-82.

Hydrographic area 227A, Jackass Flats, is not a designated groundwater basin. Committed groundwater resources do not exceed the total perennial yield value of 1.1 million cubic meters (880 acre-feet) per year estimated for the entire hydrographic area (see Table 3-35). For evaluation purposes, the perennial yield estimate for hydrographic area 227A is assumed to be approximately 720,000 cubic meters (580 acre-feet) per year, representing the western two-thirds of the area. The perennial yield estimate for the eastern one-third of this hydrographic area has been estimated at approximately 370,000 cubic meters (300 acre-feet) per year. The value of 720,000 cubic meters (580 acre-feet) per year is used as a basis for evaluating the potential impacts of groundwater withdrawals (Section 4.2.6) because the western two-thirds of the hydrographic area is most representative of the potential source area from which groundwater required to support the project might be obtained. There could be approximately 910 million cubic meters (740,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer

materials within area 227A. NDWR data indicate that there are approximately 6,170 cubic meters (5 acre-feet) of documented pending annual duties (see Table 3-35) in area 227A.

Table 3-45 summarizes groundwater-quality and aquifer characteristics of hydrographic area 227A. In hydrographic area 227A, groundwater occurs in alluvial valley-fill deposits in the southern portion of the area and deeper in volcanic rocks in the central part of the basin. The depths to groundwater in wells throughout area 227A vary from approximately 12 to 650 meters (38 to 2,150 feet) (DIRS 182821-Converse Consultants 2005, p. 32). Most groundwater storage in area 227A occurs toward the southern end of the basin, south of the rail alignment. Groundwater is typically very deep near the rail alignment, generally 180 to 370 meters (600 to 1,200 feet) below ground.

Most wells penetrating the volcanic rocks are monitoring wells used for monitoring groundwater conditions southwest, southeast, and south of the Yucca Mountain Site. There are 14 USGS NWIS wells, no NDWR wells with a water right, and no springs, seeps, or other surface-water-right locations in area 227A within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-82.

Twelve of 15 NDWR existing new or replacement wells cataloged within all of hydrographic area 227A are groundwater monitoring wells; the others are listed as production wells. The volcanic rocks in this area generally have low porosity, and are not considered suitable for groundwater production except in major fractured areas.

Figure 3-82 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of common segment 6. All proposed water wells would be within the rail alignment construction right-of-way. There are no potential quarry sites along common segment 6.

Table 3-45. General groundwater-quality and aquifer characteristics – common segment 6.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (feet)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks, clastic rocks, older carbonate rocks, and alluvial valley fill[e]	50 to 150	400,000[f]	Total dissolved solids: Less than 500 to 1,000 ppm[g] Fluoride: 1 to more than 4 ppm[h]
229 Crater Flat	Volcanic rocks, older carbonate rocks, and alluvial valley fill[e]	600 to 1200	350,000[f]	Total dissolved solids: 270 ppm[h]
227A Fortymile Canyon, Jackass Flats	Volcanic rocks, older carbonate rocks, and alluvial valley fill[e]	700 to 1,200	740,000[f]	Total dissolved solids: Less than 500 to 1,000 ppm[g]

a. Depth ranges are derived from groundwater depth contours depicted on Plates 4-1 through 4-3, DIRS 182821-Converse Consultants 2005, and pp. 32, 34, and 38. Groundwater can vary over a wide range of depth depending on location in the hydrographic area.
b. To convert feet to meters, multiply by 0.3048.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 100 feet of the saturated alluvial valley-fill material in the hydrographic area.
d. ppm = parts per million.
e. Source: DIRS 182821-Converse Consultants 2005, pp. 30, 31, 35, 36, and 37; DIRS 173179-Belcher 2004, Figures E-34 and E-35; DIRS 177741-State of Nevada 2005, all, with rail alignment overlay.
f. Source: DIRS 180754- Rush et al. 1971, all.
g. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.
h. Source: DIRS 182821-Converse Consultants 2005, pp. 36 and 39.

3.2.7 BIOLOGICAL RESOURCES

This section describes the biological resources that could be affected by construction and operation of the proposed railroad along the Caliente rail alignment.

Biological resources include vegetation, wildlife, special status species, game species, and wild horses and burros within or near the construction right-of-way described in Section 3.2.7.1. This discussion of biological resources is based on the results of a review of available data from federal, State of Nevada, and local agencies, and data gathered during field investigations.

Section 3.2.7.2 provides a general overview of biological resources, including vegetation, wildlife, special status species, game species, and wild horses and burros along the Caliente rail alignment. Section 3.2.7.3 describes biological resources unique to each Caliente rail alignment alternative segment and common segment. Appendix H, Biological Resources, provides additional information regarding biological resources along the Caliente rail alignment.

Special Status Species

Endangered species are classified under the Endangered Species Act as being in danger of extinction throughout all or a significant part of their range.

Threatened species are classified under the Endangered Species Act as likely to become endangered species in the foreseeable future.

Proposed species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats and that are the subject of a Fish and Wildlife Service *Federal Register* rulemaking notice to list them as endangered or threatened.

Candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information to support a proposal to list as endangered or threatened, but development of a listing regulation is precluded by other higher priority listing activities.

Endangered Species Act candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

State protected plant and animal species. Wildlife species or subspecies are classified as protected under Nevada Administrative Code (NAC) Chapter 503 if one or more of the following criteria exists:

1. The wildlife is found only in the State of Nevada and its population, distribution, or habitat is limited.
2. The limited population or distribution within Nevada is likely to decline.
3. The population is threatened as a result of the deterioration or loss of its habitat.
4. The wildlife has ecological, scientific, educational, or other value that justifies its classification as protected.
5. The available data is not adequate to determine the exact status of the wildlife population, but does indicate a limited population, distribution, or habitat.
6. The wildlife is listed by the U.S. Fish and Wildlife Service as a candidate species, or it is classified as threatened or endangered in the federal Endangered Species Act.
7. Other evidence exists to justify classifying the wildlife as protected.

Under NAC Chapter 527, plants are classified as being in danger of extinction if their survival requires assistance because of overexploitation, disease, or other factors or because its habitat is threatened with destruction, drastic modification, or severe curtailment. There are no State of Nevada-listed endangered plants present in the areas of assessment.

BLM-designated sensitive species are species other than federally listed, proposed, or candidate species, and may include such native species as those that:

1. Could become endangered in or extirpated from a state or within a significant portion of their distribution in the foreseeable future;
2. Are undergoing a status review by the U.S. Fish and Wildlife Service to determine whether to list the species as a threatened or endangered species across all or a significant portion of its range under the Endangered Species Act;
3. Are undergoing significant current or predicted downward trends in habitat capability that would reduce their existing distribution;
4. Are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or state listed status might become necessary;
5. Have typically small and widely dispersed populations;
6. Are inhabiting ecological refugia or specialized or unique habitats; or
7. Are state listed but might be better conserved through application of BLM sensitive species status. Such species should be managed to the level of protection required by state laws or under the BLM policy for candidate species, whichever would provide better opportunity for their conservation.

3.2.7.1 Areas of Assessment

DOE used two areas of assessment to describe the affected environment for biological resources: the greater study area and the construction right-of-way.

3.2.7.1.1 Construction Right-of-Way

The rail line construction right-of-way would be a nominal width of 300 meters (1,000 feet), which is 150 meters (500 feet) on either side of the rail alignment centerline. The footprint, which would be within the construction right-of-way, is the area that would involve clearing of vegetation, excavation, and filling for subgrade to support the rail line. This area would be directly affected, long term, by rail line construction activities. The footprint would fluctuate throughout the alignment due to topography, cut and fill requirements, and land use. The footprint could also vary based on land use and avoidance or minimization of impacts to other resources (for example, water or structures) but generally would be 300 meters or less. The area between the footprint and the outer edge of the construction right-of-way would be directly affected, short term, by construction-related activities such as construction staging, material laydown, and temporary access roads. DOE analyzed the area between the footprint and the outer edge of the construction right-of-way for ***short-term impacts*** even though the use of this area would be minimized and the area might not be disturbed. For purposes of this analysis, DOE has taken a conservative approach of potentially overstating the environmental impacts to biological resources. For facilities that would be outside the nominal width of the rail line construction right-of-way (such as quarries and other ***infrastructure***), the area DOE assessed as the affected environment is the maximum area or the footprint of the proposed facility.

3.2.7.1.2 Study Area

DOE identified a study area (16 kilometers [10 miles] wide, extending 8 kilometers [5 miles] on either side of the centerline of the rail alignment) for use in database and literature searches to ensure the identification of sensitive habitat areas near the Caliente rail alignment and transient or migratory wildlife, particularly special status species, that could pass through or along the construction right-of-way. Using the larger study area identifies special status species and/or habitat that could be present near the rail alignment to better describe the habitat value and species use within the construction right-of-way.

3.2.7.2 General Environmental Setting and Characteristics

This section describes the affected environment for biological resources that could be present or have the potential to occur within the construction right-of-way or the study area. DOE used the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), which the BLM currently uses in its conservation and management actions, to characterize the vegetation communities in the construction right-of-way and the study area.

As a starting point for classification, the 2004 Southwest Regional Gap Analysis Project divided the southwestern United States into general ***ecoregions*** (relatively discrete sets of ecosystems characterized by certain plant communities or assemblages) based on physical and biological similarities. Using satellite imagery and field data, the Project classified geographic areas or "mapping zones" within each ecoregion based on their land-cover types, and generated maps of these land-cover types. The Project classified naturally vegetated types using the "ecological systems" and developed and described types based on dominant vegetation, physical characteristics of the land, hydrology, and climate in the area (DIRS 176369-Lowry et al. 2005, all; DIRS 173051-Comer et al. 2003, all). These mapping zones represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. As shown in Figure 3-83, the Caliente rail alignment would cross three mapping zones: the Pioche, the Mojave, and the Nellis. The land-cover types are grouped into land-cover classes. Eleven land-cover classes occur in this part of Nevada. To identify the land-cover types and classes within the construction right-of-way and the study area, digital maps of the land-cover types within the affected map zones were overlain (spatial analysis using the Geographic Information System) with the Caliente rail alignment construction right-of-way and operations support facilities. Additionally, Figure 3-84 discloses the BLM Areas of

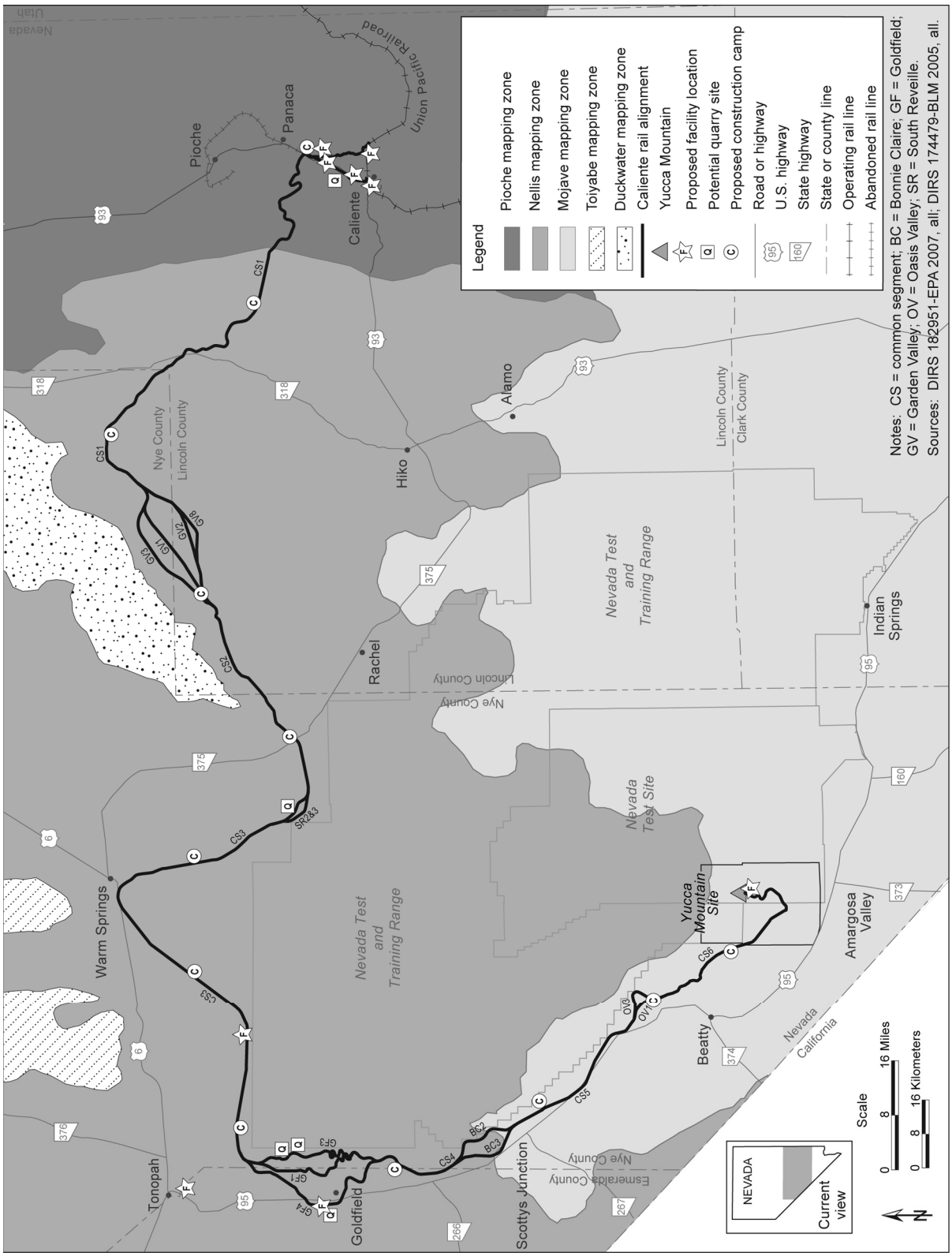


Figure 3-83. Mapping zones along the Caliente rail alignment.

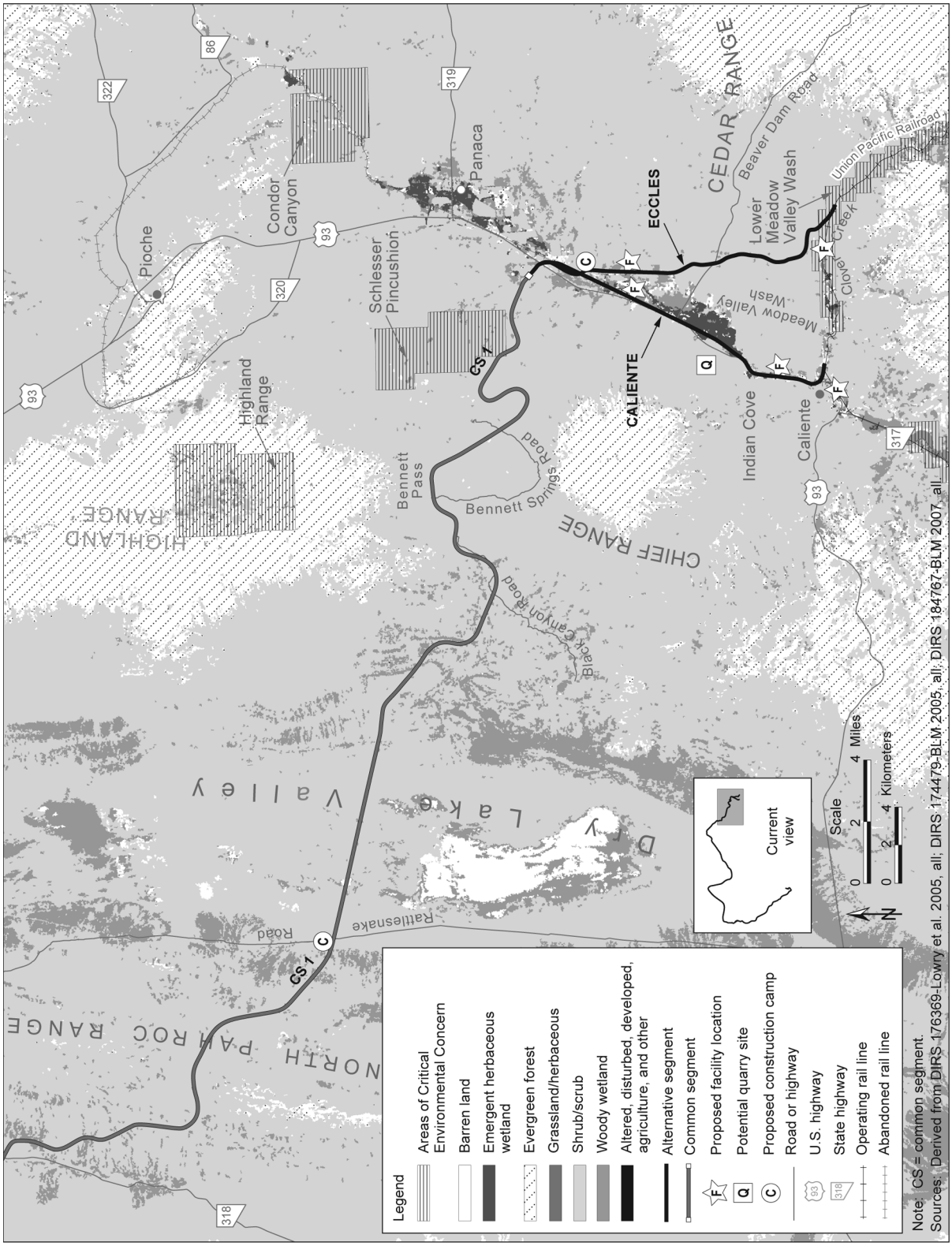


Figure 3-84. Land-cover classes the Caliente rail alignment would cross within map area 1.

Critical Environmental Concern. The BLM has proposed the Lower Meadow Valley Wash Area of Critical Environmental Concern for protection of federally endangered, threatened, and candidate species, and for sensitive species such as the Meadow Valley Wash desert sucker and Meadow Valley Wash speckled dace (DIRS 184767-BLM 2007, Table 2.4-28). The proposed Schlesser Pincushion Area of Critical Environmental Concern is along Caliente common segment 1 and the Lower Meadow Valley Wash Area of Critical Environmental Concern occurs within the Eccles alternative segment. A detailed description of the Areas of Critical Environmental Concern can be found in the Land Use and Ownership section of this Rail Alignment EIS. These Areas of Critical Environmental Concern are classified as avoidance areas.

The Caliente rail alignment construction right-of-way would cross nine of the 11 classes (DIRS 174324-NatureServe 2004, all). Table 3-46 lists classes and types and Figures 3-84 through 3-90 show the classes the rail alignment would cross.

To document additional site-specific information regarding vegetation and habitat, DOE performed literature and database searches, and consulted with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, the Nevada Department of Wildlife, the University of Nevada–Reno, and the Nevada Division of Forestry.

In addition to the review of existing information, DOE conducted field surveys and gathered data to further characterize the mapping zones and associated vegetation communities, and to further characterize the habitats in the study area that might support special status species. DOE chose field survey locations to provide representative survey coverage of the different types of vegetation along the Caliente rail alignment, specifically in the construction right-of-way, but also in the larger study area. The field survey data DOE collected helped further characterize the types of habitats in the construction right-of-way and identified by the Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Appendix H describes the field survey methodology. The additional surveys and data searches are outlined in each specific resource area below.

3.2.7.2.1 Vegetation

The Caliente rail alignment is situated within two large deserts: the Great Basin and the Mojave. The Great Basin Desert is considered a cold desert and has been referred to as the Basin and Range region due to its parallel north-south trending ranges, or mountains, and intervening basins, or valleys. This region covers most of central and northern Nevada, with its southern extent ending roughly in southern Lincoln, Esmeralda, and Nye Counties. The Mojave Desert is considered a hot desert and covers most of southern Nevada and much of southeastern California (DIRS 174412-Ryser 1985, all). Just as the two deserts are distinguished from one another climatically, the predominant vegetation and vegetation communities also define each desert.

The Great Basin Desert is generally characterized by big sagebrush (*Artemisia tridentata*), which is mostly absent from the Mojave Desert except at moderate to high elevations in the mountains. Alternatively, the Mojave Desert is dominated by creosote bush (*Larrea tridentata*), which is mostly absent from the Great Basin Desert. There is a broad transitional zone where these two deserts meet, which exhibits characteristics of both regions.

Based on the spatial analysis described above, the Caliente rail alignment would intersect 25 land-cover types, which are listed in Table 3-46. The most common plant communities within the study area are the Inter-Mountain Basins Mixed Salt Desert Scrub and the Inter-Mountain Basins Big Sagebrush Shrubland. Appendix H, Table H-1, describes plant communities. The acreages in the table are representative of the

Table 3-46. Land-cover classes and types in the mapping zones.

Class and type	Total amount of classes and land-cover types within the Pioche, the Mojave, and the Nellis mapping zones (acres)[a]
Barren Lands	
Inter-Mountain Basins Playa	280,000
Inter-Mountain Basins Wash	400
Inter-Mountain Basins Cliff and Canyon	100,000
North American Warm Desert Playa	130,000
North American Warm Desert Bedrock Cliff and Outcrop	450,000
Evergreen Forest	
Great Basin Pinyon-Juniper Woodland	2,600,000
Scrub/Shrub	
Inter-Mountain Basins Mixed Salt Desert Scrub	6,400,000
Inter-Mountain Basins Big Sagebrush Shrubland	1,900,000
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	4,800,000
Great Basin Xeric Mixed Sagebrush Shrubland	1,900.000
Mojave Mid-Elevation Mixed Desert Scrub	2,600,000
Sonora-Mojave Mixed Salt Desert Scrub	370,000
Grassland/Herbaceous	
Inter-Mountain Basins Semi-Desert Shrub Steppe	1,200,000
Inter-Mountain Basins Semi-Desert Grassland	25,000
Inter-Mountain Basins Montane Sagebrush Steppe	130,000
Woody Wetland	
Inter-Mountain Basins Greasewood Flat	360,000
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	35,000
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	7,600
Emergent Herbaceous Wetland	
North American Arid West Emergent Marsh	0
Altered or Disturbed	
Invasive Annual Grassland	13,000
Invasive Annual and Biennial Forbland	7,300
Developed and Agriculture	
Developed, Open Space - Low Intensity	100,000
Agriculture	100,000
Developed, Medium-High Intensity	20,000
Other	
Barren Lands, Non-Specific	7,500

a. To convert acres to square kilometers, multiply by 0.0040469.

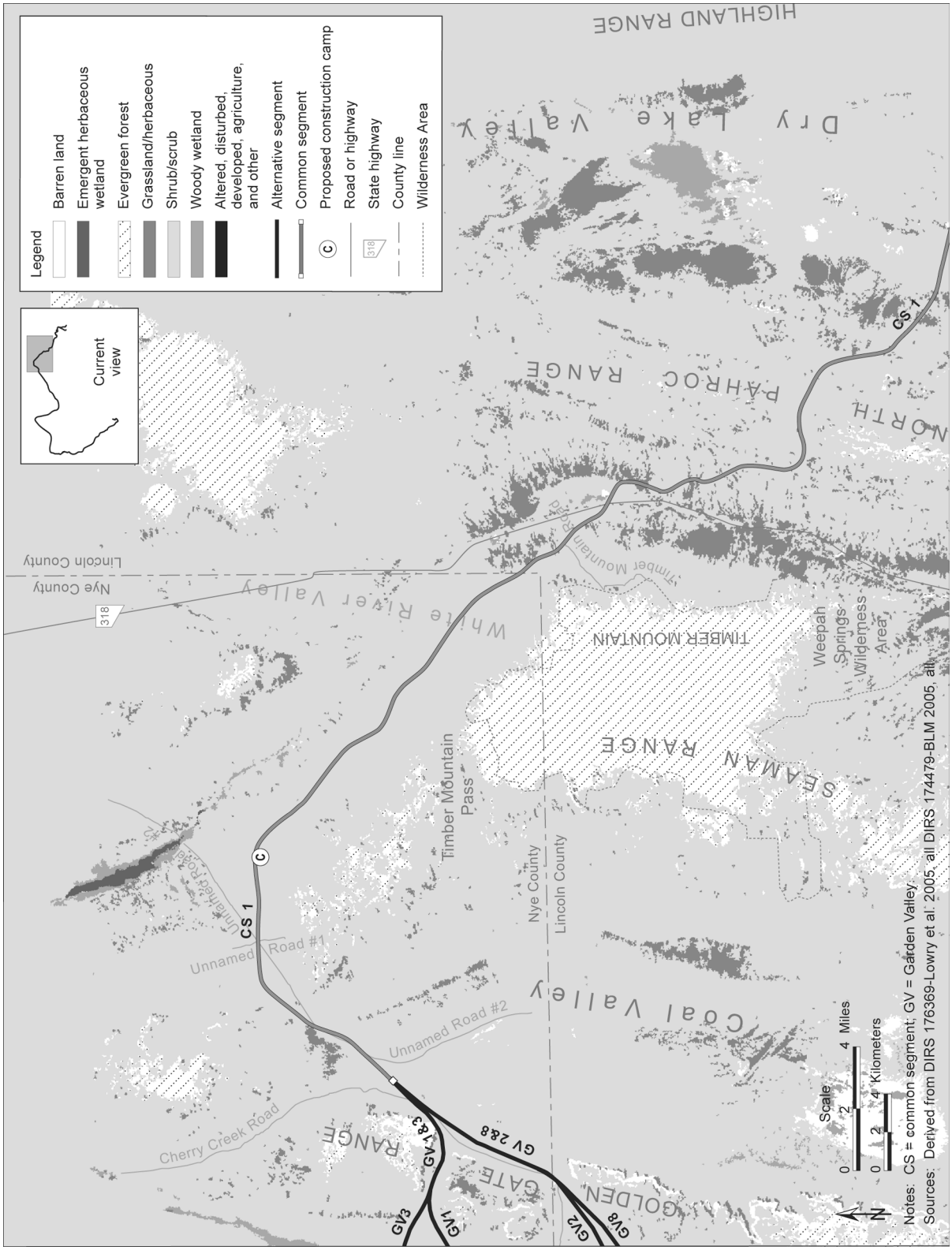


Figure 3-85. Land-cover classes the Caliente rail alignment would cross within map area 2.

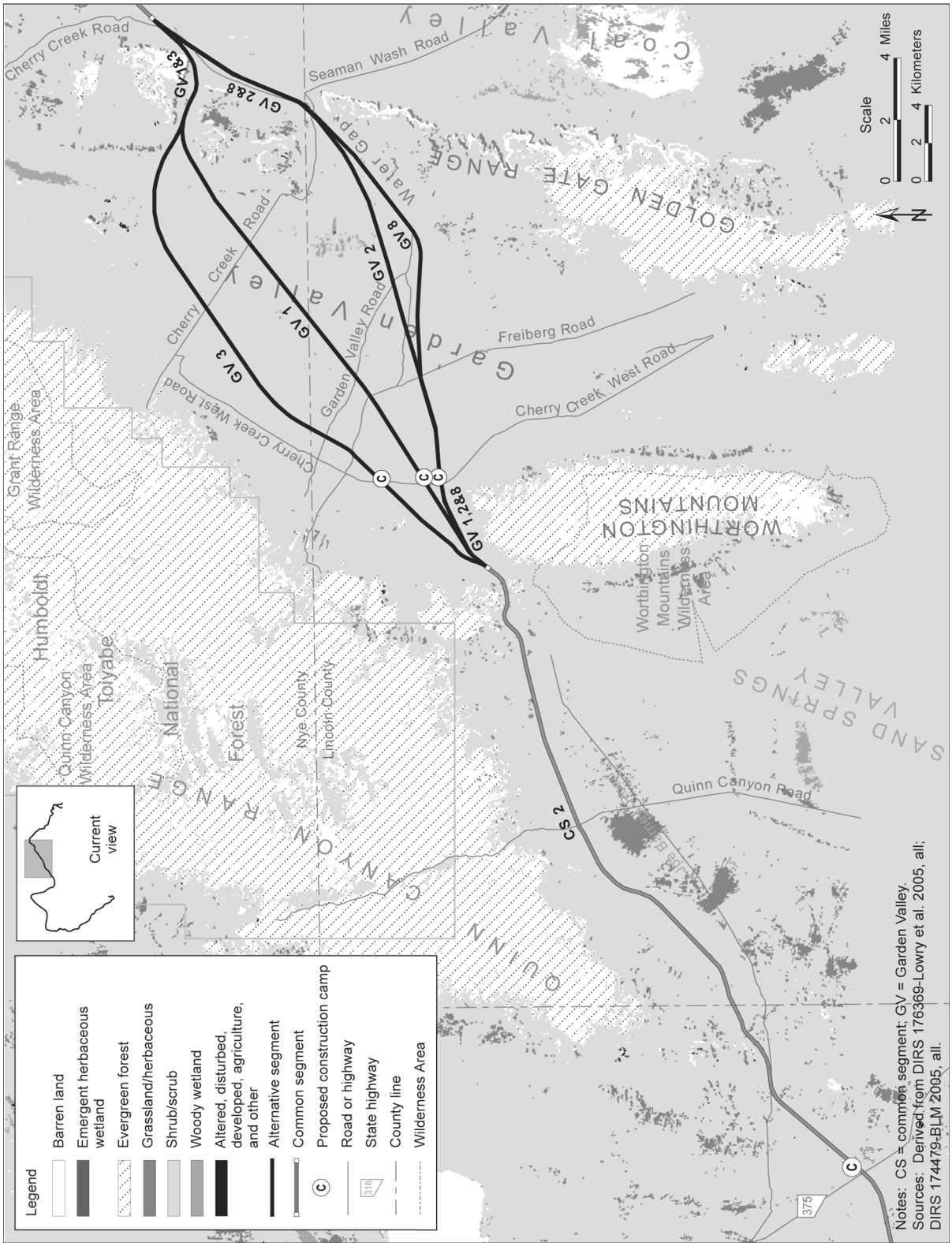


Figure 3-86. Land-cover classes the Caliente rail alignment would cross within map area 3.

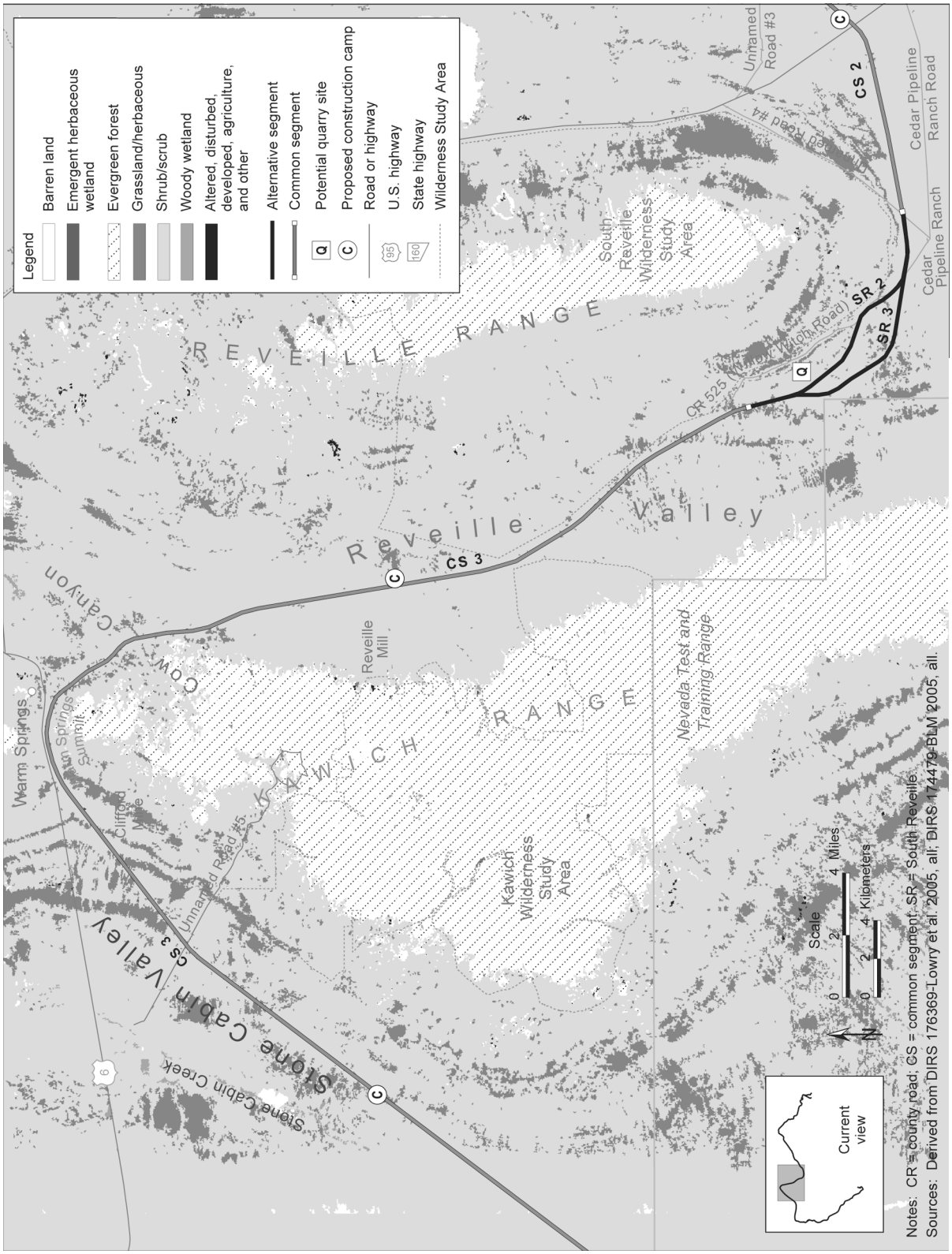


Figure 3-87. Land-cover classes the Caliente rail alignment would cross within map area 4.

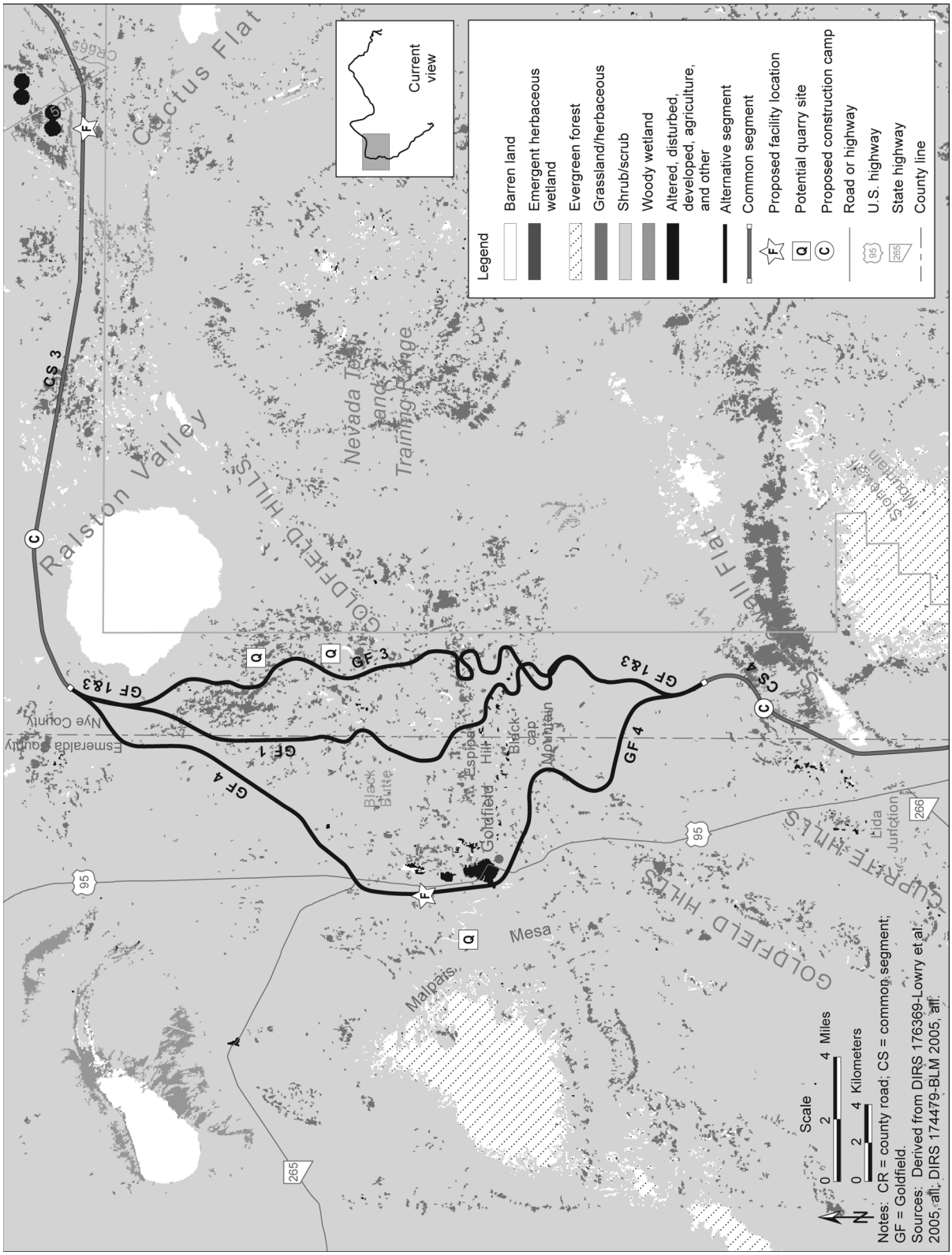


Figure 3-88. Land-cover classes the Caliente rail alignment would cross within map area 5.

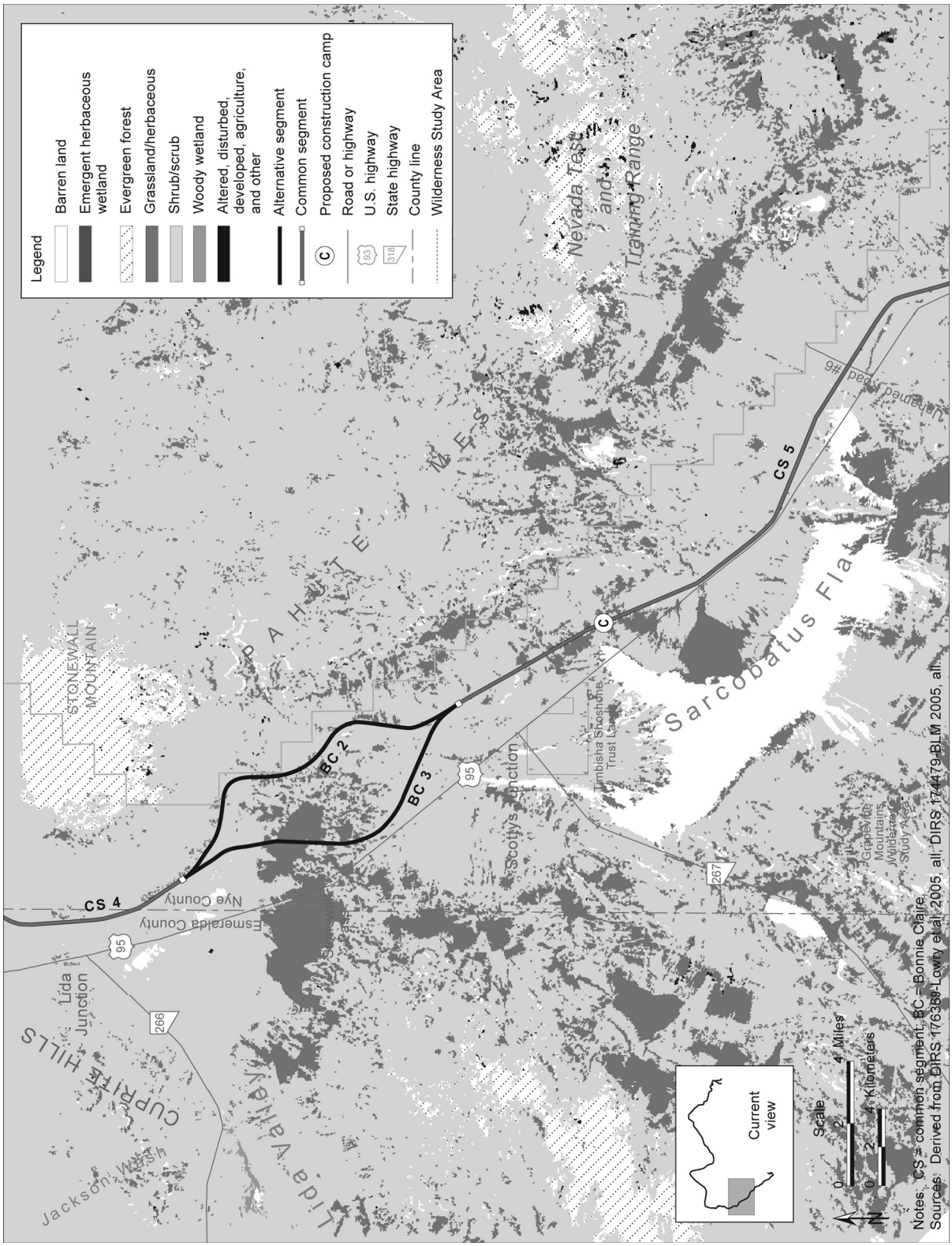


Figure 3-89. Land-cover classes the Caliente rail alignment would cross within map area 6.

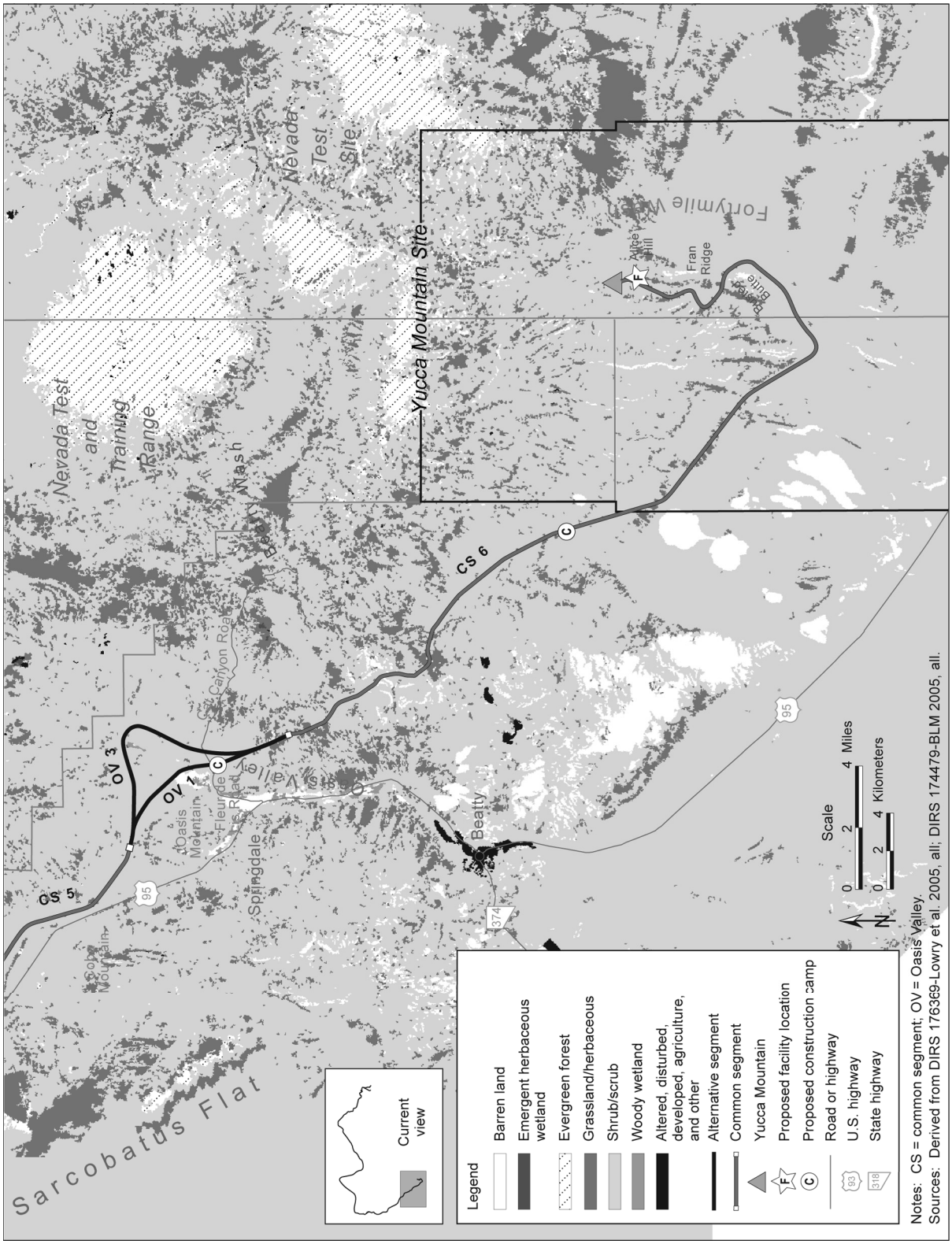


Figure 3-90. Land-cover classes the Caliente rail alignment would cross within map area 7.

total acreages in the mapping zones (the Pioche, the Mojave, and the Nellis) that intersect the Caliente rail alignment.

Undisturbed areas of winterfat, or whitesage (*Krascheninnikovia lanata*), are present, but uncommon, within the construction right-of-way. While they have no official protected status with any federal or state agency, the BLM has identified these vegetation communities as important and their conservation or protection should be considered during development of any projects.

In addition to shrubs and grasses, biological soil crusts are an important component to both the Mohave and Great Basin ecosystems. Biological crusts are comprised of multiple species of lichen, moss, cyanobacteria, and algae which live on top of the soil surface, binding with soil particles and forming a cohesive mat or crust on the surface of arid landscapes (DIRS 181866-Belnap 2006, p. 1). Cyanobacteria is the dominant component of crusts in the Mojave Desert, while soil lichen and moss species tend to be limited. Biological crusts (if present) could play an important role in maintaining the health of some of the desert vegetation communities listed in Table 3-46, including but not limited to facilitating water infiltration, retaining soil moisture, and reducing soil loss from wind and water erosion (DIRS 181957-Kaltenecker and Wicklow-Howard 1994, pp. 1 to 8). Crusts are highly sensitive to surface disturbance and are easily destroyed. Biological crusts likely occur within the region of influence in some areas where there has been no surface disturbance. Biological crusts are potentially present in areas where construction would occur, but because of insufficient data regarding the location and extent of biological crusts in the region of influence, Section 4.2.7 does not discuss impacts to biological crusts.

Non-native plant species: A species found in an area where it has not historically been found.

Native plant species: With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13112, *Invasive Species*).

Invasive plant species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, *Invasive Species*).

Noxious weeds: The BLM defines a noxious weed as: "A plant that interferes with management objectives for a given area of land at a given point in time" (DIRS 177037-BLM 1996, p. 3). The State of Nevada defines noxious weeds as: "Any species of plant which is, or is likely to be, detrimental or destructive and difficult to control or eradicate" (Nevada Revised Statute 555.005).

Weeds can be native or non-native, invasive or non-invasive, and noxious or not noxious. Invasive species include not only noxious weeds, but also other non-native plants. The BLM considers plants invasive if they have been introduced into an environment where they did not evolve. As a result, invasive species usually have no natural enemies to limit their spread and can produce significant detrimental changes.

3.2.7.2.1.1 Noxious Weed and Invasive Species. The Great Basin-Mojave Desert region is threatened by a number of non-native, invasive plant species that have displaced ***native plant species***. Invasive plant species, such as red brome (*Bromus rubens*), tamarisk (*Tamarix ramosissima*), and cheatgrass (*Bromus tectorum*), have the ability to out-compete individual species of native range plants, which results in extensive monocultures of the introduced species. ***Invasive species*** usually have little to no nutritional value for livestock and wildlife; some invasive species are toxic or physically injurious to animals, can increase the frequency of wildfires, and degrade wildlife habitat by reducing the diversity of native vegetation (DIRS 155925-Nevada Weed Action Committee 2000, p. 5).

Some plant species are considered ***noxious weeds***, an official designation used by federal and state authorities to identify species with a high likelihood of being very destructive or difficult to control or eradicate. Chapter 555.010 of the Nevada Administrative Code lists species designated as noxious. Chapter 555 of the Nevada Revised Statutes directs that designated noxious weeds are to be controlled on

both public and private land, and provides for enforcement measures should the landowner or occupier fail to take corrective action. While many noxious species are invasive, invasiveness is not required for a species to be designated noxious. Some species managed as noxious weeds are not considered truly invasive because they cannot effectively out-compete healthy communities of native vegetation.

3.2.7.2.1.2 Wetlands and Riparian Habitats. Riparian habitats are transition areas from wetland or stream habitat to upland habitat. Wetlands are areas that are saturated by water for a sufficient amount of time to support vegetation that is adapted to saturated soil conditions. While wetland and riparian habitats in Nevada cover a very small percentage of the total area of the state, they support a comparatively high number and large diversity of species, many of which are locally ***endemic***. Wetland and riparian habitats have been reduced in the region over the years due in part to water removal and the presence of invasive species, such as tamarisk (DIRS 174518-BLM 2005, p. 3.5-9). Appendix F contains information on wetlands within the project area and Sections 3.2.5 and 4.2.5 discuss impacts in relation to Section 404 of the Clean Water Act and wetland fill permitting. This section discusses wetlands and riparian habitats that support terrestrial and aquatic species.

To maintain consistency within this section, DOE assessed the amount and types of wetland and riparian habitats utilizing the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Section 3.2.5, Surface-Water Resources, utilizes National Wetlands Inventory maps (DIRS 176976-MO0605GISNWIDQ.000) and the results of the wetland delineations conducted during the field surveys in 2005 (DIRS 183595-PBS&J 2006, pp. 15 and 16) and 2006 (DIRS 183595-PBS&J 2006, pp. 11 and 12) to calculate the area of the wetlands. Therefore, the area totals differ between Sections 3.2.5 and 3.2.7 because Section 3.2.7 analyzes wetland and riparian habitat and Section 3.2.5 analyzes only the wetland areas.

According to the Southwest Regional Gap Analysis Project, there are three types of wetland or riparian habitats along the Caliente rail alignment and at locations of the proposed railroad construction and operations support facilities: North American Warm Desert Lower Montane Riparian Woodland and Shrubland; Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland; and North American Arid West Emergent Marsh (Figures 3-91 to 3-94 and Table 3-46).

The North American Warm Desert Lower Montane Riparian Woodland and Shrubland is found along perennial and seasonally intermittent streams. Generally located in middle to low elevations and found in canyons and valleys, vegetation in this land-cover type depends on seasonal flooding and removal of sediment that occurs during these flood events. The vegetation is a mix of tree and shrub species including Fremont cottonwood (*Populus fremontii*) and willows, including sandbar willows (*Salix exigua*) and seep willows (*Baccharis salicifolia*) (DIRS 174324-NatureServe 2004, pp. 140 to 142).

The Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland land cover occurs in the mountains of the Great Basin from middle to high elevations. This habitat requires flooding, and the scouring and subsequent deposition of soils that occurs during flood events, for maintenance and germination of vegetation. Vegetation typically associated with this type of riparian habitat includes Fremont cottonwood, willows, rushes (*Juncus* spp.), and sedges (*Carex* spp.) (DIRS 174324-NatureServe 2004, pp. 149 and 150).

The North American Arid West Emergent Marsh type occurs throughout the arid regions of the western United States. This land cover occurs along slow-moving streams, has soils that are able to accumulate organic material, and contains vegetation that is adapted to frequently or continually saturated soil conditions. Vegetation commonly found in marsh areas includes bulrushes (*Scirpus* spp.), cattails (*Typha* spp.), and rushes (DIRS 174324-NatureServe 2004, pp. 154 to 156). Further discussion of riparian habitats as opposed to wetlands is contained in Appendix F of this document.

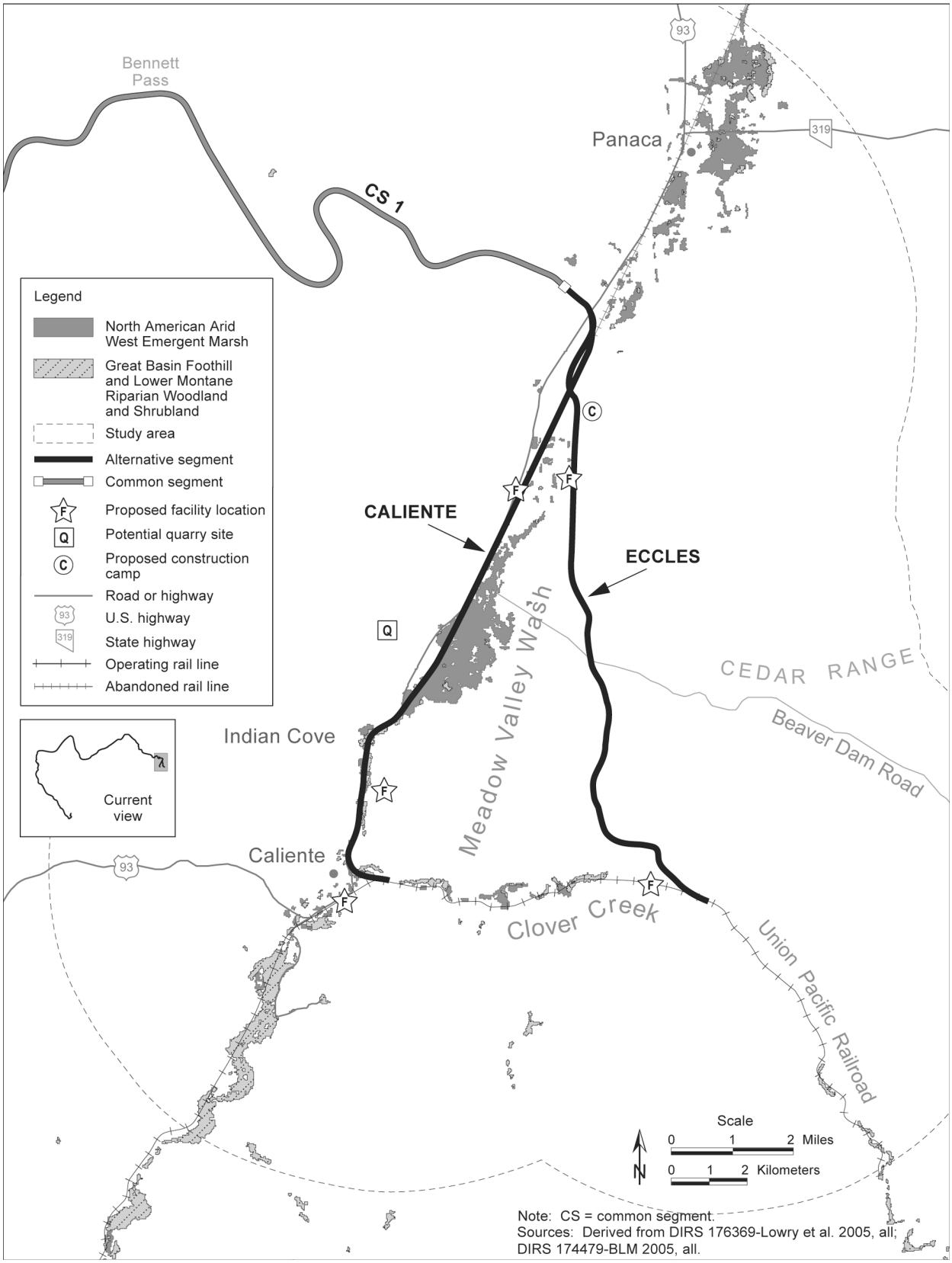


Figure 3-91. Wetland/riparian habitat within the study area near the Caliente and Eccles alternative segments.

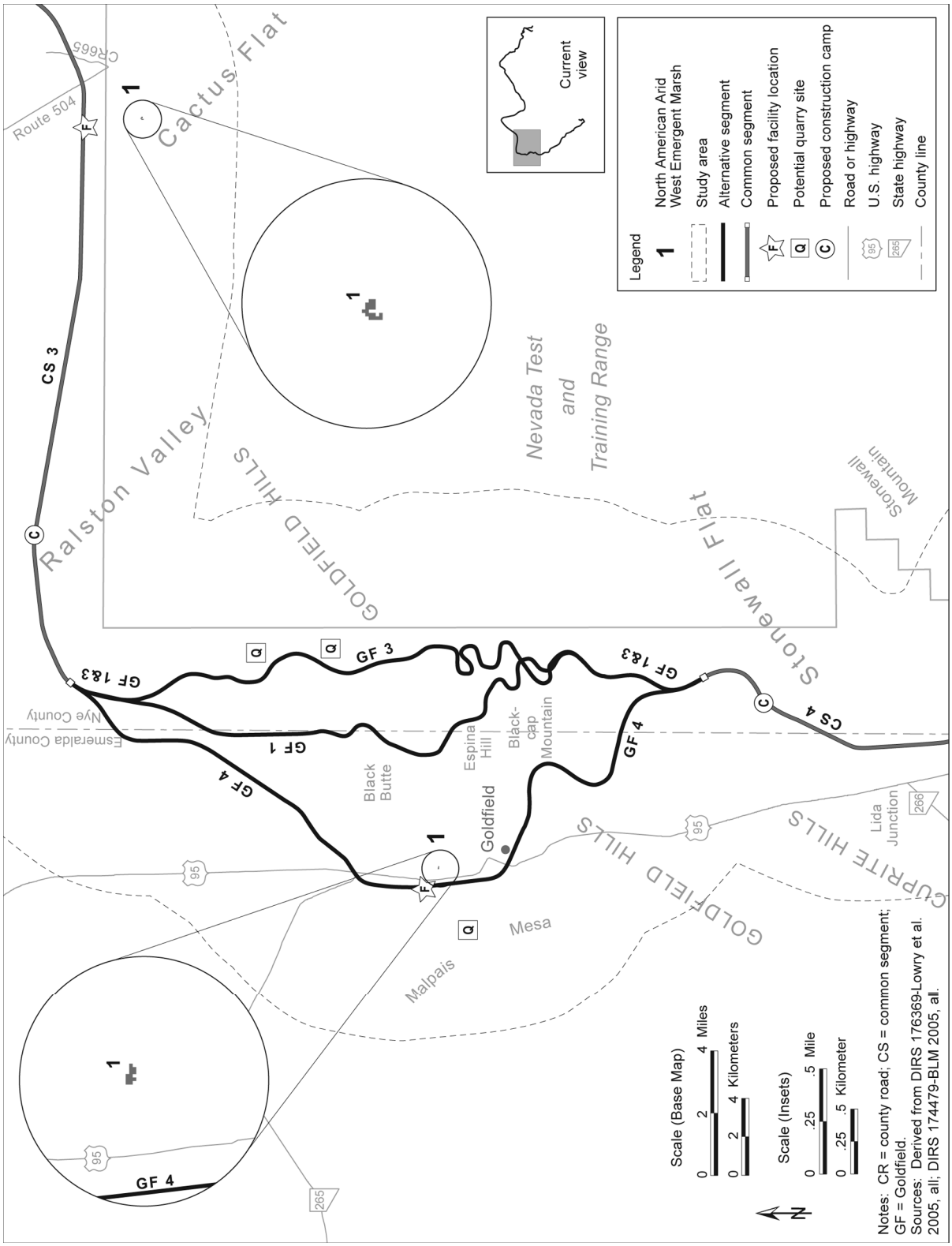


Figure 3-92. Wetland/riparian habitat within the study area adjacent to the Goldfield alternative segments.

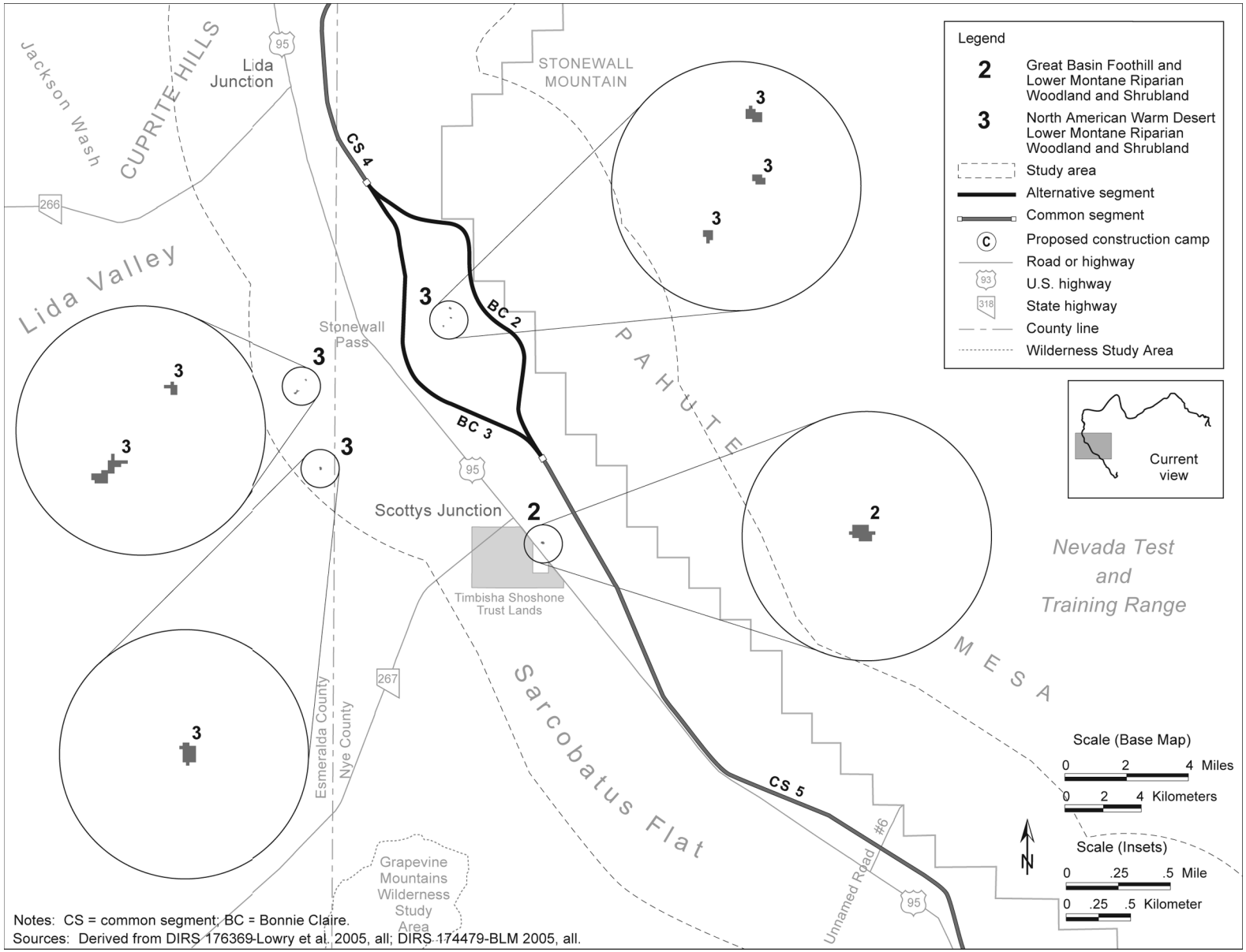


Figure 3-93. Wetland/riparian habitat within the study area near the Bonnie Claire alternative segments.

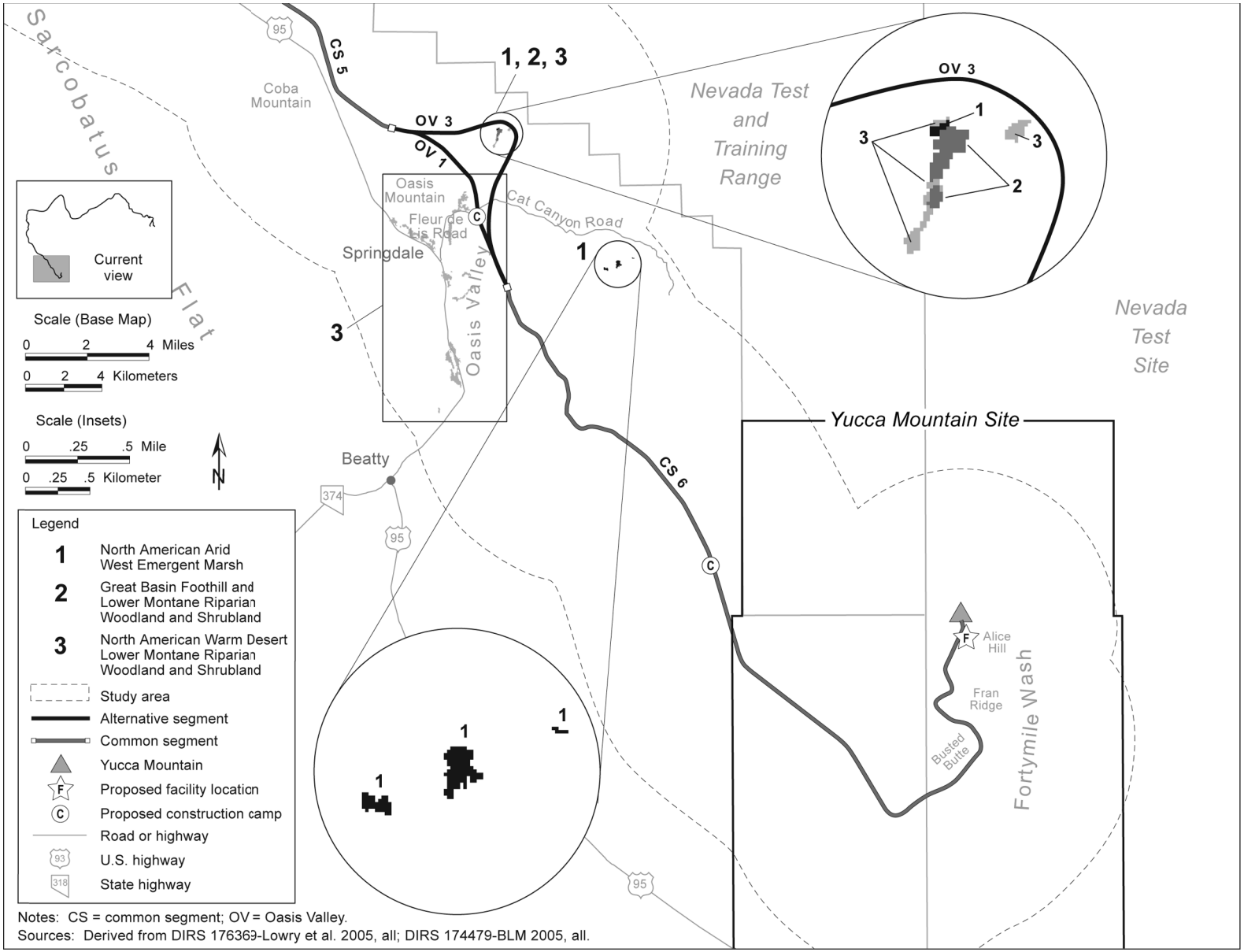


Figure 3-94. Wetland/riparian habitat within the study area near the Oasis Valley alternative segments.

3.2.7.2.2 Wildlife

As with the vegetation communities and wetland habitats, DOE gathered data on wildlife communities to identify existing information regarding the occurrence and distribution of wildlife, including mammals, birds, reptiles, and aquatic species, within the construction right-of-way.

These investigations incorporated literature and database searches and consultations with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, and the Nevada Department of Wildlife. DOE also obtained information regarding Nevada game species from these agencies. Concurrent with other field surveys, the Department gathered information on field observations to identify the presence of wildlife within the construction right-of-way.

Wildlife abundance and diversity is related to habitat or land-cover types and quality. DOE mapped the wildlife and species synonymous with the habitat or land-cover types to the construction right-of-way. Appendix H contains a map detailing field survey locations.

3.2.7.2.3 Special Status Species

Special status species are plants, fish, and wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. DOE contacted the U.S. Fish and Wildlife Service to obtain a list of species protected under the federal Endangered Species Act that are known to exist or could exist within the construction right-of-way or within the study area (DIRS 174439-Williams 2005, all). The Department assessed the potential for federally listed species to occur within the construction right-of-way by reviewing agency listings of known, or potentially occurring, listed species, and through a review of potential habitat for those species along the Caliente rail alignment. The Department also obtained location records for special status species from a statewide database managed by the Nevada Natural Heritage Program that contains records of incidental observations of rare or protected plants, fish, and wildlife species (DIRS 182061-BSC 2006, all). The special status species DOE selected for further consideration are one or a combination of the following:

- Special status species documented as occurring within the study area
- Special status species identified as potentially occurring in the study area by personnel affiliated with appropriate resource management agencies, including the BLM (DIRS 172900-BLM 2003, all), the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry
- Special status species identified as potentially occurring in the study area because field personnel identified potentially suitable habitat during the field surveys

DOE used a Geographic Information System database to map the documented occurrences of special status plants and wildlife species within the study area in relation to the Southwest Regional Gap Analysis Project types. The Department then used these maps to identify and match areas of potential habitat and the presence of the documented special status species within those habitats. Through field surveys, the Department further evaluated areas that appeared to contain viable habitat for a special status species. Appendix H provides details on the survey methodology for special status species.

3.2.7.2.4 State of Nevada Game Species

Table 3-47 lists the game species identified in the Nevada Administrative Code Sections 503.020, 503.045, and 503.060 that potentially occur in the study area. Game species identified in these sections of the Nevada Administrative Code that are absent from the study area are listed in Appendix H, Table H-5,

Table 3-47. Nevada game species present or potentially present in the biological resources study area – Caliente rail alignment.[a]

Common name	Scientific name	Occurrence within the study area
Game mammals		
Pronghorn antelope	*Antilocapra americana*	Present
Mule deer	*Odocoileus hemionus*	Present
Mountain lion	*Felis concolor*	Present
Cottontail rabbit	*Sylvilagus* spp.	Present
Pygmy rabbit	*Sylvilagus idahoensis*	Present
Black-tailed jackrabbit	*Lepus californicus*	Present
Bighorn sheep	*Ovis canadensis*	Present
Elk	*Cervus elaphus*	Present
Upland and migratory game birds		
Greater sage-grouse	*Centrocercus urophasianus*	Potentially present
Chukar	*Alectoris chukar*	Present
Ring-necked pheasant	*Phasianus colchicus*	Present
Gambel's quail	*Callipepla gambelii*	Present
Wild turkey	*Meleagris gallopavo*	Present
American crow	*Corvus brachyrhynchos*	Present
Ducks, geese, and swans	Family *Anatidae*	Present only in wetland/marsh areas
Wild doves and pigeons	Family *Columbidae*	Present
Cranes	Family *Gruidae*	Present only in wetland/marsh areas
Rails, coots, and gallinules	Family *Rallidae*	Present only in wetland/marsh areas
Woodcocks and snipes	Family *Scolopacidae*	Present only in wetland/marsh areas

a. Source: Nevada Administrative Code Sections 503.020, 503.045, and 503.060.

and are not considered further in this Rail Alignment EIS. The greater sage-grouse *(Centrocercus urophasianus)* and pygmy rabbit *(Sylvilagus idahoensis)* are game species that are also BLM-listed sensitive and State of Nevada protected. The bighorn sheep is a BLM-listed sensitive species managed by the Nevada Department of Wildlife as a big game mammal.

DOE conducted surveys along the Caliente rail alignment to further characterize the presence or absence of game species. Observations included identification of tracks and fecal pellets, and direct observation of animals within the rail alignment study area. Results do not imply population level or habitat quality, only the presence or absence of game species and their approximate level of use.

3.2.7.2.5 Wild Horses and Burros

The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros that the herd management area is managed for, and it is established to avoid the ecological degradation of the herd management area. DOE reviewed the Tonopah Resource Management Plan (DIRS 173224-BLM 1997, all), the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, all), and herd management plans for the Ely and Battle Mountain BLM Districts to obtain current information on herd management areas. The Department contacted the BLM to obtain Geographic Information System data on management

areas and to obtain data regarding the use of the herd management areas by wild horses and burros. Concurrent with other field investigations, DOE performed observations for wild horses and burros, or signs of their presence. Section 3.2.2, Land Use and Ownership, describes the grazing allotment planning process. Under the BLM Ely Proposed Resource Management Plan (DIRS 184767-BLM 2007, all), some herd management areas would be eliminated, while some smaller ones would be consolidated into larger aggregations.

3.2.7.3 Affected Environment along Alternative Segments and Common Segments

This section describes biological resources in the Caliente rail alignment construction right-of-way and study area. To avoid unnecessary repetition, this section discusses biological resources by resource type (vegetation, wildlife, special status species, migratory birds, State of Nevada game species, and wild horses and burros) rather than by alternative segment or common segment.

3.2.7.3.1 Vegetation

There are 25 different land-cover types within the construction right-of-way and multiple options for the proposed Caliente railroad construction and operations support facilities. Tables 3-48 through 3-50 list land-cover types along the rail alignment and the areas of proposed operations support facilities. The percentages disclosed are the percent of land-cover types that could be affected and these percentages relate to the total acreages in the Pioche, the Mojave, and the Nellis mapping zones (see Table 3-46). The land-cover types listed and the percentages that could be affected are based on the nominal width of the rail line construction right-of-way for the alternative segments and common segments and the footprint of each proposed operations support facility. Table 3-51 lists the land-cover types present in the areas of the potential quarry sites.

3.2.7.3.1.1 Noxious Weeds and Invasive Species. Cheatgrass is found along most of the Caliente rail alignment where it fills open space between shrubs. Red brome is also common, although it is generally confined to areas along the rail alignment that would cross the Mojave Desert region. These observations were made during the 2005 field surveys.

The BLM and the Nevada Department of Agriculture maintain databases identifying the locations of documented occurrences of noxious weeds and invasive species (DIRS 174479-BLM 2003, all). The databases identify the following noxious weeds and invasive species in the Meadow Valley Wash near the Caliente alternative segment:

- Dalmatian toadflax (*Linaria dalmatica*)
- Hoary cress (*Cardaria draba*)
- Spotted knapweed (*Centaurea maculosa*)
- Tall whitetop (*Lepidium latifolium*)
- Russian knapweed (*Acroptilon repens*)

These databases also identify tall whitetop along the Eccles alternative segment and Caliente common segment 1, and Scotch thistle (*Onopordum acanthium*) along the Eccles alternative segment.

3.2.7.3.1.2 Wetlands and Riparian Habitat. Before conducting field surveys, DOE reviewed pertinent maps, the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), and available state wetland and land-use inventories to identify the locations of possible wetland and riparian habitat within the rail line construction right-of-way and the study area.

DOE identified wetland and riparian habitat along the following portions of the Caliente rail alignment using a combination of fieldwork and the 2004 Southwest Regional Gap Analysis Project (see Figures 3-91 through 3-94):

- Caliente alternative segment
- Eccles alternative segment
- Caliente common segment 1
- Goldfield alternative segments
- Bonnie Claire alternative segments
- Oasis Valley alternative segments

This section discusses only portions of the Caliente rail alignment in which there are wetland and/or riparian habitats. Section 3.2.5, Surface-Water Resources, provides information on springs and their locations and specific information for function and value of wetlands for Section 404 permitting. This section discusses wetlands and riparian areas in relation to the vegetation and habitat that is supplied for terrestrial and aquatic species. Table 3-52 details the riparian types found in the construction right-of-way and the study area along alternative segments and common segments of the Caliente rail alignment. Section 4.2.5 discloses impacts to the wetlands; additional information can be found in Appendix F.

Plant species that are considered indicators of wetland conditions that were found along the Caliente alternative segment include bulrushes, sedges, Fremont cottonwood, willows (including sandbar willow), broadleaf cattail (*Typha latifolia*), Baltic rush (*Juncus balticus*), common reed (*Phragmites australis*), tamarisk, and Russian olive (*Eleagnus angustifolia*) (DIRS 183595-PBS&J 2005, p. 17).

The wetlands along the Eccles alternative segment at the Meadow Valley Wash were classified as emergent, emergent/rock bottom, and scrub-shrub/rock bottom wetlands (DIRS 183595-PBS&J 2005, p. 16). Additional information regarding wetland analysis can be found in Appendix F. The impact assessment in Section 4.2.7 also includes acres of impact to wetlands.

In the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east), Caliente common segment 1 would pass near an approximately 0.01-square kilometer (3-acre) wetland. This wetland is adjacent to a single, developed unnamed spring, approximately 440 meters (1,450 feet) outside the rail line construction right-of-way near Black Rock Spring (DIRS 183595-PBS&J 2005, p. 18 and Figure 5). The unnamed spring was likely developed to provide a stock watering area. The wetland area is classified as emergent/rock bottom/unconsolidated bottom and emergent wetlands.

The Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all) lists the riparian habitat in this area as Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland.

Oasis Valley alternative segment 3 contains a small (approximately 0.02 square kilometer [4.7 acres]) wetland area that would be within the construction right-of-way. This wetland area contains willow and inland saltgrass (*Distichlis spicata*) (DIRS 183595-PBS&J 2005, Figure 4T).

3.2.7.3.2 Wildlife

This section describes the wildlife and wildlife communities potentially present in the Caliente rail alignment construction right-of-way. Figure 3-95 details the manmade wildlife water sources, also called ***wildlife guzzlers***, within the study area. There are three

A **wildlife guzzler** is a water development for wildlife that relies on rainfall or snowmelt to recharge it, rather than springs or streams. Usually used where there are no other sources of water for wildlife.

Table 3-48. Land-cover types and percentages within the construction right-of-way by common segment.[a]

Land-cover type	Area covered by common segment[b,c] (percent)					
	CS1	CS2	CS3	CS4	CS5	CS6
Barren Lands, Non-Specific	0	0.04	0	0	0	0
Great Basin Pinyon-Juniper Woodland	< 0.01	0.11	0	0	0.1	0
Great Basin Xeric Mixed Sagebrush Shrubland	13.25	0.60	0.75	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	45.95	20.59	20.46	0.64	0.05	0
Inter-Mountain Basins Greasewood Flat	0.19	0.08	0.46	0.35	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	33.59	77.37	71.35	95.36	0	0
Inter-Mountain Basins Playa	0.28	0	0.33	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0.24	0.07	1.57	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	4.3	1.14	5.05	3.65	7.55	13.59
Invasive Annual and Biennial Forbland	0	0	0.03	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	2.17	0	0	0	12.46	23.92
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0	0	0.39
North American Warm Desert Playa	0	0	0	0	<0.01	0.13
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	< 0.01	0	0	0	26.47	61.38
Sonora-Mojave Mixed Salt Desert Scrub	< 0.01	0	0	0	53.37	0.59
Totals[d]	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004, all.
b. CS = common segment.
c. < = less than.
d. Totals might differ from sums of values due to rounding.

Table 3-49. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 1 of 2).

	Area covered by alternative segment (percent)														
	Interface with Union Pacific Railroad Mainline alternative segments		Garden Valley				South Reveille		Goldfield			Bonnie Claire		Oasis Valley	
Land-cover type	Caliente	Eccles	GV1	GV2	GV3	GV8	SR2	SR3	GF1	GF3	GF4	BC2	BC3	OV1	OV3
Agriculture	1.84	1.21	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren Lands, Non-Specific	0	0.38	0	0	0	0	0	0	0	0	0.03	0	0	0	0
Developed, Medium-High Intensity	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0	0
Developed, Open Space - Low Intensity	0.85	0	0	0	0	0	0	0	0	0	0.21	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	5.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	15.57	1.14	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	16.4	35.04	0.08	0.01	0.04	0.33	2.88	1.25	0.99	6.33	1.35	0.11	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	22.99	35.56	29.5	20	60	19.1	18.44	17.4	10.3	15.44	9.57	5.04	0.8	0	0
Inter-Mountain Basins Cliff and Canyon	0	0	0.02	0.06	0.02	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	10.43	6.02	0.04	0.02	0.09	0.02	0	0	1.49	1.37	1.33	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	6.01	19.82	70.19	79.9	40.8	80.45	68.92	71.49	83.9	69.91	85.63	33.59	30.27	0	0
Inter-Mountain Basins Montane Sagebrush Steppe	6.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3-49. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 2 of 2).

	Area covered by alternative segment (percent)														
	Interface with Union Pacific Railroad Mainline alternative segments		Garden Valley				South Reveille		Goldfield			Bonnie Claire		Oasis Valley	
Land-cover type	Caliente	Eccles	GV1	GV2	GV3	GV8	SR2	SR3	GF1	GF3	GF4	BC2	BC3	OV1	OV3
Inter-Mountain Basins Playa	0	0	0	0	0	0	0	0	0	0	0	0	0.51	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0.13	0.67	0.17	0	0.13	0.1	9.56	9.86	3.12	6.95	1.81	10.66	16.53	4.88	3.13
Inter-Mountain Basins Wash	2.87	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Annual Grassland	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	0.09	0	0	31.44	23.43	3.61	0.45
North American Arid West Emergent Marsh	10.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.43
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0	0	0	0	0	5.33	1.07
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	13.88	27.01	77.56	72.68
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	5.29	1.84	8.63	22.24
Totals[b]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. Totals might differ from sums of values due to rounding.

Table 3-50. Land-cover types and percentages within facility footprints by facility[a] (page 1 of 2).

	Area covered by facility[b,c] (percent)								
	Interchange Yard		Staging Yard			Maintenance-of-Way Trackside Facility	Maintenance-of-Way Headquarters Facility	Maintenance-of-Way Facility	Rail Equipment Maintenance Yard
Land-cover type	Caliente	Eccles	Caliente-Upland	Caliente-Indian Cove	Eccles-North	(GF1 or GF3 option)	(GF1 or GF3 option)	(GF4 option)	
Developed, Open Space - Low Intensity	0.27	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	1.6	5.17	0	26.74	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	12	8.8	0.28	6.69	1.67	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	29.87	19.37	1.82	29.61	8.24	0	7.27	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	6.13	54.68	3.11	4.57	9.21	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0	0	64.1	0	41.85	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	38.67	10.59	4.63	0	38.82	93.16	92.73	99.26	0
Inter-Mountain Basins Montane Sagebrush Steppe	0	1.39	0	0.06	0	0	0	0.74	0

Table 3-50. Land-cover types and percentages within facility footprints by facility[a] (page 2 of 2).

	Area covered by facility[b,c] (percent)								
	Interchange Yard		Staging Yard			Maintenance-of-Way Trackside Facility	Maintenance-of-Way Headquarters Facility	Maintenance-of-Way Facility	Rail Equipment Maintenance Yard
Land-cover type	Caliente	Eccles	Caliente-Upland	Caliente-Indian Cove	Eccles-North	(GF1 or GF3 option)	(GF1 or GF3 option)	(GF4 option)	
Inter-Mountain Basins Playa	0	0	1.28	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	6.69	0	0.5	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0	6.34	0	0	15.04
Inter-Mountain Basins Wash	0	0	20.99	15.62	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	8.04
North American Arid West Emergent Marsh	11.47	< 0.01	3.83	10.02	0.19	0	0	0	0
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	74.94
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	1.98
Totals[d]	100	100	100	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. < = less than.
c. GF = Goldfield.
d. Totals might differ from sums of values due to rounding.

Table 3-51. Land-cover types and percentages within the footprints of potential quarry sites[a] (page 1 of 2).

Land-cover type	Area covered (percent)
Quarry CA-8B	
Great Basin Foothill and Lower Montane Riparian Woodland & Shrubland	0.38
Barren Lands, Non-Specific	0.24
Great Basin Pinyon-Juniper Woodland	0.64
Great Basin Xeric Mixed Sagebrush Shrubland	66.40
Inter-Mountain Basins Mixed Salt Desert Scrub	0.78
Inter-Mountain Basins Montane Sagebrush Steppe	0.22
Inter-Mountain Basins Big Sagebrush Shrubland	24.73
North American Arid West Emergent Marsh	8.00
Total[b]	100
Quarry NN-9A	
Great Basin Xeric Mixed Sagebrush Shrubland	8.07
Inter-Mountain Basins Big Sagebrush Shrubland	27.96
Inter-Mountain Basins Mixed Salt Desert Scrub	50.95
Inter-Mountain Basins Semi-Desert Shrub Steppe	13.02
Total[b]	100
Quarry NN-9B	
Great Basin Xeric Mixed Sagebrush Shrubland	22.62
Inter-Mountain Basins Big Sagebrush Shrubland	13.11
Inter-Mountain Basins Mixed Salt Desert Scrub	59.73
Inter-Mountain Basins Semi-Desert Shrub Steppe	4.54
Total[b]	100
Quarry NS-3A	
Great Basin Xeric Mixed Sagebrush Shrubland	14.35
Inter-Mountain Basins Big Sagebrush Shrubland	13.02
Inter-Mountain Basins Mixed Salt Desert Scrub	47.00
Inter-Mountain Basins Semi-Desert Shrub Steppe	25.66
Total[b]	100
Quarry ES-7	
Great Basin Xeric Mixed Sagebrush Shrubland	32.46
Inter-Mountain Basins Big Sagebrush Shrubland	47.50
Inter-Mountain Basins Mixed Salt Desert Scrub	18.86
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.17
Total[b]	100

See Section 3.2.5, Surface-Water Resources, and Appendix F for more specific information on wetlands function and acreage assessments.

Table 3-51. Land-cover types and percentages within the footprints of potential quarry sites[a] (page 2 of 2).

Land-cover type	Area covered (percent)
Quarry NS-3B	
Great Basin Xeric Mixed Sagebrush Shrubland	2.61
Inter-Mountain Basins Big Sagebrush Shrubland	26.68
Inter-Mountain Basins Mixed Salt Desert Scrub	60.81
Inter-Mountain Basins Semi-Desert Shrub Steppe	9.9
Total[b]	100

a. Source: DIRS 174324-NatureServe 2004, all.
b. Total might differ from sum of values due to rounding.

Table 3-52. Riparian and water-related land-cover types within the Caliente rail alignment construction right-of-way and study area[a] (page 1 of 2).

Segment/land-cover type	Amount in construction right-of-way (acres)[b]	Amount in study area (acres)
Caliente alternative segment		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	17	1,100
North American Arid West Emergent Marsh	34	2,400
Eccles alternative segment		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	500
North American Arid West Emergent Marsh	0	2,400
Caliente common segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	140
North American Arid West Emergent Marsh	0	1,900
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	1.10
Goldfield alternative segment 4		
North American Arid West Emergent Marsh	0	0.1
Bonnie Claire alternative segment 2		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	8.2
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	8.2
Bonnie Claire alternative segment 3		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	4.2
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	18
Oasis Valley alternative segment 1		

Table 3-52. Riparian and water-related land-cover types within the Caliente rail alignment construction right-of-way and study area[a] (page 2 of 2).

Segment/land-cover type	Amount in construction right-of-way (acres)[b]	Amount in study area (acres)
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	20
North American Arid West Emergent Marsh	0	32
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	500
Oasis Valley alternative segment 3		
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	4.7	500
North American Arid West Emergent Marsh	0	56
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	20

a. Source: DIRS 174324-NatureServe 2004.
b. To convert acres to square kilometers, multiply by 0.0040469.

wildlife guzzlers within the study area: Scofield #3, and two guzzlers, both named Garden Valley (Figure 3-95). Scofield #3 is approximately 7.6 kilometers (4.7 miles) north of Garden Valley alternative segment 3. The first Garden Valley guzzler is approximately 1.8 kilometers (1.1 miles) south of Garden Valley alternative segment 8. The second Garden Valley guzzler is approximately 2 kilometers (1.2 miles) south of Garden Valley alternative segment 8. Section 3.2.5, Surface-Water Resources, provides information about and locations of other sources of water available to wildlife.

The following sections describe the most common species of mammals, birds, reptiles, amphibians, and fish potentially found within the Caliente rail alignment greater study area and potentially within the construction right-of -way. Section 3.2.7.3.3 provides information on federally listed threatened and endangered species, and federally and state-listed sensitive or protected species. Section 3.2.7.3.4 discusses migratory birds, Section 3.2.7.3.5 discusses Nevada game species, and Section 3.2.7.3.6 discusses wild horses and burros.

3.2.7.3.2.1 Mammals. Mammals are known to exist within the study area along the entire length of the Caliente rail alignment. The types of mammals found within the study area would depend on the vegetation communities. Mammals that could occur within the greater study area and the construction right-of-way of the Caliente rail alignment include:

- Mountain lion (*Felis concolor*)
- Bighorn sheep (*Ovis canadensis*)
- Kit fox (*Vulpes macrotis*)
- Coyote (*Canis latrans*)
- Bobcat (*Lynx rufus*)
- Badger (*Taxidea taxus*)
- Cottontail rabbit (*Sylvilagus* spp.)
- Various rodents
- Elk (*Cervus elaphus)*
- Pronghorn antelope (*Antilocapra americana*)
- Grey fox (*Urocyon cinereoargenteus*)
- Mule deer (*Odocoileus hemionus*)
- Black-tailed jackrabbit (*Lepus californicus*)
- Ringtail (*Bassariscus astutus*)
- Various bats
- Various ground squirrel species

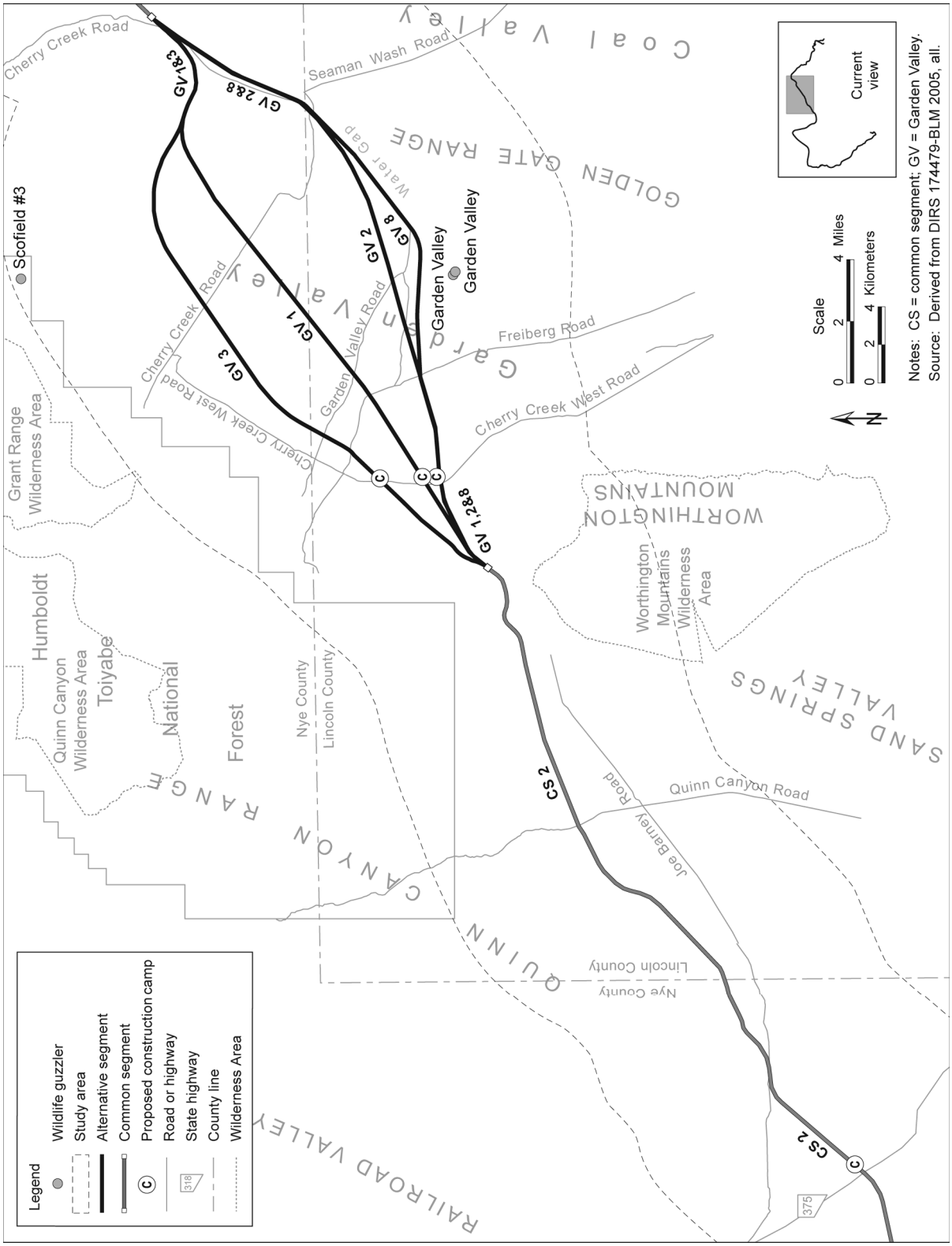


Figure 3-95. Wildlife guzzlers located along the Caliente rail alignment.

Mule deer, elk, pronghorn antelope, and bighorn sheep are Nevada game species and are discussed in Section 3.2.7.3.5.

Twenty-three species of bats have been observed in Nevada (DIRS 174474-NDOW 2002, p. 7-8). Bats, including resident, migrant, and transient species, are found throughout Nevada and in every type of habitat. Bats occupy a variety of habitats within the construction right-of-way, including mine shafts, caves, talus slopes with cracks and crevices, cliff faces, man-made structures, and pinyon-juniper and Joshua tree (*Yucca brevifolia*) forests. Bats often use different day and night roosting habitats, different nursery and non-breeding habitats, and different winter and summer habitats. Appendix H includes a list of bat species potentially found within the project area. Many of the bats along the rail alignment are special status species and are discussed further in Section 3.2.7.3.3.

3.2.7.3.2.2 Birds. A variety of bird species are commonly observed in central and southern Nevada, including year-round residents, summer residents, migratory species breeding in southern Nevada, winter residents that breed to the north, and seasonal migrants passing through central and southern Nevada en route to breeding ranges to the north and winter ranges to the south. Several federal laws and state statutes protect various groups of birds. Chapter 6 of this Rail Alignment EIS details these protections.

The Great Basin region of Nevada is an important migration route for waterfowl and other species of birds traveling between southern wintering areas and northern breeding territories; however, suitable habitat for waterfowl and shorebirds is extremely limited in the region and along the Caliente rail alignment. Portions of Meadow Valley Wash are considered to be waterfowl habitat (DIRS 101504-BLM 1979, pp. 2-35 and 2-36) and migrating birds might temporarily utilize any exposed surface-water areas. Waterfowl and shorebirds were observed during the 2005 field surveys in a few locations where there was standing surface water that supported aquatic vegetation.

Common species of resident and migrating birds observed along the Caliente rail alignment include:

- Common raven (*Corvus corax*)
- Horned lark (*Eremophila alpestris*)
- American pipit (*Anthus rubescens*)
- European starling (*Sturnus vulgaris)*
- American crow (*Corvus brachyrhynchos*)
- MacGillivray's warbler (*Oporonis tolmiei*)
- Loggerhead shrike (*Lanius ludovicianus*)
- Yellow warbler (*Dendroica petechia*)

Upland game bird species are expected to occur within the Caliente rail alignment construction right-of-way: chukar and mourning dove were observed during surveys conducted along the rail alignment. Chukars were recorded in cliff and talus habitat in the Beatty Wash area. Mourning doves are common and were observed at multiple locations along the rail alignment. In addition, Gambel's quail (*Callipepla gambelii*) occurs in southern Nevada at lower elevations, primarily in the Mojave Desert. Mourning doves are common and were observed at multiple locations along the rail alignment. The greater sage-grouse is an upland game bird that has historically occurred in low abundance near portions of the rail alignment and it could occupy suitable habitat along the northern sections of the rail alignment. The greater sage-grouse is a BLM-listed special status species and receives additional protection from the State of Nevada; it is discussed in more detail in Section 3.2.7.3.3.

Populations of raptors are typically low in numbers, and their occurrence in the rail line construction right-of-way would be very low due to the minimal amount of roosting, nesting, and foraging habitat along the alignment. Raptors observed during field surveys included prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), great-horned owl (*Bubo virginianus*), turkey vulture (*Cathartes aura*), and golden eagle (*Aquila chrysaetos)*. In addition, ferruginous hawks (*Buteo regalis*)

have been reported to occupy, and in some cases nest in, areas with trees close to the construction right-of-way (DIRS 174519-Bennet 2005, Plate 5).

Populations of bird species that rely on sagebrush habitat in Nevada are declining because cattle grazing and the proliferation of non-native weeds have degraded the native sagebrush habitat (DIRS 174518-BLM 2005, pp. 222 and 223). Sagebrush-dependent species that might occupy habitat along the proposed rail alignment could include sage thrasher (*Oreoscoptes montanus)*, sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and vesper sparrow (*Pooecetes gramineus*). The Caliente rail alignment would cross sagebrush habitat in Bennett Pass, Pahroc Pass, the western and northern portions of Garden Valley, portions of western Sand Spring Valley, southeastern Railroad Valley, and Warm Springs Pass.

3.2.7.3.2.3 Reptiles. A variety of species of lizards and snakes are present throughout the southern Great Basin Desert and northern Mojave Desert and along the Caliente rail alignment. Appendix H, Table H-6, lists the reptiles that have the potential to occur along the Caliente alignment. The desert tortoise (*Gopherus agassizii*) is found within the proposed rail line construction right-of-way at its southern end, from the Beatty Wash area to Yucca Mountain.

This special status species is discussed in Section 3.2.7.3.3.1. The most common lizard species observed during the 2005 field surveys were:

- Western fence lizard (*Sceloporus occidentalis*)
- Western whiptail lizard (*Cnemidophorus tigris*)
- Long-nosed leopard lizard (*Gambelia wislezenii*)
- Side-blotched lizard (*Uta stansburiana*)
- Sagebrush lizard (*Sceloporus graciosus*)
- Desert horned lizard (*Phrynosoma platyrhinos*)

Other lizard species that were observed, but did not appear to be common, were:

- Zebra-tailed lizard (*Callisaurus draconoides*)
- Desert spiny lizard (*Sceloporus magister*)
- Desert iguana (*Dipsosaurus dorsalis*)

Great Basin collared lizards (*Crotaphytus bicinctores*) and desert night lizards (*Xantusia vigilis*) were not observed during field surveys, but probably occur in the study area and potentially in the construction right-of-way. Chuckwalla (*Sauromalus ater*) commonly occurs in land-cover types similar to those in the southern portion of common segment 6, although none were observed during field surveys. This species is found in rocky outcrops and is rarely seen above ground.

Two species of snakes were observed during field surveys performed in February, March, and May 2005: the coachwhip snake (*Masticophis flagellum*) and the gopher snake (*Pituophis catenifer*). Various other species of snakes are likely to occur in the study area and potentially in the construction right-of-way, but were not directly observed during field surveys.

3.2.7.3.2.4 Aquatic Species. Aquatic species are species that require wet environments for at least part of their life cycle. The only native fish species found within the Caliente rail alignment greater study area are special status species and include:

- Railroad Valley springfish (*Crenichthys nevadae*)
- Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6 [unnamed])

- Meadow Valley Wash speckled dace (*Rhinichthys osculus* ssp. 11 [unnamed])
- Meadow Valley Wash desert sucker (*Catostomus clarki* ssp. [unnamed])

Nine more species of amphibians can be found in the southern Great Basin Desert and northern Mojave Desert that are not present in the Caliente rail alignment study area or construction right-of-way and are listed in Appendix H. Potential amphibian habitat correlates with the riparian and wetland habitat found along the rail alignment. The only amphibian observed during field surveys was a possible Woodhouse's toad (*Bufo woodhousii*) at an unnamed spring approximately 760 meters (2,500 feet) downgradient of Caliente common segment 1 on Pahroc Pass, which would be outside of the construction right-of-way. A tadpole in the spring outflow and a brief vocalization are the only recorded evidence; there were no direct observations of adult individuals. The Amargosa toad (*Bufo nelsoni*) occurs only in Oasis Valley north of Beatty. The southwestern toad (*Bufo microscaphus*) has been reported to occur (DIRS 174048-Bennett and Thebeau 2005, all), and is assumed still to exist, at the confluence of Clover Creek and Meadow Valley Wash, although none were observed during field surveys. Non-native bullfrogs (*Rana catesbeiana*) are also present in some waterways and water bodies in the Caliente rail alignment greater study area.

3.2.7.3.3 Special Status Species

Special status species are plants or wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. The following sections describe two categories of special status species, including threatened or endangered species and BLM special status (designated sensitive) and State of Nevada protected species. Table 3-53 lists special status species, their BLM, state, and federal status, and their likely occurrence in the greater study area and potentially within the construction right-of-way. Figures 3-96 through 3-98 show documented locations of special status species in the study area from the Nevada Natural Heritage Program database. Not all special status species listed in Table 3-53 appear on the figures because DOE obtained the additional information in the table from personnel affiliated with appropriate resource management agencies, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry, and obtained the specific locations of the special status species from a review of the Nevada Natural Heritage Program database (DIRS 182061-BSC 2006, all). The review of the Nevada Natural Heritage Program database for the study area revealed 24 special status species that have been documented as occurring within the study area.

3.2.7.3.3.1 Threatened and Endangered Species. Table 3-53 identifies six federally listed plant and wildlife species, or candidates for listing, with the potential to occur along the Caliente rail alignment, including one plant, one fish, one reptile, and three bird species. However, in 2007 the U.S. Fish and Wildlife Service delisted the bald eagle and the golden eagle. These two species are protected under the Bald and Golden Eagle Protection Act, but are no longer federally listed (See Section 3.2.7.3.3.2). There are no federally listed mammal species along the Caliente rail alignment.

Plants The threatened Ute ladies'-tresses orchid has the potential to occur in the area of the Caliente alternative segment. However, the alternative segment is within the southernmost extent of potential Ute ladies'-tresses habitat. A petition to delist the Ute ladies'-tresses was filed with the U.S. Fish and Wildlife Service in 2004. In its 90-day finding on this petition, the U.S. Fish and Wildlife Service stated that the petition presented substantial new information on the orchid, and that the Service was initiating a 5-year status review to determine if delisting of this species is warranted under 50 CFR 17. Until this review is completed and the Service issues the 12-month finding, the Ute ladies'-tresses orchid will continue to be addressed as a ***threatened species***.

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 1 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment study area where species could be found
		BLM[b]	State[c]	FWS[d]	
Plants					
Eastwood milkweed	*Asclepias eastwoodiana*	N		xC2	Goldfield alternative segments 1, 3, and 4; Caliente common segment 4
Needle Mountains milkvetch	*Astragalus eurylobus*	N		xC2	Caliente and Eccles alternative segments; Caliente common segment 1
Black woollypod	*Astragalus funereus*	N		xC2	Common segment 6; Oasis Valley alternative segments 1 and 3
Long-calyx eggvetch	*Astragalus oophorus* var. *lonchocalyx*	N			Caliente common segment 1
White River catseye	*Cryptantha welshii*	N		xC2	Caliente and Eccles alternative segments; Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8
Rock purpusia	*Ivesia arizonica* var. *saxosa*	N			Common segment 6
Pioche blazingstar	*Mentzelia argillicola*	N			Caliente and Eccles alternative segments; Caliente common segment 1
Tiehm blazingstar	*Mentzelia tiehmii*	N			Caliente common segment 1
Nevada dune beardtongue	*Penstemon arenarius*	N		xC2	Caliente common segment 3; common segment 5
Bashful beardtongue	*Penstemon pudicus*	N			Caliente common segment 3; South Reveille alternative segments 2 and 3
Williams combleaf	*Ploynctenium williamsiae*		CE		Caliente common segment 3
Tonopah fishhook cactus	*Sclerocactus nyensis*	N	CY		Caliente common segment 3
Schlesser pincusion	*Sclerocactus schlesseri*	N	CY	xC2	Caliente common segment 1
Ute ladies'-tresses	*Spiranthes diluvialis*		CE	LT	Caliente alternative segment
Wassuk beardtongue	*Penstemon rubicundus*				Goldfield alternative segments 1, 3, and 4; Oasis Valley alternative segments 1 and 3; common segments 5 and 6

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 2 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment study area where species could be found
		BLM[b]	State[c]	FWS[d]	
Plants (continued)					
Dune sunflower	*Helianthus deserticola*				Goldfield alternative segments 1, 3, and 4; common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Invertebrates					
Oasis Valley pyrg	*Pyrgulopsis micrococcus*	N		xC2	Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Fish					
Meadow Valley Wash desert sucker	*Catostomus clarki*	N	S	xC2	Caliente and Eccles alternative segments
Railroad Valley springfish	*Crenichthys nevadae*		T	LT	Caliente common segment 3
Meadow Valley speckled dace	*Rhinichthys osculus* ssp. 11[e]	N	P		Caliente and Eccles alternative segments
Oasis Valley speckled dace	*Rhinichthys osculus* ssp. 6[e]	N	P		Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Amphibians and reptiles					
Southwestern toad	*Bufo microscaphus*	N			Caliente and Eccles alternative segments; common segment 6
Amargosa toad	*Bufo nelsoni*	N	P		Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	N	T	LT	Common segment 6
Chuckwalla	*Sauromalus ater*	N		xC2	Common segment 6
Birds					
Western burrowing owl	*Athenes cunicularia*	N		xC2	All segments
Greater sage-grouse	*Centrocercus urophasianus*	N	G		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8
Western yellow-billed cuckoo	*Coccyzus americanus*		S	C	Caliente alternative segment
Southwestern willow flycatcher	*Empidonax traillii extimus*		E	LE	Caliente alternative segment; Oasis Valley alternative segments 1 and 3
Ferruginous hawk	*Buteo regalis*	N		xC2	Caliente and Eccles alternative segments; Caliente common segments 1 and 2; common segment 5

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 3 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Birds (continued)					
Swainson's hawk	*Buteo swainsoni*	N		--	Oasis Valley alternative segments 1 and 3; common segment 6
Peregrine falcon	*Falco peregrinus*	N	E	NL	Caliente alternative segment; Oasis Valley alternative segments 1 and 3; common segment 6
Bald eagle	*Haliaeetus leucocephalus*		E	NL	Caliente alternative segment
Loggerhead shrike	*Lanius ludovicianus*	N	S	xC2	All segments
Sage thrasher	*Oreoscotes montanus*	N	S		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Oasis Valley alternative segments 1 and 3
Phainopepla	*Phainopepla nitens*	N		--	Oasis Valley alternative segments 1 and 3; common segment 6
Brewer's sparrow	*Spizella breweri*	N	S		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Oasis Valley alternative segments 1 and 3; common segment 6
Western least bittern	*Ixobrychus exilis hesperis*	N	P	xC2	Common segment 5
White-faced ibis	*Plegasis chihi*	N	P	xC2	Oasis Valley alternative segments 1 and 3; common segment 6
Mammals					
Pygmy rabbit	*Brachylagus idahoensis*	N	G	xC2	Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8
Pale kangaroo mouse	*Microdipidops pallidus*		P		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Goldfield alternative segments 1, 3, and 4
Dark kangaroo mouse	*Microdipodops megacephalus albiventer*	N	P	xC2	Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Goldfield alternative segments 1, 3, and 4

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 4 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Mammals (continued)					
Desert bighorn sheep	*Ovis canadensis*	N	G		Caliente common segment 1; Bonnie Claire alternative segment 2; common segment 5; common segment 6
Pallid bat	*Antrozous pallidus*		P		All segments
Townsend's big-eared bat	*Corynorhinus townsendii*	N	S		Goldfield alternative segment 4; Oasis Valley alternative segments 1 and 3; common segment 6
Big brown bat	*Eptesicus fuscus*	N			All segments
Greater western mastiff bat	*Eumops perotis*	N	S	xC2	All segments
Spotted bat	*Euderma maculatum*		T	xC2	Caliente and Eccles alternative segments; Caliente common segment 1; Goldfield alternative segment 4
Allen's lappet-browed bat	*Idionycteris phyllotis*	N	P	xC2	All segments
Western red bat	*Lasiurus blossivillii*	N	S		All segments
Hoary bat	*Lasiurus cinereus*	N			All segments
Silver-haired bat	*Lasionycteris noctivagans*	N			All segments
California leaf-nosed bat	*Macrotus californicus*	N	S	xC2	All segments
California myotis	*Myotis californicus*	N			All segments
Small-footed myotis	*Myotis ciliolabrum*	N		xC2	All segments
Long-eared myotis	*Myotis evotis*	N			All segments
Little brown myotis	*Myotis lucifugus*	N			All segments
Fringed myotis	*Myotis thysanodes*	N	P	xC2	Common segment 6
Cave myotis	*Myotis velifer*	N		xC2	All segments
Long-legged myotis	*Myotis volans*	N			All segments
Yuma myotis	*Myotis yumanensis*	N			All segments
Western pipistrelle	*Pipistrellus hesperus*	N			All segments
Brazilian free-tailed bat	*Tadarida brasilliansis*	N	P		All segments

a. Source: DIRS 182061-BSC 2006, all.
b. BLM = U.S. Bureau of Land Management. Status definitions: N = designated sensitive by the BLM state office.
c. State = State of Nevada Protected Species (under NAC 503). Status definitions: G = game; P = protected; T = threatened; E = endangered; S = sensitive; CE = critically endangered plant; CY = state-protected cactus and yucca.
d. FWS = U.S. Fish and Wildlife Service. Status definitions: LE = listed endangered; LT = listed threatened; C = candidate; xC2= former Category 2 candidate, now "species of concern;" NL = not listed (removed from list).
e. Numbers refer to unnamed subspecies.

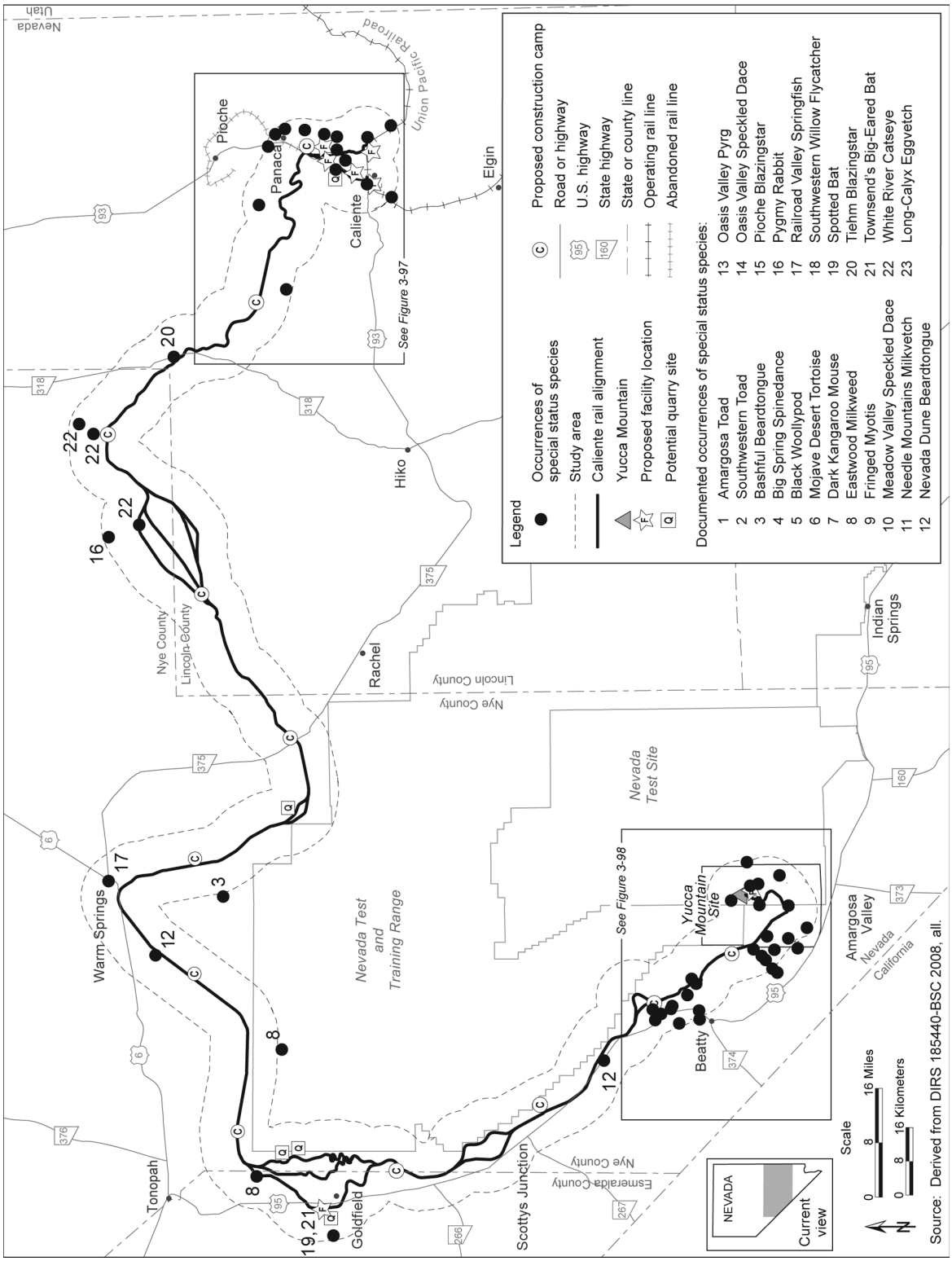


Figure 3-96. Occurrences of special status species documented in the Nevada Natural Heritage Program database along the Caliente rail alignment.

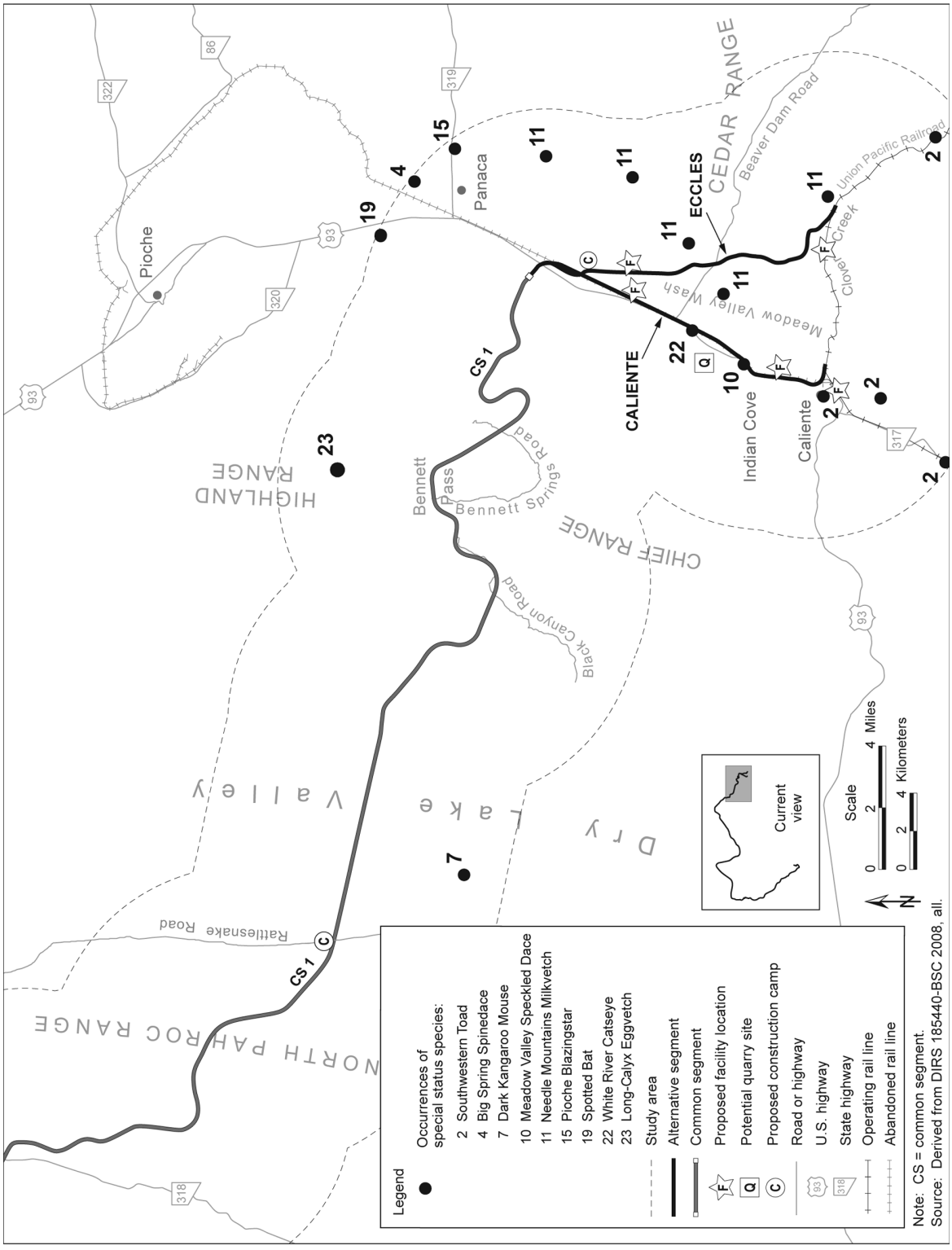


Figure 3-97. Occurrences of special status species documented in the Nevada Natural Heritage Program database adjacent to the Caliente and Eccles alternative segments.

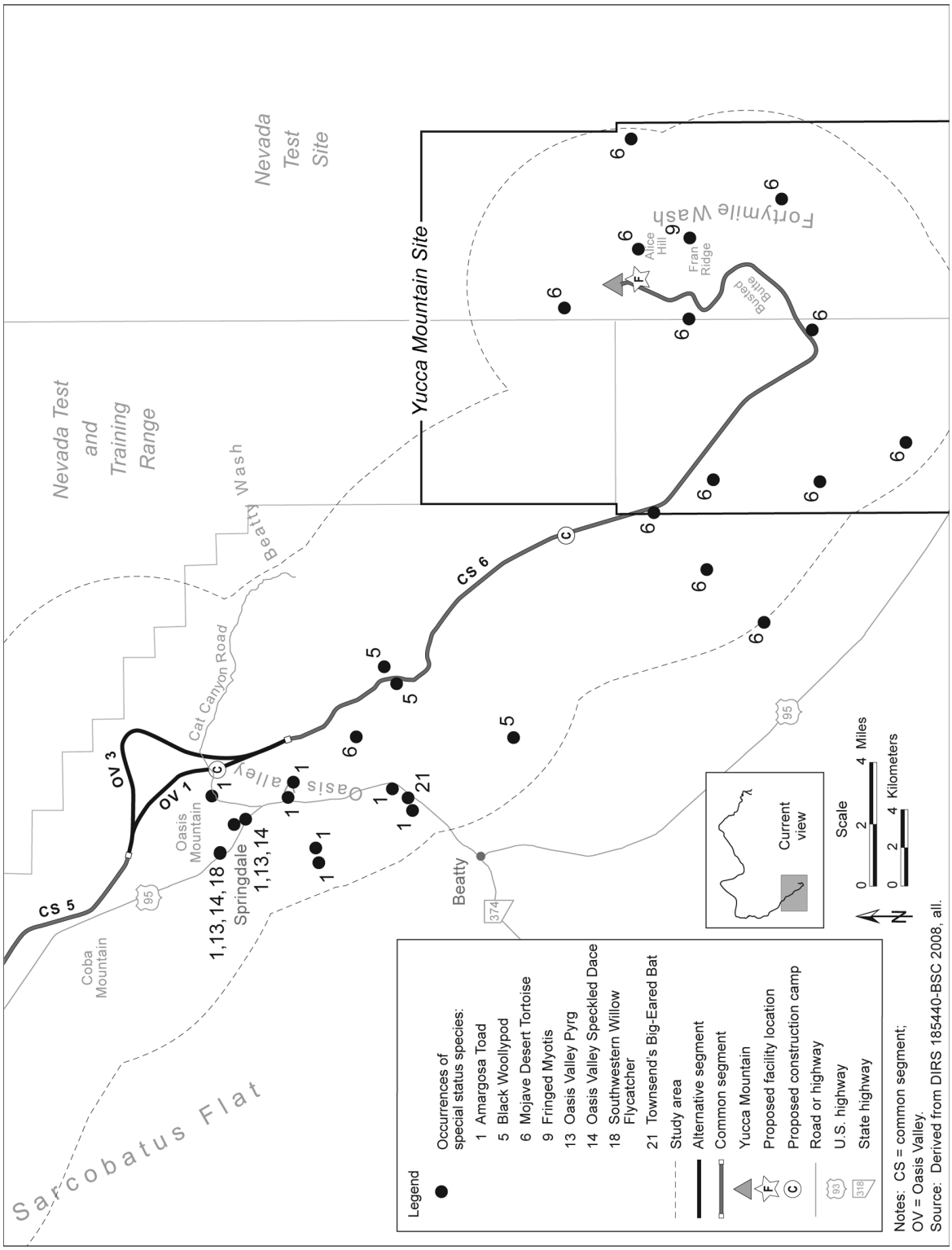


Figure 3-98. Occurrences of special status species documented in the Nevada Natural Heritage Program database adjacent to the Oasis Valley alternative segments and the Yucca Mountain Site.

An historic observation of the Ute ladies'-tresses orchid was documented in 1936 approximately 8 kilometers (5 miles) north of the Caliente and Eccles alternative segments near Panaca Spring (Meadow Valley Wash watershed). Until recently, this species was believed to no longer exist in Nevada (*Endangered and Threatened Wildlife and Plants; Final Rule to List the Plant Spiranthes diluvialis (Ute Ladies'-Tresses) as a Threatened Species* [57 *FR* 2048, January 17, 1992]). However, in July 2005, the population at Panaca Spring was rediscovered and included 80 to 100 individual plants (DIRS 176365-Fertig, Black, and Wolken 2005, p. 12). The Ute ladies'-tresses orchid is associated with moist soil conditions, which in the southwest can include perennial streams or washes, floodplains or spring-fed stream channels, or wetlands. There is no designated critical habitat for this species within the study area (DIRS 174439-Williams 2005, all). However, there is a potential for the Ute ladies'-tresses orchid to occur within Meadow Valley Wash between Panaca and Caliente, along the proposed Caliente alternative segment (DIRS 181606-Rautenstrauch 2007, all).

Fish The endangered Railroad Valley springfish was reportedly introduced into Warm Springs near the Warm Springs summit, north of U.S. Highway 6. The Nevada Natural Heritage Program documented the occurrence approximately 3.3 kilometers (2 miles) northeast of Caliente common segment 3 (see Figure 3-92). A survey of the springs in 1994 indicated that the springfish was no longer present in this area, and the Draft Ely District Resource Management Plan indicates that the introduction failed (DIRS 174518-BLM 2005, p. 3.7-5). This fish is typically found in warm spring pools, outflow streams, and adjacent marshes.

Amphibians and Reptiles The desert tortoise, which is listed as threatened under the Endangered Species Act and by the State of Nevada (Mojave Desert population only), is found along the southern end of the Caliente rail alignment from approximately Beatty Wash to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 57 to 72). The desert tortoise's range in this portion of Nevada extends approximately 16 kilometers (10 miles) north of Beatty near Springdale (DIRS 176649-Williams 2003, p. 7). About 48 kilometers (30 miles) of the rail alignment would be within potentially suitable desert tortoise habitat, including common segment 6 and the Rail Equipment Maintenance Yard (Figure 3-99). Mojave Desert tortoises are generally confined to warm, creosote bush and shadscale (*Atriplex confertifolia*) scrub habitats with well-drained sandy ***loam*** soils. These soils are composed of sand or sandy gravel that permit the tortoises to burrow and nest (DIRS 102475-Brussard et al. 1994, p. 15). The area through which common segment 6 would pass and the location of the Rail Equipment Maintenance Yard are not designated as critical habitat for the desert tortoise. This area is primarily considered low-density for the desert tortoise, with the population of tortoises at a low level in relation to other areas within the range of this species in Nevada.

Birds Until recently, the yellow-billed cuckoo, which is a federal ***candidate species*** under the Endangered Species Act, had been considered to no longer exist in Nevada; however, recent Nevada Department of Wildlife survey data indicated that at least one nesting pair has been observed along the Meadow Valley Wash area in southeastern Nevada approximately 27 kilometers (17 miles) south of the City of Caliente (DIRS 173227-Micone and Tomlinson 2000, all; DIRS 173228-Gallagher, Tomlinson, and Furtek 2001, p. 10; DIRS 173229-Furtek, Tomlinson, and Griego 2002, pp. 13 to 21; DIRS 173230-Furtek, Tomlinson, and Williams 2003, pp. 18 to 23; DIRS 173231-Furtek and Tomlinson 2003, pp. 16 to 22). Yellow-billed cuckoos nest in tall cottonwood trees and willow riparian woodlands in the West and require patches of an average of 0.17 square kilometer (42 acres) of dense riparian habitat with at least 0.03 square kilometer (7 acres) of it closed canopy (DIRS 175505-Laymon and Halterman 1987, pp. 19 to 25). There is no suitable breeding habitat for yellow-billed cuckoos within the Caliente rail alignment construction right-of-way (DIRS 182308-Rautenstrauch 2007, all). There is an area of marginally suitable migratory or non-nesting yellow-billed cuckoo habitat approximately 320 meters (1,050 feet) long on the northern border of the City of Caliente. This habitat is between U.S. Highway 95 and the Caliente rail alignment and outside the construction right-of-way. There is also a stand

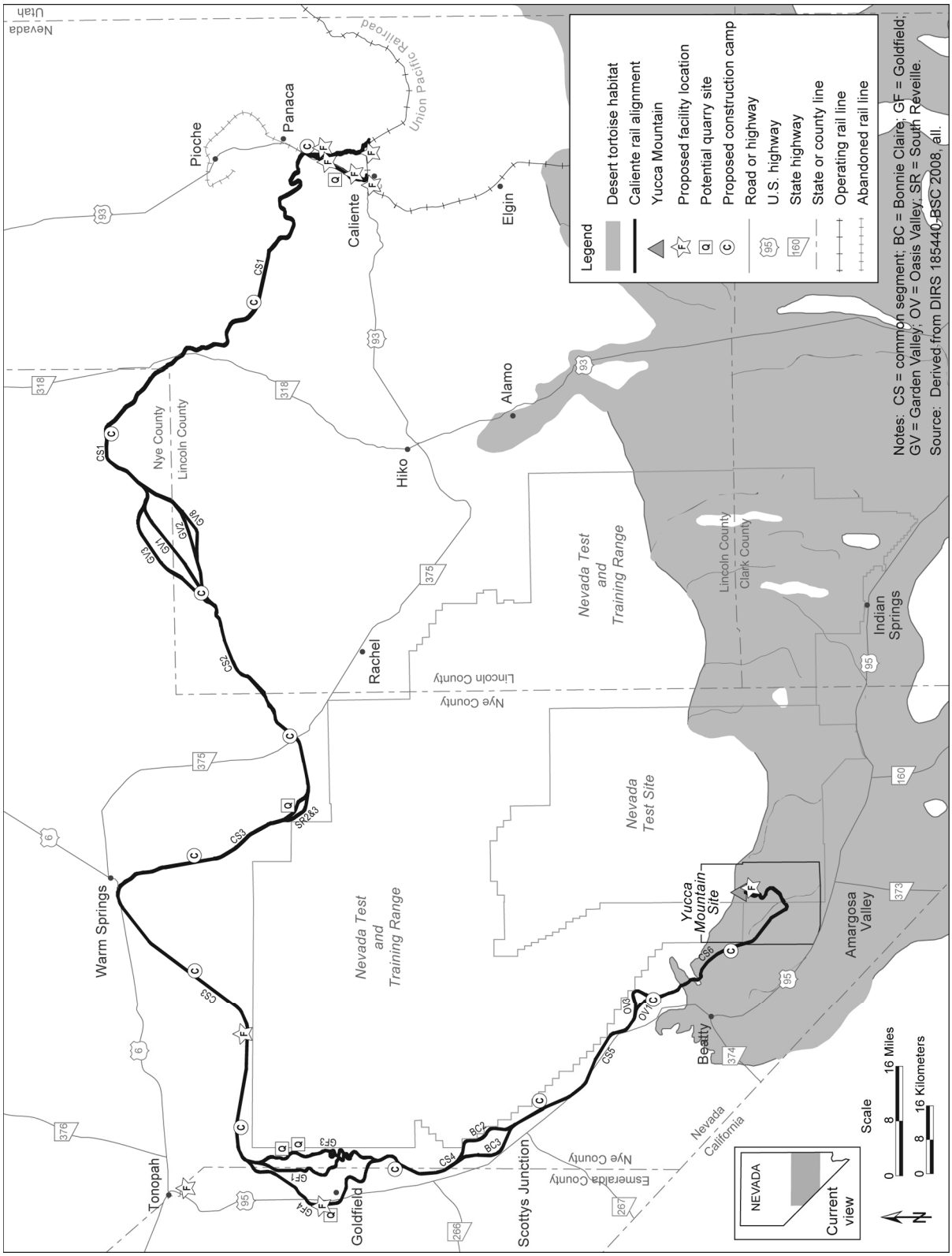


Figure 3-99. Estimated northern extent of potential desert tortoise habitat in relation to the Caliente rail alignment.

of riparian vegetation west of the Eccles Interchange Yard location along Clover Creek; although suitable for migratory or non-nesting yellow-billed cuckoos, this area is outside the Caliente rail alignment construction right-of-way. This area of riparian vegetation would not be disturbed during the construction of the Eccles Interchange Yard. The lack of confirmed records for this species throughout Nevada and the lack of sufficient breeding habitat within the Caliente rail alignment construction right-of-way suggest that it is highly unlikely that the yellow-billed cuckoo would occur within the project area.

The southwestern willow flycatcher, listed as endangered under the Endangered Species Act, is potentially present in Nevada from May through September and breeds in dense riparian habitat. This species' preferred habitat is typically dominated by willows, cottonwood, or invasive tamarisk. The southwestern willow flycatcher has been observed in dense stands of riparian vegetation in Meadow Valley Wash in Lincoln County. The closest recorded occurrence of this species within Meadow Valley Wash was approximately 12 kilometers (7.5 miles) from the beginning of the Caliente alternative segment, south of the City of Caliente (DIRS 182061-BSC 2006, all). A U.S. Fish and Wildlife Service-funded study identified suitable southwestern willow flycatcher habitat along Meadow Valley Wash in the vicinity of the Caliente Hot Springs Motel. Further, the U.S. Fish and Wildlife Service identifies southwestern willow flycatcher habitat as "suitable or potentially suitable, migratory or non-nesting" habitat.

Immediately north of Caliente, the Caliente alternative segment would be constructed on an existing, abandoned rail roadbed adjacent to and east of Meadow Valley Wash. In this area, Meadow Valley Wash is incised 6.1 to 9.1 meters (20 to 30 feet) below U.S. Highway 93 to the west and the rail roadbed to the east. Along about 518.2 meters (about 1,700 feet) of this section, from Clover Creek to Antelope Canyon, there is a thin stand of velvet ash, Fremont cottonwood, Goodding's willow, and narrowleaf willow in the incised wash bottom. In most areas, this stand of trees is less than 9.1 meters (30 feet) wide. There is a denser, 15.2- to 30.5-meter (50- to 100-foot)-wide stand of narrowleaf willow, with a sparse overstory of Goodding's willow and Fremont cottonwood trees, along an approximately 76.2-meter (approximately 250-foot) section of Meadow Valley Wash at the confluence of Antelope Canyon Wash. As described in the Southwestern Willow Flycatcher Recovery Plan 9 (DIRS 185438-FWS 2002, all), the riparian overstory in this area is too narrow and sparse to be breeding habitat for southwestern willow flycatchers. However, this riparian habitat may be used by nonbreeding and migrating southwestern willow flycatchers.

There is also a stand of riparian vegetation west of the proposed location of the Eccles Interchange Yard along Clover Creek, outside the construction right-of-way, which could be suitable for migrating and non-nesting southwestern willow flycatchers. This area of riparian vegetation would not be disturbed during construction of the Eccles Interchange Yard. Southwestern willow flycatchers have also been documented approximately 19 kilometers (12 miles) north of Beatty, near Oasis Valley (DIRS 182061-BSC 2006, all). This recorded occurrence was approximately 4.4 kilometers (2.7 miles) southwest of Oasis Valley alternative segment 1 and well outside the Caliente rail alignment construction right-of-way.

3.2.7.3.3.2 BLM Special Status and State of Nevada Protected Species. The BLM State Office and the State of Nevada have identified a number of species as requiring conservation and protection. The BLM State Office designates species as sensitive and the State of Nevada designates species protected. Many of the species designated as sensitive by the BLM are also designated as protected by the State of Nevada. Additionally, a few ***BLM-designated sensitive species*** and State of Nevada-designated protected species are listed as threatened, endangered, proposed, or candidate under the Endangered Species Act. Table 3-53 lists BLM-designated sensitive and State of Nevada-designated protected species and provides information on their status and known or potential locations along the Caliente rail alignment. These species are described below by plant and animal categories.

Plants DOE performed field surveys in May 2005 to confirm the presence of BLM-designated sensitive species and to identify potential habitat for such species along the Caliente rail alignment. Appendix H contains detailed survey information. In addition to location records for BLM-designated sensitive species obtained from the Nevada Natural Heritage Program (DIRS 182061-BSC 2006, all), these species were passively observed during field surveys in other locations with habitat characteristics of the species. Because the field surveys did not cover the entire construction right-of-way, and there is both seasonality to the presence or absence of visible signs of plants and annual variability among plant species, the fact that a BLM-designated sensitive species was not documented at a specific location does not indicate a definitive absence of the species.

The Eastwood milkweed has been documented 140 meters (460 feet) west of Goldfield alternative segment 4, near Mud Lake. Surveys in May 2005 in this location documented an individual Eastwood milkweed plant within the construction right-of-way of Goldfield alternative segment 4. Typical habitat for this species consists of sandy soils in mixed desert shrub or salt desert scrub, including blackbrush (*Coleogyne ramosissima*) and sagebrush from 1,130 to 2,000 meters (3,700 to 6,500 feet) elevation (DIRS 176456-Welsh et al. 1993, all).

Needle Mountains milkvetch has been recorded in large populations within approximately 0.8 kilometer (0.5 mile) of the Eccles alternative segment (DIRS 182061-BSC 2006, all). Field surveys identified this species in the gravelly, eroded sandstone badlands between the areas east of Bennett Pass to where the Caliente or Eccles alternative segment would join Caliente common segment 1, and continuing south along the Eccles alternative segment to the dirt road between U.S. Highway 93 and Beaver Dam State Park and outside the construction right-of-way. This species typically occurs in deep, sandy, gravelly, or clay soils and is frequently found in or along drainages. Although this species appears to be locally common, its distribution is patchy, and habitat outside this area is rare.

The black woollypod has been observed approximately 6 kilometers (4 miles) east of U.S. Highway 95 near Beatty Wash. Field surveys along common segment 6 in Beatty Wash confirmed the presence of this species in the study area but outside the construction right-of-way. This plant is common locally on very steep, gravelly slopes of light-colored volcanic tuff in the area where there is little competition from other species. Habitat for this species is characterized by open, talus, or gravelly slopes on alluvium soils composed of volcanic tuff around 975 to 2,340 meters (3,200 to 7,700 feet) elevation (DIRS 181872-NNHP 2001, all).

Long-calyx eggvetch has been recorded in the vicinity of the Highland Range, approximately 4.5 kilometers (2.8 miles) north of Bennett Pass, just west of Panaca within the study area but outside the construction right-of-way. There is very little information on the habitat of this species in Nevada. Typical habitat includes pinyon-juniper associations and other mixed-shrub communities (DIRS 176456-Welsh et al. 1993, all), which occur at elevations of 1,770 and 2,300 meters (5,800 and 7,550 feet) throughout the Great Basin.

White River catseye is known to occur in gravelly, eroded sandstone badlands between the areas east of Bennett Pass to where the Caliente or Eccles alternative segment would join Caliente common segment 1, and continuing south along the Eccles alternative segment to the dirt road between U.S. Highway 93 and Beaver Dam State Park. It has also been recorded in the Meadow Valley watershed near the Caliente alternative segment; however, the location description puts the species in a wet meadow, which is not typical habitat for the species. No White River catseye were observed in the construction right-of-way during field surveys; however, this species has been documented approximately 200 meters (660 feet) south of Garden Valley alternative segment 3.

Rock purpusia has been documented approximately 13 kilometers (8 miles) from common segment 6 within the study area but outside the construction right-of-way. No systematic surveys have been

completed for this species; therefore, there is no habitat and range information. Studies at the Nevada Test Site show this species tends to occur in cliff crevices and boulders on volcanic and possibly carbonate rocks in the upper mixed-shrub, sagebrush, and pinyon-juniper zones (DIRS 180962-NatureServe Explorer 2007, all).

Pioche blazingstar is a newly described species that has been documented approximately 7.5 kilometers (4.7 miles) north of Bennett Pass, less than 1.6 kilometers (1 mile) east of Panaca. This species appears to be restricted to barren clay knolls and slopes between Panaca and the Patterson Wash area of southern Lake Valley and is known from only five reported occurrences in this area of Nevada (DIRS 181846-NatureServe Explorer 2007, all).

Tiehm blazingstar has been documented in the White River Valley, west of the White River approximately 1.6 kilometers (1 mile) from Caliente common segment 1. Field surveys conducted in May 2005 did not detect the presence of this species at the location described by the Nevada Natural Heritage Program (DIRS 182061-BSC 2006, all). Additionally, no occurrences were documented along the Caliente rail alignment construction right-of-way in the White River Valley, although it is possible that the plant would not have matured enough to be identified. Other occurrences of this species were recorded approximately 40 kilometers (25 miles) to the north, near Sunnyside, in an area dotted with knolls of white, chalky soil, the type of habitat typically associated with this species. The area in White River Valley consists of a series of gravelly mesas separated by steep washes and lacks the white chalky soil found to the north.

A population of the Nevada dune beardtongue was documented during field surveys along the Caliente rail alignment within the Sarcobatus Flats area outside the construction right-of-way. This species is common locally in a sandy area along common segment 5 on both sides of a bisecting secondary road, but appears restricted to this area of deep, sandy soil. Typical habitat for this species consists of deep, loose sandy soils of valley bottoms, often in alkaline areas, sometimes on road banks and other previously disturbed areas with associated vegetation including shadscale, four-winged saltbush (*Atriplex canescens*), and rabbitbrush (*Chrysothamnus nauseosus* spp.) (DIRS 180960-NatureServe Explorer 2007, all).

Bashful beardtongue, also known as the Kawich Range beardtongue, has been documented along the Caliente rail alignment where it would pass through the Kawich Range at Warm Springs Summit. This species has a narrow distribution and is known from only five sites within the Kawich Range. Typical habitat for this species includes coarse rocky slopes in pinyon-juniper or mountain mahogany woodlands and sagebrush communities around 2,300 to 2,700 meters (7,500 to 8,900 feet) elevation (DIRS 181882-NNHP 2001, all).

Williams combleaf has been found within the Kawich Range approximately 10 kilometers (6 miles) south of the study area along Caliente common segment 3 but outside the construction right-of-way. This species has a small range in Nevada and is found in relatively barren sandy to sandy-clay soils associated with high-elevation, non-alkaline, seasonal lakes in sagebrush, pinyon-juniper zones around 1,700 to 2,700 meters (5,700 to 8,900 feet) (DIRS 181881-NNHP 2001, all).

The Tonopah fishhook cactus has been recorded near the Caliente rail alignment in Reveille Valley. Only general locations of this species are included in the Nevada Natural Heritage Program database (DIRS 182061-BSC 2006, all) because of the risk of illegal collection. Field surveys consisting of two 1.6-kilometer (1-mile) transects perpendicular to the rail alignment in Reveille Valley did not locate any Tonopah fishhook cacti within the construction right-of-way. This species is typically found in dry, rocky soils or outcrops, or under shrubs in the upper salt desert and lower sagebrush zones (DIRS 181880-Nevada Natural Heritage Program 2001, all).

A population of the Schlesser pincushion was recorded 640 meters (2,100 feet) north of the Caliente rail alignment near the city of Panaca. The habitat for this species is typified by open, gravelly or sandy-clay soils, with dense shrubs or grass canopies dominated by shadscale shrubs (DIRS 181879-NNHP 2001, all). Surveys along the rail alignment nearest the recorded occurrence, east of Bennett Pass to where the Caliente or Eccles alternative segment would join Caliente common segment 1, found no Schlesser pincushion. The BLM has proposed an Area of Critical Environmental Concern for protection of the Schlesser pincushion, a BLM sensitive species (DIRS 184767-BLM 2007, Table 2.4-28). This proposed Area of Critical Environmental Concern is east of Bennett Pass about 16 kilometers (10 miles) north of the City of Caliente. Common segment 1 would cross the extreme southwest corner of this proposed Area of Critical Environmental Concern (Figure 3-84).

As defined in Section 3.2.7.3.3, special status species are species that are afforded some level of protection or special management under federal or state laws or regulations. Cacti, yucca, and Christmas trees (evergreen trees) are considered special status because the State of Nevada (NRS 527.060 through 527.120 and NAC 527.500) prohibits unauthorized removal or destruction and regulates removal for commercial purposes, and, in addition, cacti and yucca are afforded consideration by the BLM under protocols for salvage and replanting for land reclamation consistent with BLM Manual 6840, *Special Status Species Management* (DIRS 172901-BLM 2001, all). DOE would comply with the requirements of Nevada State law, and pursuant to BLM protocols would salvage and replant cacti and yucca that would be removed from the right-of-way during the construction phase.

Invertebrates The Oasis Valley pyrg, a snail, is known to occur in the Amargosa River drainage in Oasis Valley. Specifically, this snail has been observed in an unnamed spring near Fleur de Lis Spring 12 kilometers (7.5 miles) north-northeast of Beatty (DIRS 104593-CRWMS M&O 1999, p. K-6) and potentially inhabits other springs in the Amargosa River drainage. This snail inhabits small springs and stream outflows where it is typically found on stone, travertine, watercress, and plant debris (DIRS 175029-NatureServe Explorer 2005, all). There is no recorded occurrence of this snail in the construction right-of-way.

Fish The Meadow Valley Wash desert sucker is also found in Meadow Valley Wash (DIRS 104593-CRWMS M&O 1999, pp. E-2 and E-4) and in the White River drainage. This subspecies is typically found in small- to moderate-sized streams, often with pools and riffles or shallow areas, with mainly gravel-rubble, sandy silt substrates (DIRS 180964-NatureServe Explorer 2007, all).

The Meadow Valley Wash speckled dace has been historically observed in Meadow Valley Wash approximately 60 meters (200 feet) northwest of the Caliente rail alignment (DIRS 182061-BSC 2006, all; DIRS 104593-CRWMS M&O 1999, pp. 3-23, E-2, and E-4). This subspecies has a very limited range and is only known within this watershed. Specific distribution of this fish varies within Meadow Valley Wash due to water availability within the wash.

The BLM has proposed the Lower Meadow Valley Wash Area of Critical Environmental Concern for protection of federally endangered, threatened, and candidate species, and for sensitive species such as the Meadow Valley Wash desert sucker and Meadow Valley Wash speckled dace (DIRS 184767-BLM 2007, Table 2.4-28). This proposed Area of Critical Environmental Concern is located throughout lower Meadow Valley Wash and portions of Clover Creek. The Interchange Yard for the Eccles alternative segment would be constructed within a portion of this proposed Area of Critical Environmental Concern in Clover Creek (Figure 3-84).

The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near the towns of Springdale and Beatty, less than 1.6 kilometers (1 mile) from Oasis Valley alternative segment 1. This subspecies has a very limited range and is only known from the watershed in Oasis

Valley. Specific distribution of this fish varies with available water (DIRS 181847-NatureServe Explorer 2007, all).

Amphibians and Reptiles The Amargosa toad is found in or near riparian habitats associated with the Amargosa River drainage (Oasis Valley) and at Fleur de Lis Spring, Crystal Spring, Indian Spring, and other springs and seeps near the towns of Springdale and Beatty (DIRS 174414-Stebbins 2003, pp. 209 and 210; DIRS 104593-CRWMS M&O 1999, p. 3-20). Vegetation bordering this toad's habitat includes cottonwood trees, cattails, and sedges. Adult toads hide and rest under bushes and in rodent burrows, and generally hibernate from November to March. In the late summer and fall, adult toads have been documented as traveling more than 183 meters (600 feet) from water sources. If moist soil is available, open water might not be necessary for the adult toad to survive (DIRS 176795-BLM [n.d.], all).

The southwestern toad (also known as Arizona toad) has been documented in locations in Meadow Valley Wash near the City of Caliente, and also within Clover Creek (DIRS 174048-Bennett and Thebeau 2005). Specifically, this toad has been documented approximately 0.8 kilometer (0.5 mile) south of the Caliente alternative segment and approximately 4.8 kilometers (3 miles) south of the Eccles alternative segment in Clover Creek outside the construction right-of-way. This species can be found in cottonwood-willow associations, creeks, pools, irrigation ditches, flooded fields, and reservoirs. This toad normally breeds in low- to moderate-gradient streams and is not dependent on rainfall (DIRS 174414-Stebbins 2003, pp. 213 and 214; DIRS 175487-NatureServe Explorer 2005, all). There were no southwestern toads found within the Caliente rail alignment study area during the 2005 field surveys. However, the potential presence of this species cannot be discounted, because the survey of potentially suitable toad habitat was limited to areas that were accessible and along the construction right-of-way. Thus, the survey excluded large areas of potentially suitable habitat on private property to which DOE had no access. The Lower Meadow Valley Wash Area of Critical Environmental Concern (Figure 3-84) has been proposed by the BLM in part for the protection of this species (DIRS 184767-BLM 2007, Table 2.4-28).

Chuckwalla has been documented in the southeastern foothills of Yucca Mountain, adjacent to common segment 6 but outside the construction right-of-way. This area represents the chuckwalla's northernmost range in southern Nevada. This large lizard is typically found among talus slopes, large rocky outcrops and boulders, which provide cover and basking sites (DIRS 174414-Stebbins 2003, pp. 269 and 270).

Birds Western burrowing owls are known to occur throughout the Mojave and Great Basin Deserts (DIRS 176455-Dickinson ed. 1999, p. 256). DOE identified one burrowing owl burrow, which appeared to be active, within the Caliente rail alignment study area in the vicinity of Yucca Mountain. Typical burrowing owl habitat is characterized by well-drained, level-to-gently sloping areas in arid or semi-arid environments. This species has been known to overwinter throughout Nevada; however, they are predominantly encountered during their breeding season from mid-March through September (DIRS 176361-Klute et al. 2003, pp. 1 to 12).

The greater sage-grouse is a BLM-designated sensitive bird species that is also listed as a game species by the State of Nevada. Greater sage-grouse are found exclusively in sagebrush habitat. Although sage-grouse are sagebrush obligate species, they require a variety of habitats within the landscape throughout the year, including various conditions and communities of sagebrush, meadow, and riparian habitats. The Caliente rail alignment would cross the extreme southern portion of the range of the greater sage-grouse. Big sagebrush and other sagebrush species provide nesting, brood, fall/winter cover, and forage throughout the year for the greater sage-grouse. Suitable winter habitat for the greater sage-grouse consists of big sagebrush stands comprised of 10 to 30 percent horizontal sagebrush cover and a diversity of sagebrush heights that are generally tall enough to emerge through any accumulated snow, and ridges or canyons where sagebrush is exposed. Nesting habitat is characterized by big sagebrush communities that have 15 to 38 percent canopy cover and 10 to 15 percent grass. Nesting habitat is usually close to

leks (communal courtship and breeding sites in open areas surrounded by sagebrush cover). Nesting and early brood rearing in Nevada usually occurs during April through June in habitat with nearby sagebrush cover and an abundance of grass and forbs to provide nutrition for chicks. After about 6 weeks, hens move chicks to summer habitat for the remaining brood rearing. Summer habitat for this species is characterized by mixed sagebrush with wet meadows and riparian habitat (DIRS 173575-Nevada Department of Wildlife 2004, Appendix E, pp. 2 and 3). The 2004 Conservation Assessment for *The Greater Sage-Grouse Management Plan for Nevada and Eastern California* shows the largest populations of sage-grouse to inhabit most of Elko county and portions of Washoe, White Pine, Humboldt, Lincoln, and Nye Counties (of these, the proposed Caliente rail alignment would pass through Lincoln and Nye Counties). Documented lek sites in Nye County are concentrated in the north-central portion of the county, outside the study area. However, there is suitable winter, year-round, and nesting habitat along Caliente common segment 3 outside of the construction right-of-way. There is suitable winter habitat within the construction right-of-way of all Garden Valley alternative segments and within the northern portion of Caliente common segment 1 and a portion of the Caliente common segment 3 construction right-of-way (Figure 3-100). There are documented lek sites within the construction right-of-way of Garden Valley alternative segment 3 (DIRS 173575-Nevada Department of Wildlife 2004, p. 12). No greater sage-grouse or sage-grouse leks were observed in the construction right-of-way during the field surveys of the Caliente rail alignment in the spring of 2005. Appendix H provides additional information on the greater sage-grouse surveys.

Bald eagles almost exclusively occupy habitat associated with large bodies of water during the breeding season, but occasionally use upland areas for food and roost sites. They usually nest in tall trees and feed opportunistically on fish, waterfowl and seabirds, various mammals, and carrion. In the winter, bald eagles preferentially roost in large, shelter-providing trees (DIRS 180967-NatureServe Explorer [n.d.], all). There is no nesting habitat for the bald eagle within the Caliente rail alignment study area. The marsh habitat in Indian Cove and Meadow Valley Wash provides potential foraging habitat for migrating eagles. However, the waterbodies are small and not used by enough fish and waterfowl to support wintering eagles. Any use of the study area by bald eagles would be transitory.

Ferruginous hawks have been reported to occupy and, in some cases, nest in areas adjacent to the Caliente rail alignment (DIRS 174519-Bennett 2005, all). The ferruginous hawk is a relatively rare breeding species in the study area. This species prefers to nest in trees; however, in Nevada tall trees are scarce, so the species is often found in pinyon-juniper associations or occasionally on shrubs or rocks on the ground. No ferruginous hawks or nests were observed during the 2005 field surveys, although they have been previously reported in the area.

Peregrine falcons are found in a wide variety of habitats during the breeding season, from tundra, moorlands, steppe, and seacoasts to mountains, open-forested regions, and human population centers. They typically nest on rocky cliffs. Outside the breeding season, the falcons occur in areas where prey (primarily birds) concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports (DIRS 180966-NatureServe Explorer 2007, all). There is potential nesting habitat for peregrine falcons on cliffs within the Clover Creek area and near the City of Caliente.

Loggerhead shrikes have been documented along the Caliente rail alignment where suitable habitat is present. Habitat used by this species during the breeding season includes open country with scattered trees and shrubs, savanna, desert scrub (southwestern United States) and, occasionally, open woodlands (DIRS 180963-NatureServe Explorer 2007, all). They typically nest in thick brush, shrubs, or small trees in open areas. Potentially suitable habitat for loggerhead shrikes occurs along all segments of the Caliente alignment.

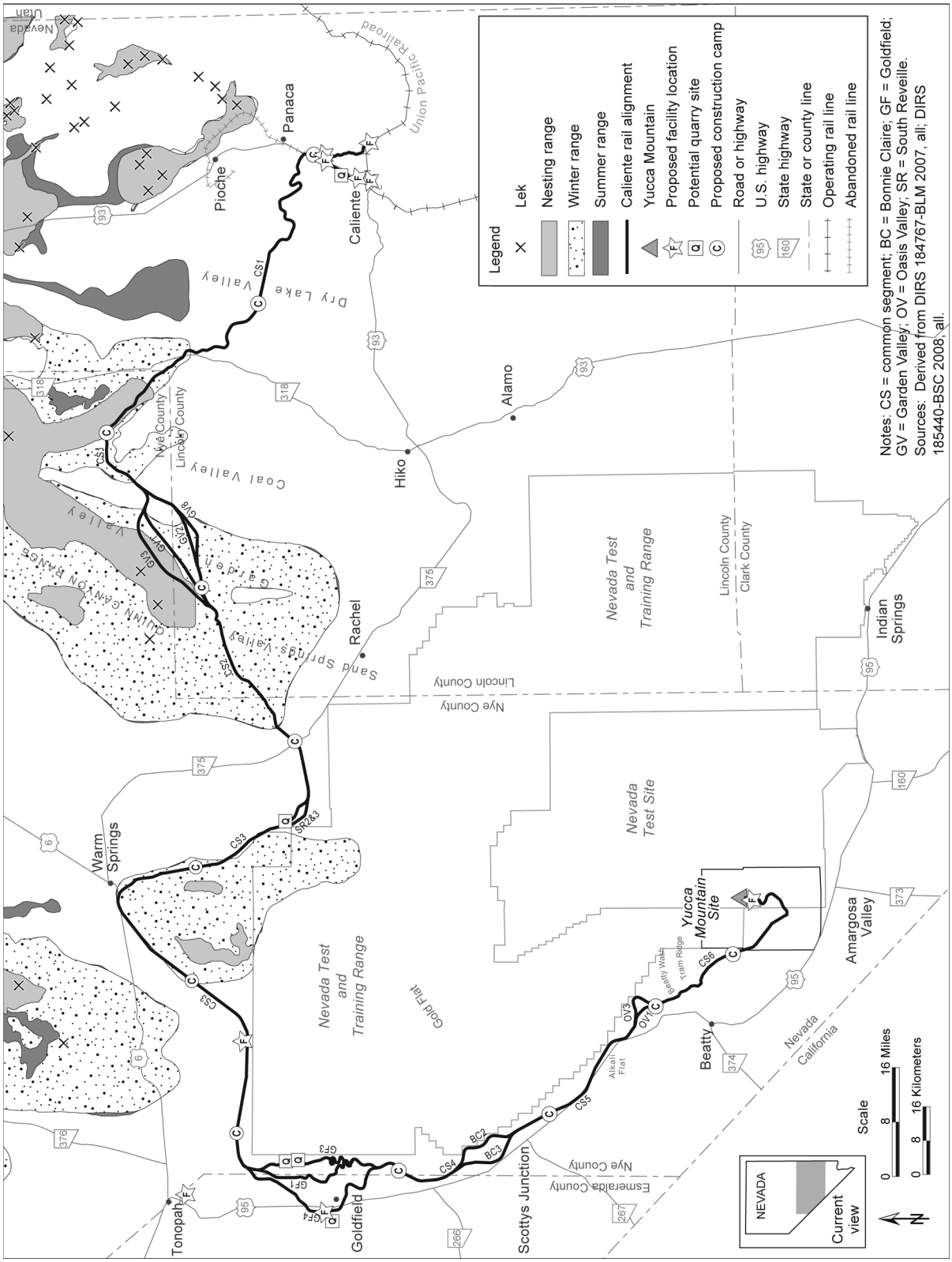


Figure 3-100. Potential greater sage-grouse habitat along the Caliente rail alignment.

Sage thrashers are known to occur in sagebrush habitat within the Caliente rail alignment construction right-of-way. During field surveys in May 2005, an individual was sighted near Pahroc Pass within the common segment 1 study area in the Highland Range. Habitat for this bird species is associated with large stands of sagebrush habitat, which can be found in areas where the rail alignment would cross mountain ranges, including the Highland, Reveille, and Kawich Ranges. There is potential sagebrush habitat near Bennett Pass, Pahroc Pass, the western and southern portions of Garden Valley, western Sand Spring Valley, southeastern Railroad Valley, and at Warm Springs Summit.

Brewer's sparrows are strongly associated with sagebrush over most of their range, in areas with scattered shrubs and short grass (DIRS 180959-NatureServe Explorer 2007, all). Sagebrush habitat can be found in areas where the rail alignment would cross mountain ranges, including the Highland, Reveille, and Kawich Ranges. There is potential sagebrush habitat near Bennett Pass, Pahroc Pass, the western and southern portions of Garden Valley, western Sand Spring Valley, southeastern Railroad Valley, and at Warm Springs Summit. Brewer's sparrows are likely to occur in sagebrush habitat within the Caliente rail alignment construction right-of-way.

Mammals The State of Nevada classifies desert bighorn sheep as a game species. As further discussed in Section 3.2.7.3.5, the State of Nevada manages the desert bighorn sheep as a game species throughout the state.

The pygmy rabbit (*Brachylagus idahoensis*), a small sagebrush-dependent rabbit, has been documented 7.5 kilometers (4.6 miles) northwest of Garden Valley alternative segment 3 (DIRS 174519-Bennett 2005, Plate 3). This species is well-distributed throughout the Great Basin; however, overall the populations tend to be locally clustered in areas of high-density sagebrush, which they use for both cover and food. DOE field surveys did not indicate the presence of pygmy rabbit habitat within the Caliente rail alignment construction right-of-way.

The dark kangaroo mouse and the closely related pale kangaroo mouse are known to occur in appropriate habitat from the Dry Lake Valley to Goldfield (DIRS 174519-Bennett 2005, all). Habitat for these two mouse species is characterized by alkali (salt) sinks and desert scrub dominated by shadscale or big sagebrush. These rodents usually prefer soft sand accumulated at bases of shrubs for burrow sites (DIRS 176370-O'Farrell and Blaustein 1974, pp. 1 and 2; DIRS 176372-O'Farrell and Blaustein 1974, p. 1).

There are 23 species of bats in Nevada. In general, bats are highly mobile; all of the 23 species could at some time of the year fly over or, if appropriate habitat exists, roost and forage near the Caliente rail alignment. Twenty-one of the 23 species of bats in Nevada are BLM-designated sensitive (DIRS 172900-BLM 2003, p. 2) and nine are State of Nevada protected.

Of these bat species, seven have a strong probability of utilizing habitat along the rail alignment (DIRS 181865-Bradley et al. 2006, all), as follows:

- Pallid bat
- Townsend's big-eared bat
- Big brown bat
- California myotis bat
- Small-footed myotis bat
- Western pipistrelle bat
- Brazilian free-tailed bat

All of these bat species are commonly found throughout the Mojave and southern Great Basin Deserts. These species are known to roost in cliff faces, caves, rocky outcrops, and man-made structures where available. Bats are also known to forage over natural or artificial water sources.

3.2.7.3.4 Migratory Birds

More than 300 species of birds are commonly observed in southern Nevada, including year-round residents, seasonal migrants that breed in southern Nevada, winter residents that breed in the north, and seasonal migrants that pass through southern Nevada while traveling in spring and fall between breeding ranges to the north and winter ranges to the south. All of the migratory birds found along the Caliente rail alignment are protected under the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq*.) and Executive Order 13186.

3.2.7.3.5 State of Nevada Game Species

The Caliente rail alignment would cross several areas designated as game habitat (DIRS 173224-BLM 1997, Maps 9 to 13; DIRS 174518-BLM 2005, Maps 3.6-1 to 3.6-4). As shown in Table 3-53, three game species that occur, or have the potential to occur, within or near the construction right-of-way are cross-listed as BLM-designated sensitive, are state protected, or both. The game species that are also BLM-designated sensitive include greater sage-grouse, pygmy rabbit, and desert bighorn sheep. Section 3.2.7.3.3.2 provides information on the greater sage-grouse and pygmy rabbit. The Nevada Department of Wildlife actively manages the desert bighorn sheep as a big game animal. Its distribution is shown on Figure 3-101. Other game species that could be affected by the proposed railroad construction and operations include mule deer, pronghorn antelope, elk, and mountain lion. Figures 3-101 to 3-104 indicate the general habitat locations for desert bighorn sheep, mule deer, pronghorn antelope, and elk. Mountain lions occur throughout the State of Nevada in canyon, mountain, and forested areas; therefore, no distribution map is included for this species. Sections 3.2.7.3.5.1 through 3.2.7.3.5.5 summarize game species information.

3.2.7.3.5.1 Desert Bighorn Sheep. Desert bighorn sheep are found predominantly in lower foothills and grasslands of mountain ranges, often where terrain is rough, rocky and steep, and broken up by canyons and washes. Desert bighorn sheep require access to freestanding water, especially during the summer, and distribution of water holes significantly influences patterns of home-range movement (DIRS 176363-Shackleton 1985, p. 4). Any natural or artificial water sources within this species' range could be subject to desert bighorn sheep use. Caliente common segment 1 would cross year-round desert bighorn sheep habitat near the Pahroc Range, and common segment 6 would cross a ***movement corridor***, or an area of high use at certain times of the year, in the Beatty Wash area (Figure 3-101). The Caliente rail alignment would not cross any crucial habitat for this species. However, there is "yearlong unoccupied" habitat in the Golden Gate Range within the greater study area.

3.2.7.3.5.2 Mule Deer. Mule deer are fairly common in southern Nevada and throughout the western United States, and are found in a variety of habitats from coniferous forests at high elevations to desert shrub, chaparral, and grasslands at lower elevations (DIRS 176454-Whitaker 1992, p. 652). Mule deer are often associated with early transitional vegetation, especially near agricultural lands. Mule deer are found throughout the area the Caliente rail alignment would cross, but would most likely be encountered in the segments from Caliente eastward. Caliente common segment 1 would pass through year-round mule deer habitat in the Chief Range and Pahroc Range and a small amount of crucial habitat just east of Dry Lake Valley. The central portion of the alignment through Coal Valley and Sand Springs Valley would cross crucial and winter habitat. The western portion of Caliente common segment 1, the Garden Valley alternative segments, much of Caliente common segment 2, and Caliente common segment 3 at the Warm Springs Summit would cross mule deer winter habitat. Figure 3-102 details habitat for mule deer.

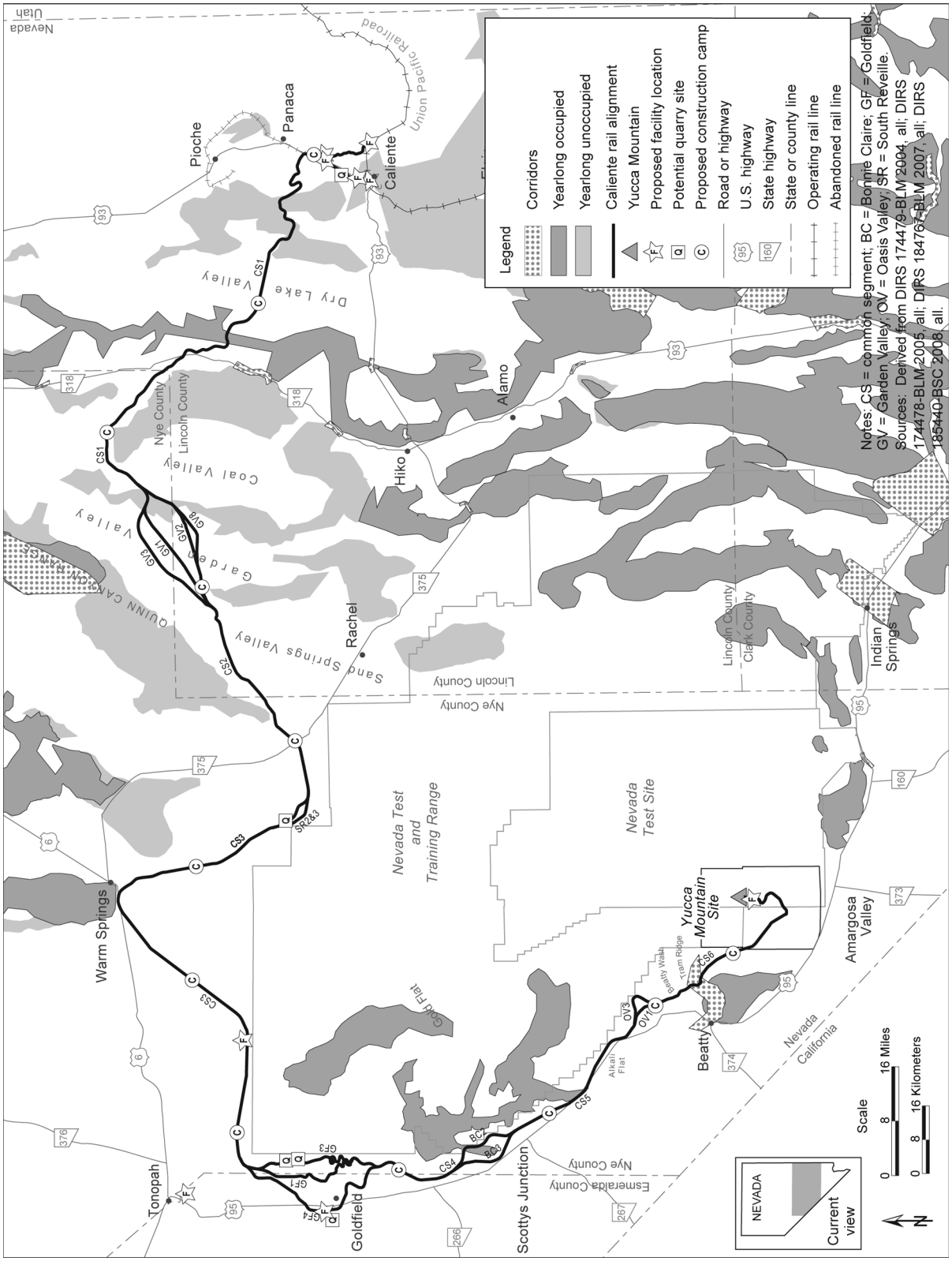


Figure 3-101. Desert bighorn sheep habitat along the Caliente rail alignment.

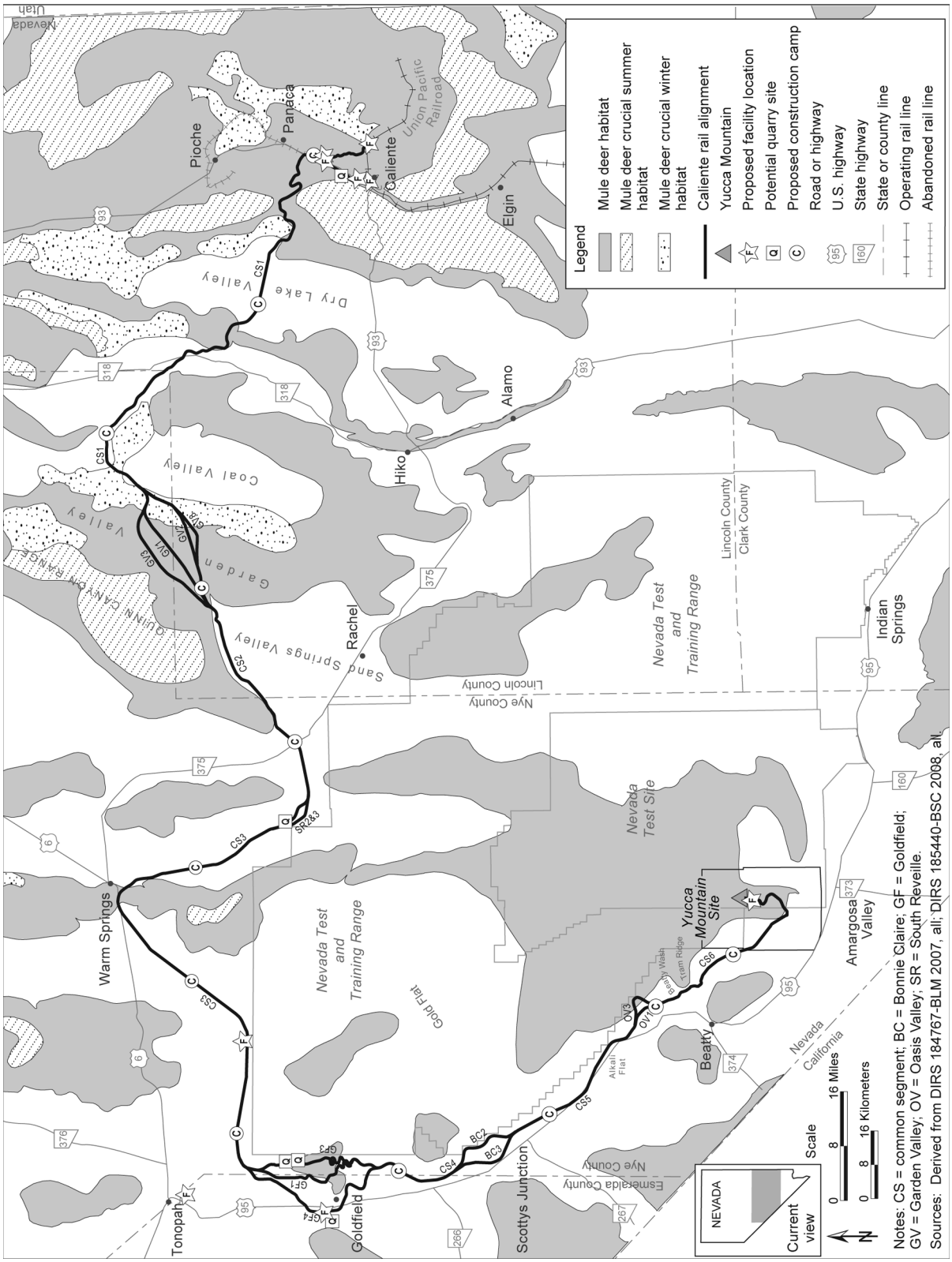


Figure 3-102. Mule deer habitat along the Caliente rail alignment.

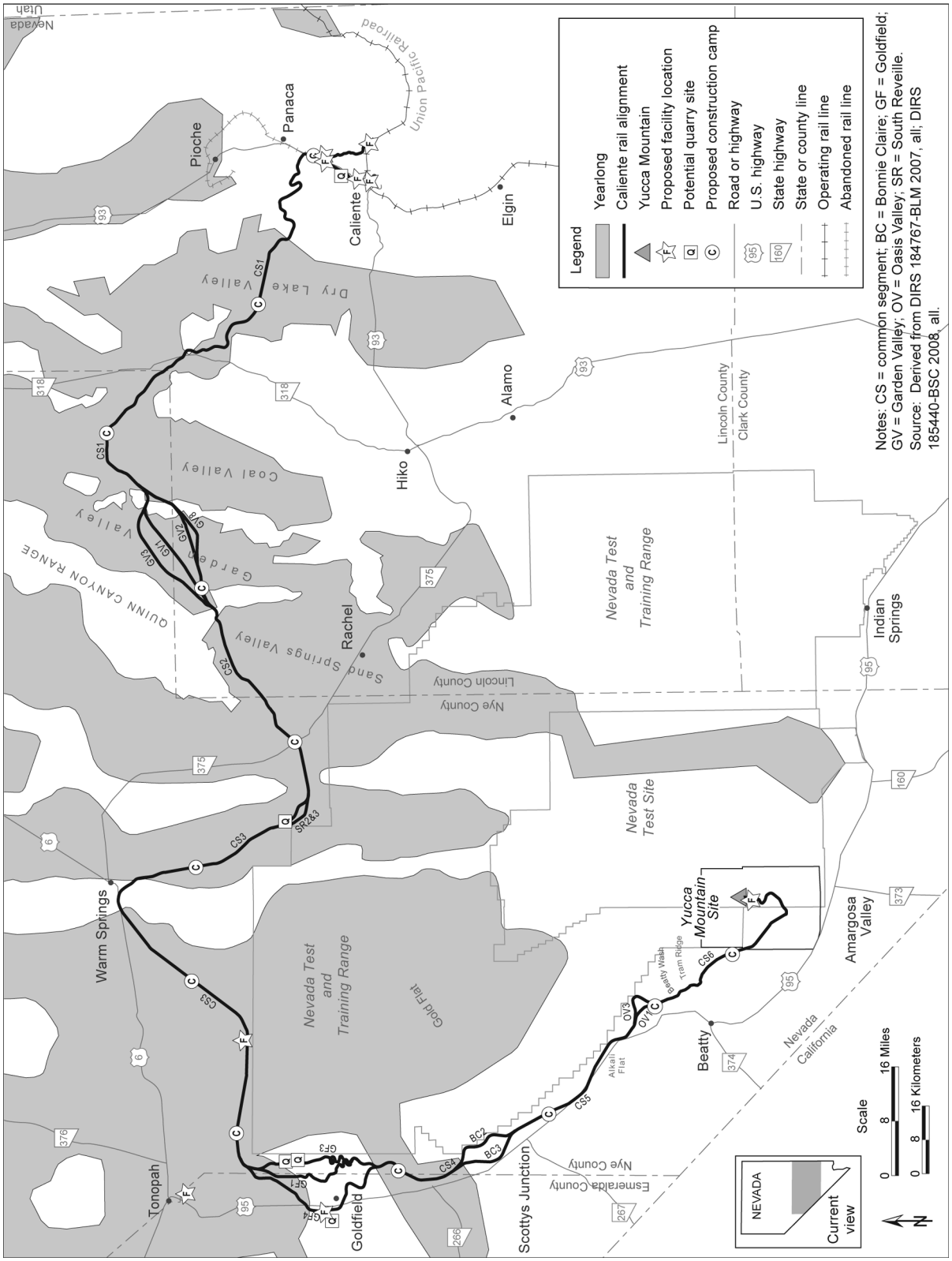


Figure 3-103. Pronghorn antelope habitat along the Caliente rail alignment.

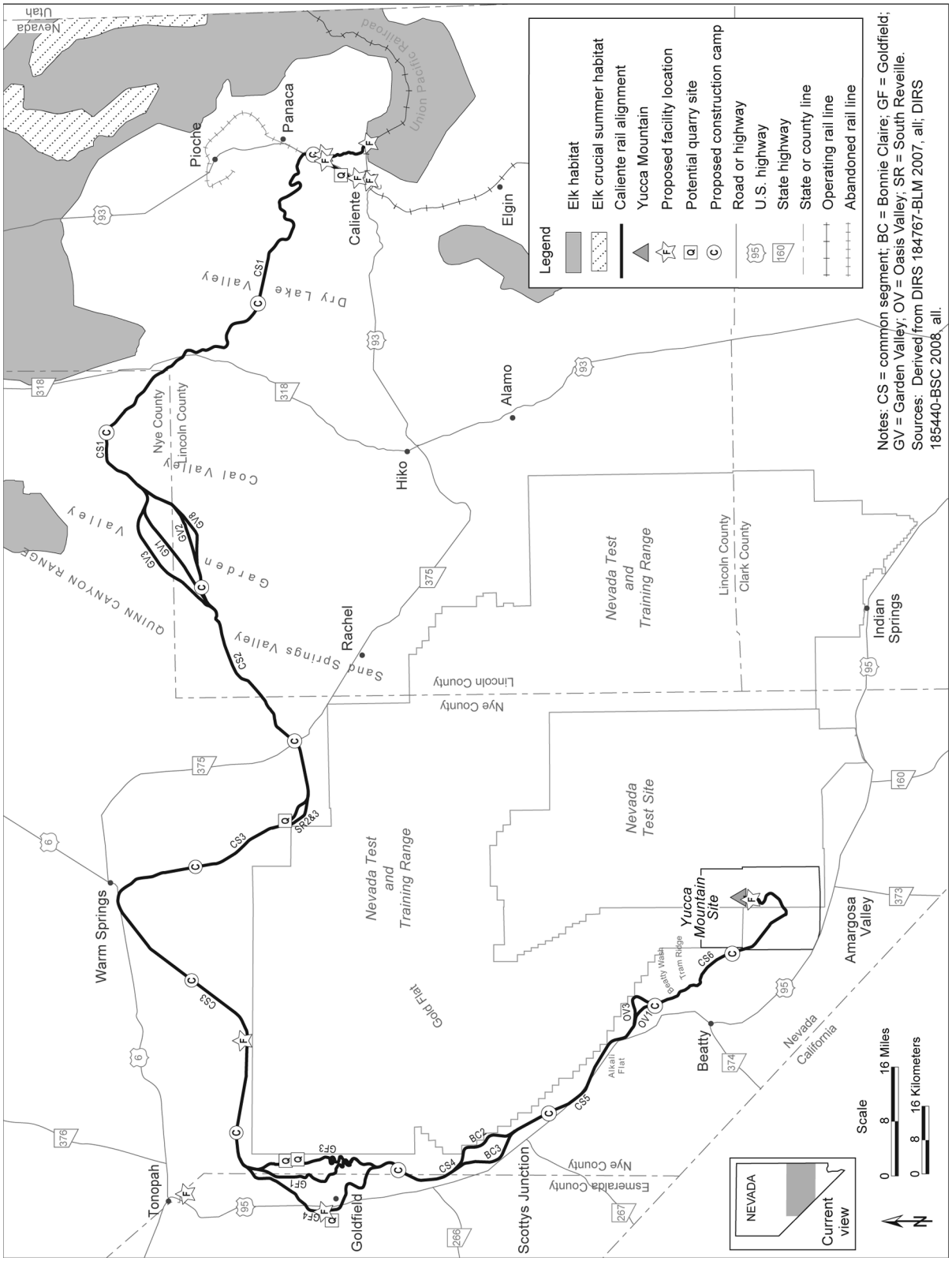


Figure 3-104. Elk habitat along the Caliente rail alignment.

3.2.7.3.5.3 Pronghorn Antelope. Most of the Caliente rail alignment would cross year-round pronghorn antelope habitat from Dry Lake Valley west to Goldfield (Figure 3-103). Pronghorn antelope are generally found at lower elevations in open desert grasslands, salt desert scrub, or bunchgrass-sagebrush vegetation in the valleys and foothills throughout the western United States. This species also occurs in dense sagebrush communities at higher elevations during the breeding season (DIRS 176454-Whitaker 1992, pp. 662 and 663). The Nevada Department of Wildlife has not identified any areas along the Caliente rail alignment as pronghorn antelope augmentation areas.

3.2.7.3.5.4 Elk. The Ely Proposed Resource Management Plan describes elk winter and yearlong habitat along portions of the Caliente rail alignment from Garden Valley and the Quinn Canyon Mountain Range eastward. Elk habitat is usually composed of moderate- to low-density conifer woodlands and open mountain grasslands (Figure 3-104). This species is migratory, moving to lower elevations with dense wooded slopes during the winter (DIRS 176454-Whitaker 1992, pp. 647 to 650).

3.2.7.3.5.5 Mountain Lion. Mountain lions occur throughout the State of Nevada in low numbers in canyon, mountainous, and forested areas (DIRS 103439-Hall 1995, pp. 269 to 271). They are known to occur within the study area and might move along the Caliente rail alignment construction right-of-way. This species is shy, solitary, secretive, and active mostly at night (DIRS 103439-Hall 1995, pp. 269 to 271).

3.2.7.3.6 Wild Horses and Burros

Wild horses are generally presumed to descend from horses that were released by, or escaped from, settlers of western North America, possibly dating as far back as Spanish settlers in the 1600s. The size, color, and confirmation of the horses depend on the type of stock or breed from which the wild horses descended (DIRS 174518-BLM 2005, p. 3.8-1).

Generally, burros live in the lower elevations year-round, while wild horses reside in the higher elevations in summer and migrate to the lower elevations in winter. Both wild horses and burros will travel as far as 16 kilometers (10 miles) away from permanent water sources. Their diets vary–burros prefer shrubs, horses tend to prefer grasses (DIRS 103079-BLM 1998, p. 3-48).

Wild horse herd areas were originally identified by federal agencies in 1971 with passage of Public Law 92-195, the Wild Free-Roaming Horses and Burros Act. The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros the BLM has determined the herd management area can support, and it is established to avoid the ecological degradation of the herd management area and any riparian areas within each herd management area (DIRS 176364-Department of Conservation & Natural Resources [n.d.], all).

The Caliente rail alignment would cross approximately 13 designated wild horse and burro herd management areas (Figure 3-105). Appendix H provides detailed information on the individual herd management areas. Table 3-54 identifies each Caliente rail alignment alternative segment and common segment that would cross or lie within herd management areas and describes the location, size, and management level of each herd management area.

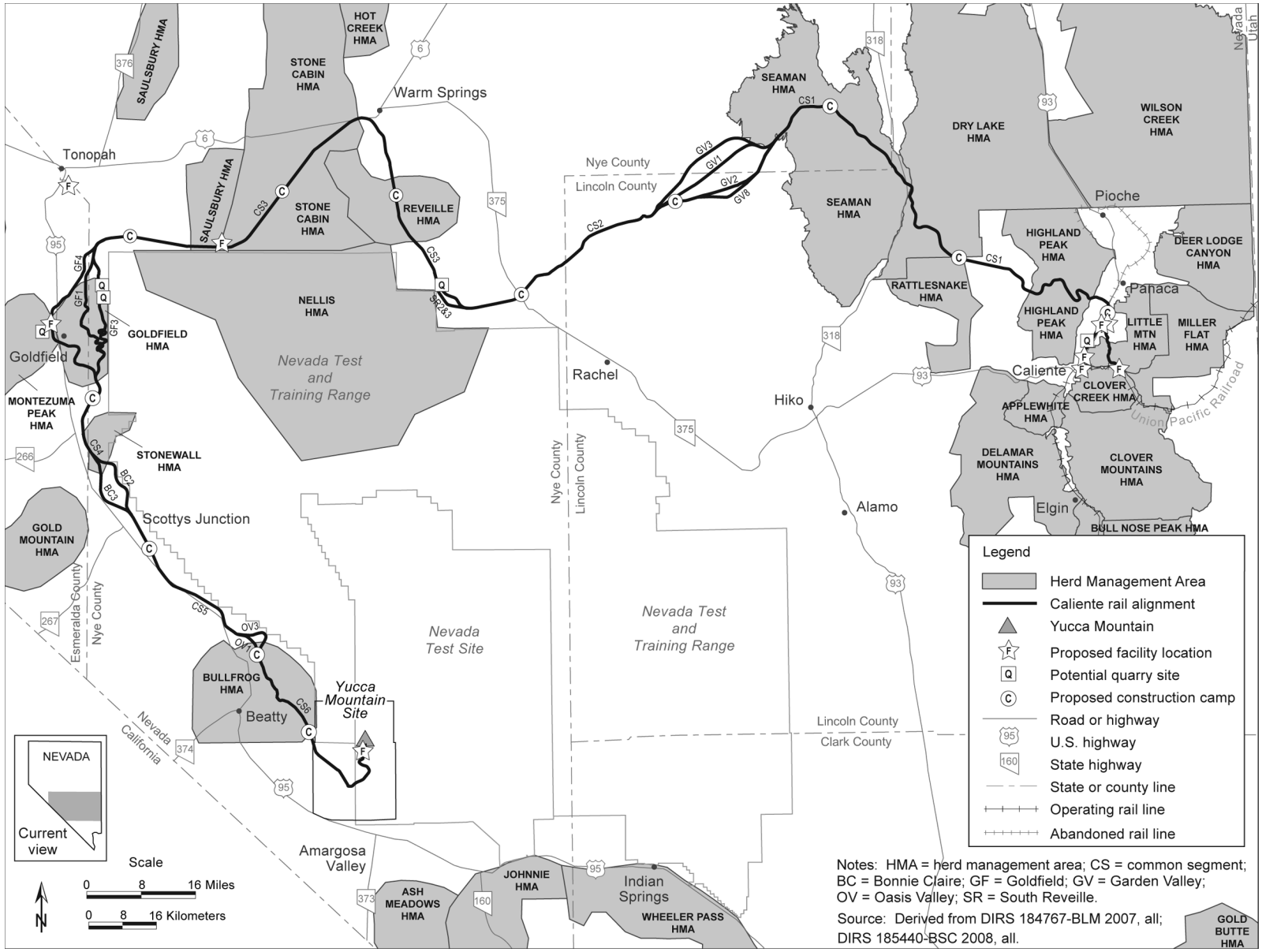


Figure 3-105. Herd management areas along the Caliente rail alignment.

Table 3-54. Herd management areas the Caliente rail alignment would cross.[a]

Herd management area	Location[b]	Area (acres)[c]	Appropriate management level	Alternative segment or common segment that would cross area
Miller Flat	Lincoln County, northeast of Caliente	92,000	9 to 15 horses	Caliente and Eccles alternative segments
Little Mountain	Lincoln County, northeast of Caliente	53,000	9 to 15 horses	Caliente and Eccles alternative segments
Highland Peak	West of Panaca	140,000	20 to 33 horses	Caliente common segment 1
Rattlesnake	16.8 miles west of Caliente	71,000	1 horse	Caliente common segment 1
Dry Lake	West of Pioche	490,000	94 horses	Caliente common segment 1
Seaman	34.8 miles south of Lund	360,000	159 horses	Caliente common segment 1; Garden Valley alternative segments 1, 2, and 3
Reveille	49.7 miles east of Tonopah and 11.8 miles south of Warm Springs	130,000	138 horses	Caliente common segment 3
Stone Cabin	28 miles east of Tonopah	400,000	364 horses	Caliente common segment 3
Saulsbury	16.2 miles east of Tonopah	140,000	40 horses	Caliente common segment 3
Goldfield	East of Goldfield	64,000	125 horses 50 burros	Goldfield alternative segments 1, 2, and 3
Montezuma Peak	West of Goldfield	76,000	146 horses 10 burros	Goldfield alternative segment 4
Stonewall	West of Lida Junction and south of Goldfield	25,000	50 horses 25 burros	Caliente common segment 4; Bonnie Claire alternative segments 2 and 3
Bullfrog	Surrounds Beatty	130,000	12 horses 185 burros	Oasis Valley alternative segments 1 and 3; common segment 6

a. Sources: DIRS 174047-Bennett 2005, all; DIRS 174046-Bennett 2005, all; DIRS 174479-BLM 2003, all; DIRS 174478-BLM 2005, all; DIRS 174329-BLM [n.d.], all; DIRS 174333-BLM [n.d.], all; DIRS 174332-BLM [n.d.], all; DIRS 174330-BLM [n.d.], all; DIRS 173064-BLM 2007, all; DIRS 173063-BLM [n.d.], all; DIRS 173062-BLM [n.d.], all; DIRS 173061-BLM [n.d.], all; DIRS 173060-BLM [n.d.], all; DIRS 173059-BLM [n.d.], all; DIRS 173057-BLM [n.d.], all; DIRS 174518-BLM 2005, all.
b. To convert miles to kilometers, multiply by 1.6093.
c. To convert acres to square kilometers, multiply by 0.0040469.

3.2.8 NOISE AND VIBRATION

This section describes existing noise and vibration in the Caliente rail alignment region of influence. Section 3.2.8.1 describes the region of influence; Section 3.2.8.2 describes general regional characteristics for noise and vibration; and Section 3.2.8.3 describes the existing environment for noise and vibration in more detail for Caliente rail alignment alternative segments and common segments.

Noise is considered a source of pollution because it can be a human health hazard. Noise effects on people range from hearing impairment at very high noise levels to annoyance at moderate to high noise levels. Sound waves are characterized by frequency and measured in ***hertz***; sound pressure is expressed as ***decibels*** (dB). Appendix I, Noise and Vibration Assessment Methodology, provides more information on the fundamentals of analyzing noise.

With the exception of prohibiting nuisance noise, neither the State of Nevada nor local governments have established numerical noise standards. Nevertheless, many federal agencies use the ***day-night average noise level*** (DNL) as a guideline for land-use compatibility and to assess the impacts of noise on humans.

For the operation of trains during proposed railroad construction and operations, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 ***A-weighted decibels*** (dBA) or more.
- An increase to a noise level of 65 DNL or greater.

Day-night average noise level (DNL): The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

If the estimated noise level increase at a location exceeds either of these criteria, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, recent noise evaluations indicate that both criteria components must be met to cause an adverse impact from noise (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more to cause an adverse impact.

There are three potential ground-borne vibration (vibration propagating through the ground) impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. To evaluate potential impacts of vibration from construction and operations activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded human annoyance criterion for infrequent events 80 VdB (vibration velocity in decibels) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inches per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be an impact from vibration (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

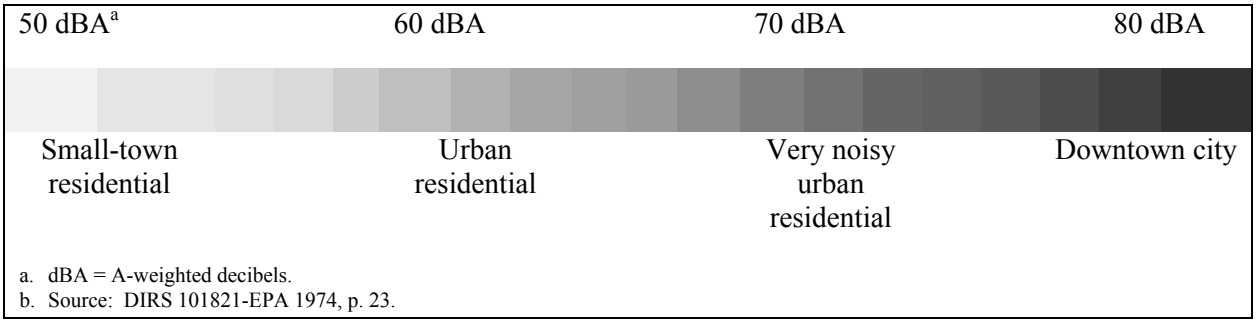
3.2.8.1 Region of Influence

Ambient noise: The sum of all noise (manmade and natural) at a specific location over a specific time is called ambient noise.

The region of influence for noise and vibration for construction and operation of a railroad along the Caliente rail alignment includes the construction right-of-way and extends out to variable distances, depending on several analytical factors (ambient noise level, train speed, number of trains per day, and number of railcars). Similarly, the region of influence for the railroad construction and operations support facilities depends on the magnitude of noise that would be generated and ambient noise levels, which would affect how far away the noise might be heard. In areas with low ambient noise conditions along the proposed rail alignment, project-related noise might be heard farther away. Therefore, the region of influence varies along the rail alignment. In addition, DOE has reviewed recent aerial photographs along the entire rail alignment to identify the locations of receptors in the region of influence that might be affected by noise, vibration, or both.

3.2.8.2 General Regional Characteristics for Noise and Vibration

The Caliente rail alignment is primarily in a quiet desert environment where natural phenomena such as wind, rain, and wildlife account for most of the ambient noise. Manmade noise in some areas of the region of influence is caused by vehicles traveling along public highways and an occasional low-flying military jet. At present, there is no train activity in the region of influence except in the City of Caliente. Historically, there was train activity in Goldfield, Nevada. Baseline sound conditions vary somewhat along the rail alignment and are site-specific. Most of the region of influence for the Caliente rail alignment is typical of other desert environments in which the DNL values range from 22 decibels on a calm day to 38 decibels on a windy day (DIRS 102224-Brattstrom and Bondello 1983, p. 170). Areas within the region of influence are sparsely populated and, in general, ambient noise levels are low. The noise level at a specific location depends on nearby and distant sources of noise. Noise levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation noise (Figure 3-106).



a. dBA = A-weighted decibels.
b. Source: DIRS 101821-EPA 1974, p. 23.

Figure 3-106. Typical DNLs for residential areas.[b]

Ground-borne vibration occurs as a result of both natural phenomena (such as seismic activity) and manmade activities (such as construction and transportation activities). Human activities that can create perceptible levels of ground-borne vibration are important when sensitive sites, structures, or activities could be affected. Background vibration exists as a component of the overall effects of ground-borne vibration, higher in areas with more human activity, lower in areas more distant from human activities. Vibration levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation vibration. Background levels of ground-borne vibration along the Caliente rail alignment are low.

3.2.8.3 Existing Environments for Noise and Vibration at Three Measurement Locations along the Caliente Rail Alignment

DOE evaluated existing noise and vibration conditions along the Caliente rail alignment and compiled the detected ranges of noise and vibration levels at different locations under different conditions. Most of the region of influence for the rail alignment is sparsely populated and, in general, ambient noise levels are low and there are no detectable vibrations. DOE measured ambient noise and vibration levels at three locations along the proposed rail alignment: in Caliente, in Garden Valley near *City* (a large complex of abstract sculptural and architectural forms made from earth, rock, and concrete), and in Goldfield. DOE selected these locations for ambient noise and vibration measurements because they are representative of the few populated areas or Special Recreational Management Areas within the region of influence. The ambient noise measurements at these representative locations along the rail alignment ranged from 47 to 62 DNL (Table 3-55) and ambient vibration levels ranged from 25 to 44 VdB (Table 3-56).

Table 3-55. Ambient noise measurements along the Caliente rail alignment.

Location	DNL dBA[a]
Caliente	53[b]
Garden Valley	62[c]
Goldfield	47[d]

a. DNL dBA = day-night average noise level in A-weighted decibels.
b. DNL measurements were taken on January 11, 2005 (with a result of 54 DNL), and February 9, 2005 (with a result of 53 DNL). To be conservative, DOE selected the lowest value because the relative difference between project noise levels and ambient noise levels could influence the potential impact.
c. DNL measurements were taken in Garden Valley on February 9, 2005.
d. DNL measurements were taken in Goldfield on January 12, 2005.

Table 3-56. Ambient vibration measurements along the Caliente rail alignment.

Location	VdB[a]
Caliente	44[b]
Garden Valley	29[c]
Goldfield	25[d]

a. VdB = vibration velocity in decibels with respect to 1 micro-inch per second.
b. Vibration measurements were taken in Caliente on January 11, 2005.
c. Vibration measurements were taken in Garden Valley on February 9, 2005.
d. Vibration measurements were taken in Goldfield on January 12, 2005.

3.2.8.3.1 Caliente

DOE took noise measurements for 24-hour periods in Caliente, Nevada, on January 11, 2005, and on February 9, 2005. The measurements were repeated on February 9 because there was a major flood in the area during the January 11 measurements, which could have affected measurement results. Train activity was halted during that period, and there was substantial helicopter activity associated with flood-relief efforts. However, the DNL did not vary much between the two sets of measurements. On January 11 the noise level was 54 DNL; on February 9 it was 53 DNL (see Table 3-55). Measured DNL noise levels at Caliente are consistent with the "small-town residential" category shown on Figure 3-106.

Hourly ***equivalent sound levels*** ranged from 32 to 62 dBA. Noise sources consisted of vehicular traffic on U.S. Highway 93, train horns, noise from nearby residential areas, and aircraft overflights. Figure 3-107 shows measured noise levels taken at the Agua Caliente Trailer Park over a 24-hour period. Figure 3-108 shows the location where DOE took the ambient noise measurements in Caliente.

Equivalent sound level (Leq): A single value of sound level for any desired duration (such as 1 hour), which includes all of the time-varying sound energy in the measurement period. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant.

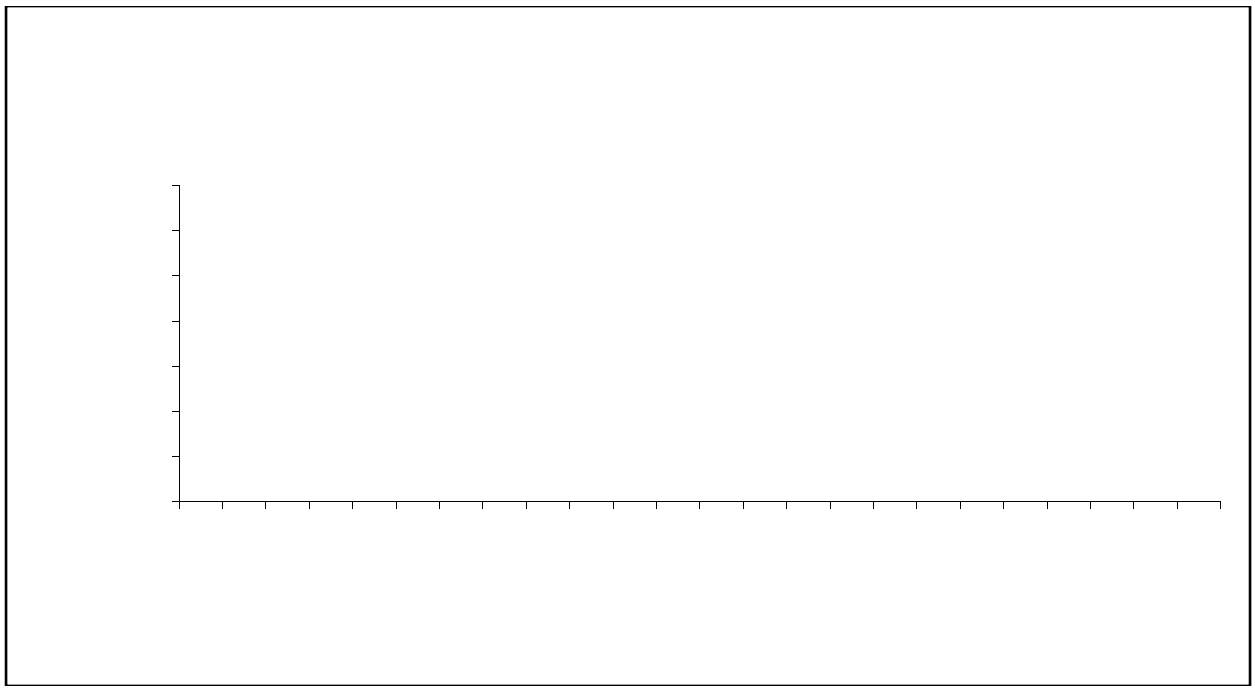


Figure 3-107. Measured noise levels over a 24-hour period in Caliente, Nevada.

Figure 3-109 shows modeled noise levels (65 DNL contour) for Union Pacific Railroad train activity in Caliente based on an average of 25 trains per day consisting of 2 locomotives and 60 railcars, and an operating speed of 64 kilometers (40 miles) per hour. The jagged shape and islands within the contour are caused by the shielding effects of buildings close to the grade crossing at South Spring Street.

DOE also took ambient ground-borne vibration measurements at the Agua Caliente Trailer Park on January 11, 2005. The vibration measurement was 44 VdB (see Table 3-56). Measured ambient vibration levels were low because of low population density and the resulting lack of vibration-producing activity. Ambient vibration levels of this magnitude are lower than human perception levels.

3.2.8.3.2 Garden Valley

DOE took noise measurements for 24 hours on February 9, 2005, near *City* in Garden Valley. Hourly equivalent sound level values ranged from 15 to 65 dBA, as shown on Figure 3-110. Figure 3-111 shows where DOE took the ambient noise measurements in Garden Valley. Two sonic booms from nearby U.S. Air Force jet activity or some other very loud noise source occurred during the measurements,

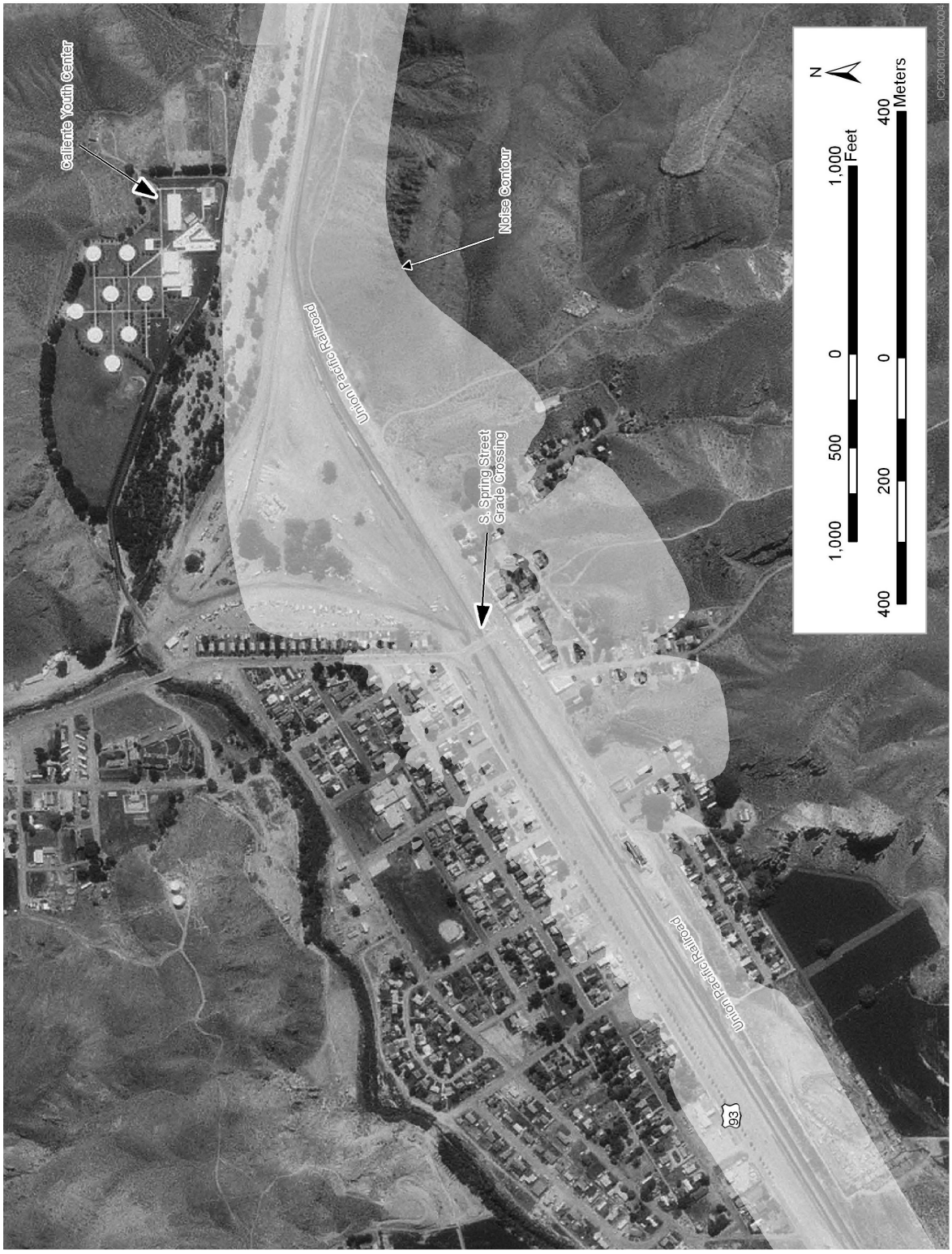


Figure 3-108. Ambient noise monitoring location at Agua Caliente Trailer Park, Caliente, Nevada.
(Source: Base map derived from DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

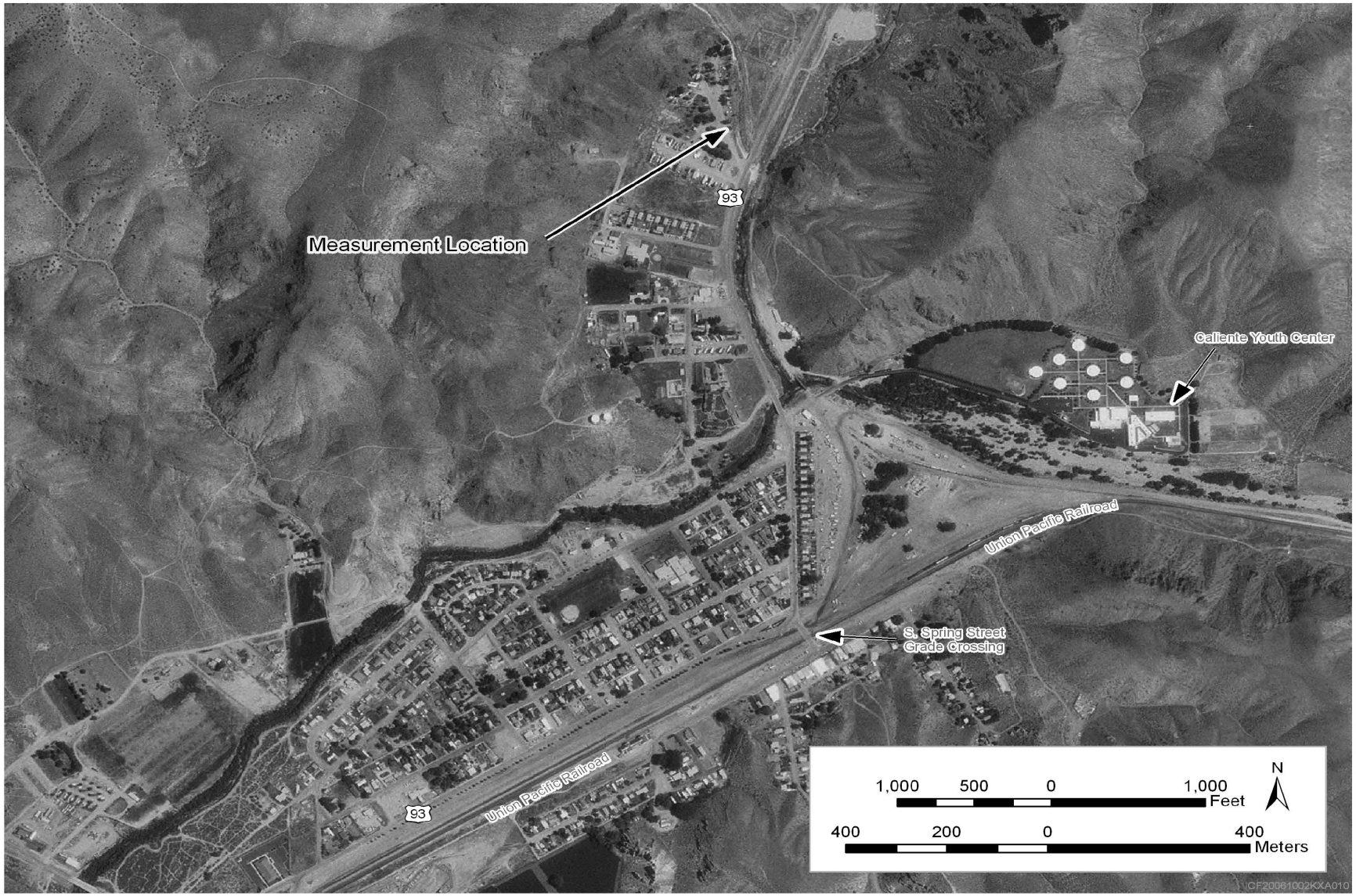


Figure 3-109. Union Pacific Railroad existing train activity in Caliente, Nevada, 65-decibel day-night average noise level contour.
(Source: Basemap derived from DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

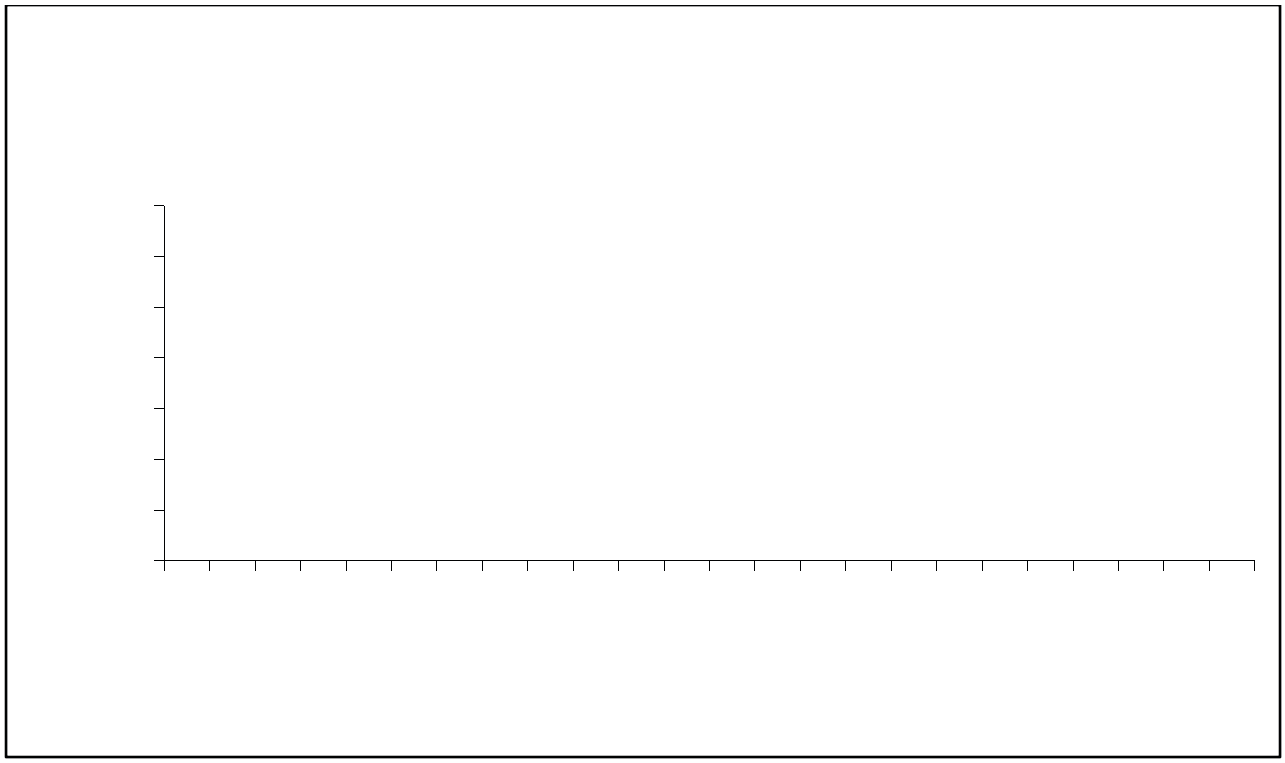


Figure 3-110. Measured noise levels over a 24-hour period in Garden Valley.

which resulted in two hourly equivalent noise level values of 65 dBA. Including these two loud noise events in the ambient noise results gives a noise level of 62 DNL (see Table 3-55). Excluding these two events, the noise level would have been 41 DNL. Measured noise levels at Garden Valley, excluding the two loud noise events, are consistent with the "small-town residential" category shown on Figure 3-106. Measured noise levels at Garden Valley, including the two loud noise events, are consistent with the "urban residential" category shown on Figure 3-106.

Noise levels varied dramatically at the Garden Valley location, from near the threshold of hearing to much higher levels. Military aircraft activity appears to be the cause of the high noise levels. While at this location, field personnel observed a substantial amount of military jet aircraft activity, some of which resulted in very high noise levels. U.S. Air Force noise data indicate that long-term noise levels associated with subsonic aircraft activity in this area range from 55 to 60 DNL (DIRS 174499-Frampton, Lucas, and Plotkin 1993, all). A separate U.S. Air Force report indicates that this Garden Valley location is within an area authorized for supersonic military training exercises to altitudes as low as 1,500 meters (5,000 feet) (DIRS 176798-Varnell et al. 1994, p. 2-5).

The measured DNL values confirm that ambient noise levels are high in this location. Noise sources consist of military aircraft and commercial aircraft. During the measurements, there were extended periods when there was no audible noise. Some construction equipment was operating at *City* during the measurements, but the noise monitor was sufficiently far away that the equipment had no effect on the measured noise level.

DOE also took ambient ground-borne vibration measurements at *City* on February 9, 2005. The vibration measurement was 29 VdB (see Table 3-56). Measured ambient vibration levels were low because of low population density and the resulting lack of activity that would produce vibration. Ambient vibration levels of this magnitude are lower than human perception levels.

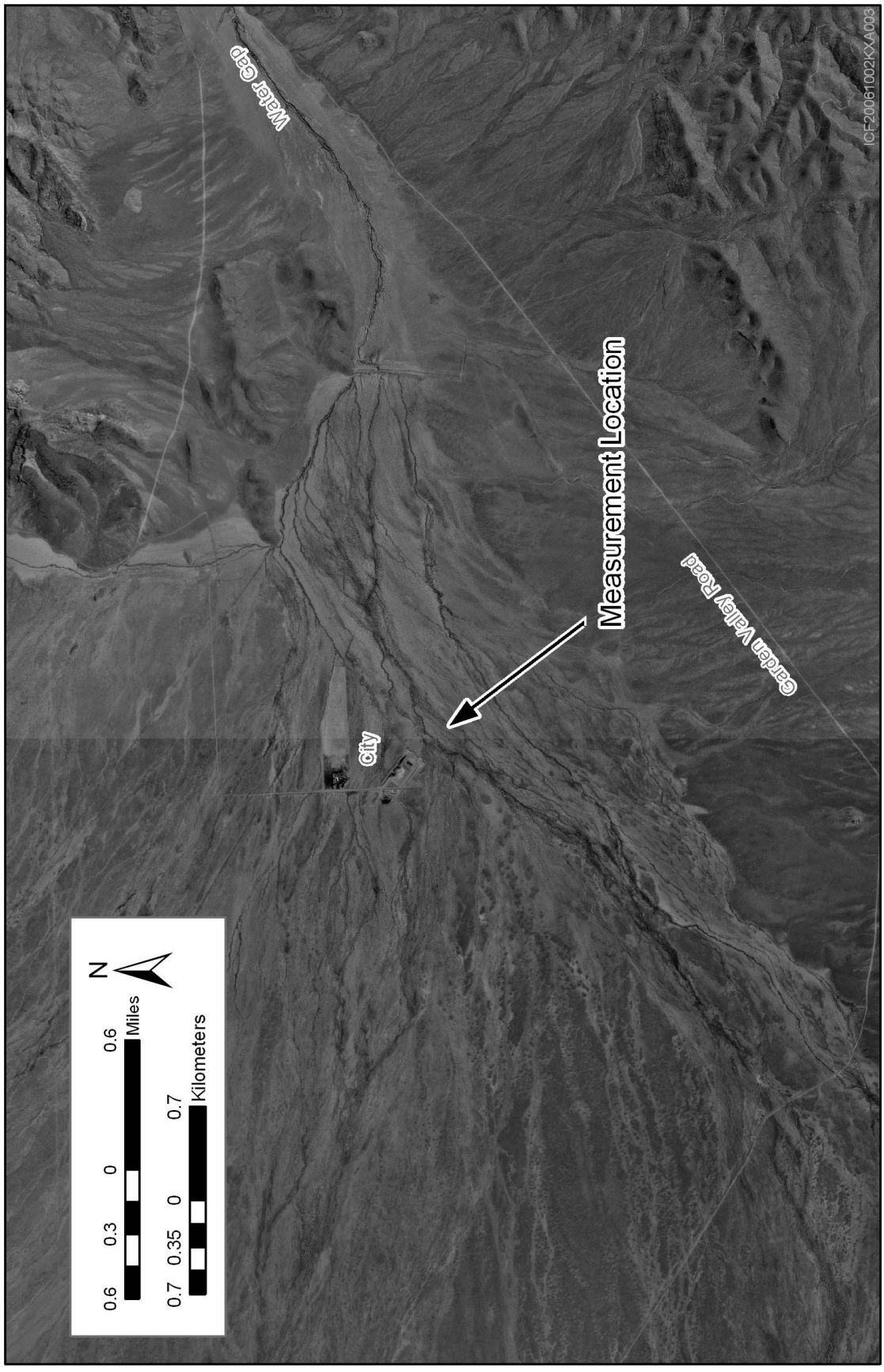


Figure 3-111. Ambient noise monitoring location in Garden Valley, Nevada.
(Source: Basemap derived from DIRS 174497-Keck Library 2004, filenames 381154A43.sid and 38115A44.sid.)

3.2.8.3.3 Goldfield

DOE conducted noise measurements for 24 hours in Goldfield on January 12, 2005. Hourly equivalent sound level values ranged from 30 to 44 dBA, as shown on Figure 3-112. The DNL at this location measured 47 dBA (see Table 3-55).

Noise sources included occasional vehicular traffic on U.S. Highway 95, barking dogs, wind, and occasional front-end-loader noise from the U.S. Department of Transportation maintenance station. Figure 3-113 shows where DOE took ambient noise measurements in the Goldfield area. Measured noise levels at Goldfield are lower than values associated with the "small-town residential" category, which is consistent with the low population density and desert environment.

DOE also took ambient ground-borne vibration measurements at the Goldfield monitoring site on January 12, 2005. The vibration measurement was 25 VdB (see Table 3-56). Measured ambient vibration levels were low because of low population density and the resulting lack of ***ground vibration***-producing activity. Ambient vibration levels of this magnitude are lower than human perception levels.

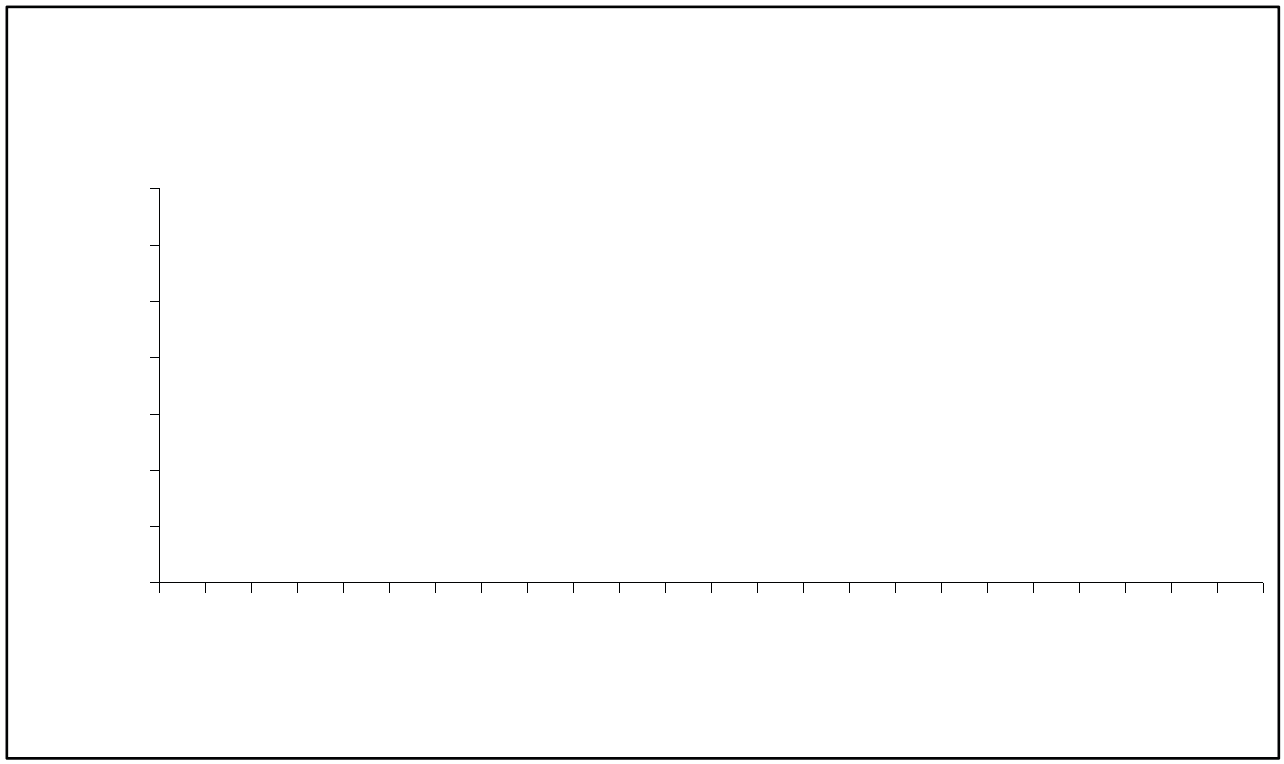


Figure 3-112. Measured noise levels over a 24-hour period in Goldfield, Nevada.

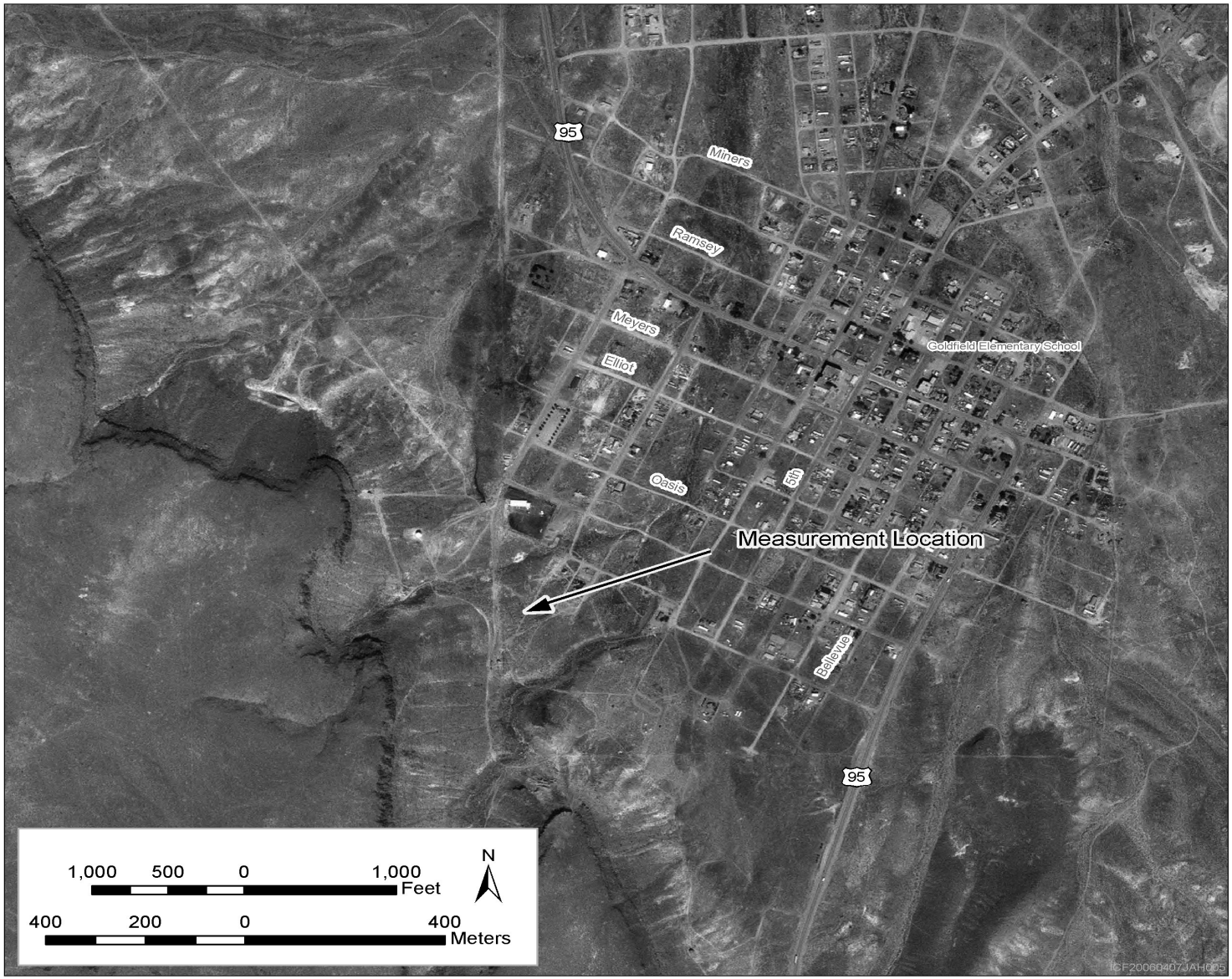


Figure 3-113. Ambient noise monitoring location on the southwestern edge of Goldfield, Nevada.
(Source: Basemap derived from DIRS 174497-Keck Library 2004, filename 37117F21.sid.)

3.2.9 SOCIOECONOMICS

This section describes the existing socioeconomic conditions (employment and income, population and housing, public services, and transportation) along the Caliente rail alignment. Section 3.2.9.1 describes the region of influence for socioeconomics; Section 3.2.9.2 summarizes the method DOE used to establish ***baseline*** socioeconomic conditions in the region of influence; and Section 3.2.9.3 describes general regional socioeconomic characteristics.

3.2.9.1 Region of Influence

The region of influence for the Caliente rail alignment socioeconomics analysis is Lincoln, Nye, Esmeralda, and Clark Counties and the Timbisha Shoshone Trust Lands.

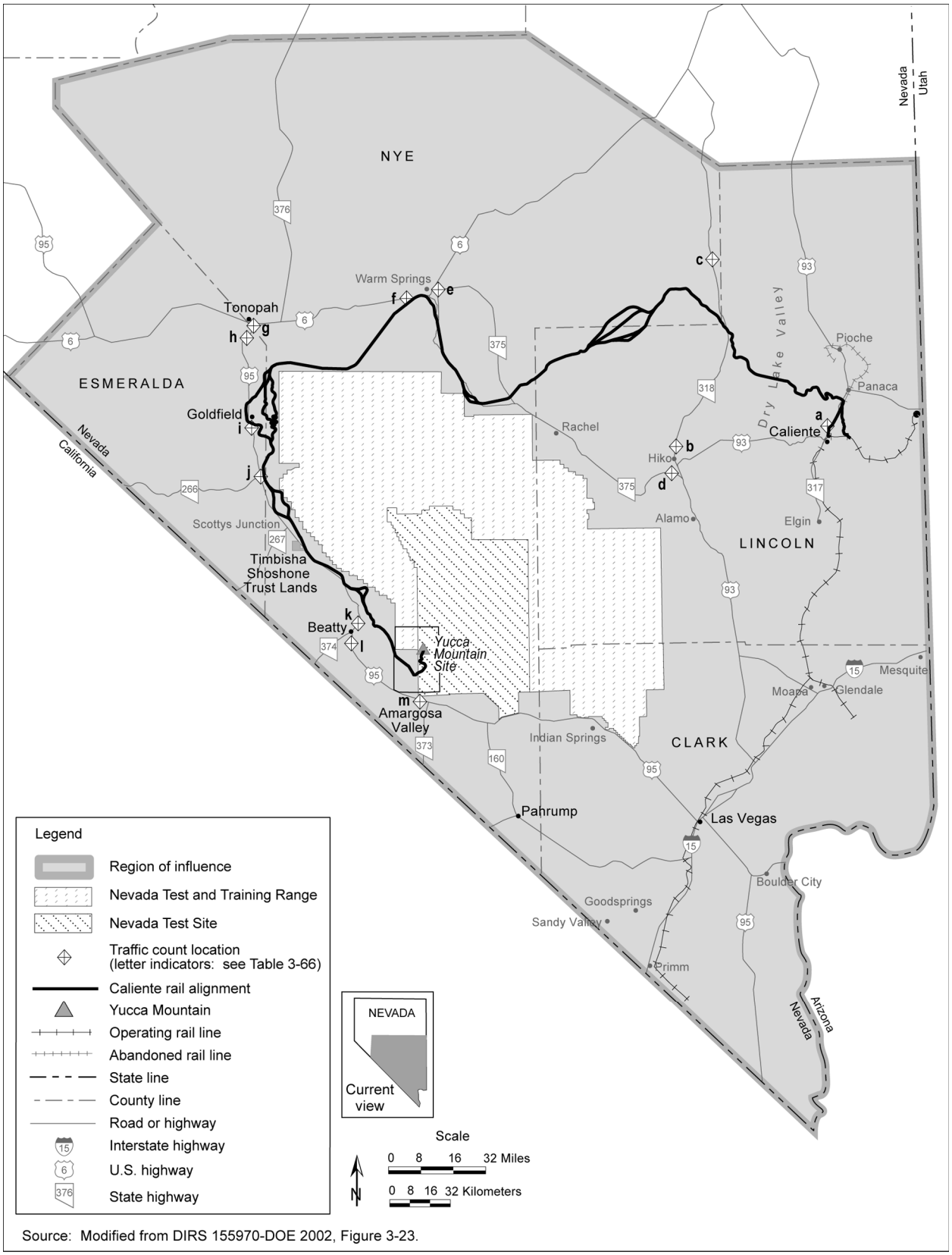
The *Final Legislative Environmental Impact Statement for the Timbisha Shoshone Homeland* (DIRS 154121-DOI 2000, all) stated that future development of the trust lands near Scottys Junction could include a service station/convenience store, a gift/souvenir shop, and single-family detached homes. No economic activity or growth has taken place on these lands, and there are no current residents; thus, while the Timbisha Shoshone Trust Lands are included in the region of influence (Figure 3-114), because of the lack of data, impacts cannot be quantified, nor can any meaningful qualitative conclusions be reached. Thus, impacts for the Timbisha Shoshone Trust Lands are not discussed in Section 4.2.9. Construction and operation of a railroad along the Caliente rail alignment could affect social and economic activities and public services in these areas. This section examines baseline socioeconomic conditions for the counties and selected communities in the counties that would likely be affected during construction and operation of the proposed railroad. This analysis presents some socioeconomics detail for Clark County because, even though the rail line would not cross Clark County, construction workers for construction of the rail and associated facilities (except those in Nye County) are assumed to come from Clark County. This is because Clark is the only county with a sufficient workforce. Construction and operations workers for facilities located in Nye County are assumed to reside 80 percent in Clark County and 20 percent in Nye County, reflecting historical patterns. Operations workers for facilities outside Nye County are assumed to reside in the county of the facility. Furthermore, Clark County medical facilities could receive medical cases from the construction camps and construction sites.
The region of influence does not extend beyond these counties in Nevada because there is no indication of a regional or national socioeconomic effect from goods and services purchased outside the region of influence, and demand for goods and services would not be likely to adversely affect regional or national supplies of required goods and services. The Yucca Mountain FEIS examined the possibility that socioeconomic effects from purchasing construction materials could be felt beyond this four-county region and concluded that there would be little or no impact (DIRS 155970-DOE 2002, p. 4-77).

The region of influence for the analysis of transportation resources includes public roadways near the Caliente rail alignment, and the rail alignment itself.

During rail line construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. Most of the rail alignment would be within Nevada Department of Transportation District 1, crossing Lincoln, Nye, and Esmeralda Counties, with a small portion in District 3 near the State Route 318 crossing (along Caliente rail alignment common segment 1). There are no operating railroads along the Caliente rail alignment.

3.2.9.2 Methodology for Determining Existing Socioeconomic Conditions

DOE characterized socioeconomic activities and resources in the region of influence with a particular emphasis on community-level resources, as appropriate.



Source: Modified from DIRS 155970-DOE 2002, Figure 3-23.

Figure 3-114. Socioeconomics region of influence – Caliente rail alignment.

For this analysis, DOE used the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3) as a basic source of data, and supplemented that data where possible with current community-level data for Lincoln, Nye, and Esmeralda Counties.

DOE used an economic-demographic forecasting model known as *Policy Insight*, developed by Regional Economic Models, Inc. (DIRS 178610-Bland 2007, all), to generate employment, ***real disposable income***, and ***gross regional product*** data for Clark, Lincoln, Nye, and Esmeralda Counties. *Policy Insight* is an eight-region model, which includes Clark, Lincoln, Nye, Esmeralda, Mineral, and Lyon Counties, the joint area of Washoe County and Carson City, and one last region encapsulating the rest of Nevada. Appendix J, Socioeconomics, contains the results of the *Policy Insight* model runs.

Real disposable income is the value of total income received after taxes; it is the income available for spending or saving.

The description of existing economic conditions in the Caliente rail alignment region of influence and the forecast values of populations, gross regional product, and real disposable income draw on data from *Policy Insight* version 9.0 (DIRS 182251-REMI 2007, all). The description includes revenue from DOE's Payments Equal to Taxes program, described in detail in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-90), and the Repository SEIS. Revenue from this program is not described separately. Because the model is based on nationally collected data for which there is a lag between collection and issuance by the national agencies, and another lag before the data are incorporated into the *Policy Insight* model, there is always a gap of approximately 2 to 3 years between the current year and the last history year. The year 2004 is the last history year for *Policy Insight* version 9.0 used in this baseline forecast. To compensate for this time lag, the model's employment update feature is specifically designed to accommodate new historical data provided by users, which update the model's growth-rate assumptions. *Policy Insight* version 9.0 uses an employment update module that relies on years 2004 to 2006 data from the Nevada Department of Education, Training, and Rehabilitation (DIRS 180712-NDETR 2006, all; DIRS 180740-DETR [n.d.], all; DIRS 180741-DETR 2005, all; DIRS 180742-DETR [n.d.], all). This version also incorporates information from the latest Clark County population projections prepared by the University of Nevada, Las Vegas (DIRS 178806-CBER 2006, all) and the latest population projections developed by the Nevada State Demographer (DIRS 178807-Hardcastle 2006, all).

Data for the affected environment (both those taken from the Yucca Mountain FEIS and supplemental information included here) come from various state, federal, community, and proprietary sources. DOE obtained current and historical population data from a report prepared for the Nevada Small Business Development Center (DIRS 177656-Nevada State Demographer's Office 2006, all). The Department obtained housing data, including information on housing stock, vacancy rates, median housing values, and gross rents, from the Nevada Small Business Development Center, which compiled the information from U.S. Census Bureau data (DIRS 173564-Nevada Small Business Development Center 2003, all; DIRS 173565-Nevada Small Business Development Center 2003, all; DIRS 173566-Nevada Small Business Development Center 2003, all; DIRS 173567-Nevada Small Business Development Center 2003, all). DOE uses the U.S. Census Bureau housing data because county-collected housing data can be inconsistent across counties due to unique county assessment practices. In addition, the Census Bureau's housing data contain characteristics that county housing data sources do not, such as whether a property is a rental property or owner-occupied, occupied, or vacant.

Income, poverty, and unemployment data come from the U.S. Census Bureau (DIRS 176856-U.S. Census Bureau 2003, all). DOE obtained current values for employment, real disposable income, and gross regional product for Lincoln, Nye, Esmeralda, and Clark Counties from the *Policy Insight* model, as previously described. DOE compiled business-establishment data from the *Nevada Workforce Informer, Data Analysis* (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all;

DIRS 173542-Nevada Department of Employment, Training & Rehabilitation 2005, all; DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all). The Department obtained data on public services mainly from interviews with county representatives in the region of influence and from the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3), augmented in some instances with information from other sources cited herein. Yucca Mountain Oversight Offices in Lincoln and Esmeralda Counties provided contact information for county agencies and suggested data sources for this section. The County Manager provided similar assistance for Nye County. DOE obtained health data from the Nevada State Health Division (DIRS 173560-State of Nevada [n.d.], all); education data from Nevada District Accountability Reports (DIRS 177758-Lincoln County School District [n.d.], all; DIRS 177759-Nye County School District [n.d.], all; DIRS 177760-Esmeralda County School District [n.d.], all); law enforcement data from the Department of Public Safety (DIRS 173399-State of Nevada 2004, all; DIRS 177747-State of Nevada 2005, all; DIRS 177748-State of Nevada 2006, all).

DOE based the description of the affected transportation environment on existing traffic volumes on the roadways (measured as average daily traffic counts), and obtained traffic volumes for roads from the Nevada Department of Transportation traffic report for 2005 (DIRS 178749-NDOT [n.d.], all). The Department then estimated levels of service on the affected roadways using guidelines in the Highway Capacity Manual (DIRS 176524-Transportation Research Board 2001, all). In response to a comment, DOE examined the Nevada Department of Transportation traffic report for 2006 to see if the updated report would provide new information that would require modification of the baseline or the analysis. DOE determined that changes from the 2005 report were very small. Sometimes the traffic counts were slightly higher, sometimes slightly lower, and often the traffic counts showed no change. As a result, DOE did not change its analysis.

3.2.9.3 General Regional Socioeconomic Characteristics

DOE examined baseline socioeconomic conditions for selected communities within the region of influence that would be likely to be affected by rail line construction and operations. These communities include Caliente in Lincoln County; Tonopah, Beatty, the Town of Amargosa Valley, and Pahrump in Nye County; and Goldfield in Esmeralda County. This section presents baseline conditions for Clark County at the county level, primarily in relation to economic measures and health-care capacity. DOE assumes that there would be an overall income effect on Clark County from the workers living there and commuting to work on the proposed rail line project, but because of the large population of Clark County, the effect would be small.

3.2.9.3.1 Employment and Income

According to the *Policy Insight* baseline projections listed in Table 3-57, Lincoln County's economy is substantially smaller than Nye County's. The three largest employment sectors in Lincoln County are state and local government (27 percent of the employed population), services (21 percent), and retail trade (11 percent). Mining is also an important employment sector, with 11 percent of the employed population. The county's largest employers include the Lincoln County School District; Lincoln County; and an engineering firm, DynCorp Technical Services, LLC (DIRS 173542-Nevada Department of Employment, Training & Rehabilitation 2005, all). Lincoln County's employment has shown modest growth in recent years (DIRS 185246-DETR 2007, all). According to *Policy Insight* baseline projections, the gross regional product of the county in 2007 will be $93.6 million, and the real disposable income will be $93.6 million.

Nye County has the second largest economy in the region of influence. The largest employment sectors are services (44 percent of the employed population), followed by retail trade (12 percent), and then transportation warehousing, information, and finance and insurance (11 percent collectively). State and

Table 3-57. Lincoln, Nye, Clark, and Esmeralda County employment by industry, 2007.[a]

Industry sector	County			
	Lincoln	Nye	Esmeralda	Clark
Private				
Forestry and fisheries	14	67	3	306
Mining	242	1,094	84	1,420
Utilities	13	185	0	3,798
Construction	187	1,793	32	124,771
Manufacturing	32	342	1	28,737
Wholesale trade	22	186	12	26,567
Retail trade	247	2,140	30	121,883
Transportation and warehousing, information, and finance and insurance	141	1,975	23	158,506
Services	456	8,088	112	577,086
Farm	191	283	67	312
Public				
Federal Government–civilian	40	161	6	11,409
Federal Government–military	8	79	4	12,663
State and local government	576	1,792	101	83,135
Totals[b]	2,169	18,184	475	1,150,594

a. Source: DIRS 178610-Bland 2007, all.
b. Totals might differ from sums of values due to rounding.

Silver production is also important and was Nevada's fourth leading mineral commodity in 2002, valued at $62 million.

local government and construction are also important sectors. The importance of construction reflects the county's population growth from 1990 to 2003 because new residents and businesses require construction materials and labor, and a range of services. Large employers include National Security Technologies, LLC (NSTec), the management and operating contractor for DOE at the Nevada Test Site, which employs between 1,000 and 1,500 people in the area, although many Nevada Test Site employees live in Clark County (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all).

Local government agencies such as the Nye County School District and Nye County, and mining companies such as the Round Mountain Gold Corporation, are also major employers (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all).

Nye County employment rebounded after a 15-percent decrease between 1990 and 1995 (DIRS 155970-DOE 2002, p. 3-87). According to *Policy Insight* baseline projections, the gross regional product of Nye County in 2007 will be $1.16 billion, and the real disposable income will be $1.12 billion.

Esmeralda has the smallest economy of the four counties. The county's three largest employment sectors are services, state and local government, and mining, which account for 24, 21, and 18 percent of the employed population, respectively. Employers include government agencies such as the State of Nevada and the Esmeralda County School District, and mining companies such as the Chemetall Foote Corporation, which runs Silver Peak Mine and Lode Star Gold, Inc. (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all).

According to *Policy Insight* baseline projections, the gross regional product of Esmeralda County in 2007 will be $25.7 million, and the real disposable income will be $29.3 million.

Clark County's economy dominates southern Nevada. The largest employment sectors are services (50 percent of the employed population; 46 percent of services employment is within the Accommodations and Food Services sectors); transportation warehousing, information, and finances and insurance (14 percent); construction (11 percent); and retail trade (11 percent). According to *Policy Insight* baseline projections, Clark County surpasses the other counties with a gross regional product of $95.4 billion, which is more than 80 times that of Nye County. According to *Policy Insight* baseline projections, Clark County residents will have $60.7 billion in real disposable income in 2007.

3.2.9.3.1.1 Mining and Agriculture. This section describes existing conditions for mining and agricultural activities, because a railroad along the Caliente rail alignment would be likely to affect these interests more than other economic activities.

Mining At present, Lincoln, and Clark Counties have only industrial mines; Nye County has metallic and nonmetallic mines and oil production fields; and Esmeralda County has industrial and metallic mineral mines. In 2007, the mining industry employed 18 percent of the 475 workers in Esmeralda County and 6 percent of workers in Nye County (DIRS 178610-Bland 2007, all). Mining also constitutes a large part of the total personal income generated in the four-county region of influence. In Esmeralda County in 2002, almost 18 percent of personal income came from mining, making it the single largest source of personal income in the county (DIRS 173546-BEA 2004, Table CA05N). Almost 7 percent of personal income in Nye County came from the mining industry in 2002 (DIRS 173548-BEA 2005, Table CA05N).

Mined minerals in the region of influence include gold, silver, aggregate (consisting of crushed stone, natural sands, and gravel), salt, and a wide range of other non-metallic minerals. Gold is central to Nevada's mining industry, and at $2.4 billion in revenue (DIRS 169127-Driesner and Coyner 2003, all; DIRS 173554-Price and Meeuwig 2003, all), it brings in more revenue than any other type of mining.

The Caliente rail alignment would cross some mining areas and districts. Caliente common segment 1 would cross the northernmost portion of the Seaman Range Mining District. As discussed in Section 3.2.2.5.2, most of historic mining activity in this mining district occurred more than 5 kilometers (3 miles) south and southwest of Caliente common segment 1. The South Reveille alternative segments and Caliente common segment 3 would pass within 3 kilometers (2 miles) of the Reveille Valley Mining Area. A portion of common segment 3 would cross the Clifford Mining District, which is near Warm Springs. Goldfield alternative segments 1, 3, and 4 would cross the Goldfield Mining District; Goldfield alternative segment 1 also would cross the Diamondfield Mining District. A portion of Caliente common segment 4 would cross the westernmost portion of the Stonewell Mining District, although most of the historic mining activity in this district was approximately 5 kilometers (3 miles) east of the common segment. Finally, common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although most historical mining activity there occurred more than 3 kilometers (2 miles) south of this common segment.

Agriculture The primary agricultural activity the Caliente rail alignment would intersect would be grazing. As discussed in Section 3.2.2, Land Use and Ownership, there are 23 separate grazing allotments along the Caliente rail alignment, 20 of which are active. In Section 3.2.2, Land Use and Ownership, Tables 3-6 and 3-7 list and describe these grazing allotments, and Figures 3-26 through 3-33 show the locations of the allotments.

The permitted grazing operations support employment and provide income for ranchers and their workers, and income for the respective counties. BLM-issued grazing permits authorize these operations, and

specify the total number of animal unit months apportioned (an animal unit month represents the forage needed to support one cow, one cow/calf pair, one horse, or five sheep for one month, which would be approximately 800 pounds of forage (DIRS 184767-BLM 2007, p. G-17). For those allotments for which information is available (see Table 3-6), animal unit months range from 118 to 48,250, and land area ranges from 17 to 4,363 square kilometers (4,200 to 1,077,990 acres). The BLM established the property base for each allotment based on land or water rights.

In addition to grazing, farming is an important source of both income and employment for the counties in the region of influence. As discussed in Section 3.2.1.2.3, less than 1 percent of soils along the Caliente rail alignment are classified as prime farmland. Three rail alignment segments would cross prime farmland soils: Caliente common segment 1, the Caliente alternative segment, and the Eccles alternative segment (see Figure 3-5). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total disturbance area by the percentage of prime farmland present along the construction right-of-way. Prime farmland soils along the Caliente and Eccles alternative segments consist of 0.11 square kilometer (27 acres) and 0.1 square kilometer (24 acres), respectively. This accounts for roughly 0.01 percent of Lincoln County's total 1,600 square kilometers (400,000 acres) of prime farmland. These soils are near private land and, at present, might be used for some farming purposes. The 1.2 square kilometers (280 acres) of prime farmland soils along common segment 1 are not being farmed, and are in a relatively isolated area in Nye County (DIRS 182843-DOE 2007, all, Plates 107 to 109). This accounts for roughly 0.2 percent of Nye County's total 610 square kilometers (150,000 acres) of prime farmland.

3.2.9.3.1.2 Personal Income, Poverty, and Unemployment. As shown in Table 3-58, Nye and Clark Counties have the highest median income in the region of influence, followed by Esmeralda and Lincoln Counties. While Nye and Clark Counties showed the highest incomes and the lowest percentage of residents in poverty in 1999 (see note on Table 3-58 for information on poverty thresholds), the unemployment rates in these counties were higher than Lincoln and Esmeralda Counties in 2000. The unemployment rate in Nye County decreased between 2000 and 2005, while Esmeralda County's unemployment rate increased over the same period. Esmeralda County had the highest unemployment rate in the region of influence.

At the community level, Beatty has the highest median income, although its poverty rate is third highest behind the City of Caliente in Lincoln County, and the Town of Amargosa Valley. The City of Caliente also has the highest unemployment rate of all communities in the region of influence.

Tonopah and Beatty in Nye County have higher median incomes and lower poverty and unemployment rates than Caliente in Lincoln County.

3.2.9.3.2 Population

Table 3-59 lists the county and community populations in the Caliente rail alignment region of influence in 1990, 2000, and 2005.

According to the Nevada State Demographer's Office Nevada 2000 census data (DIRS 173565-Nevada Small Business Development Center 2003, p. 1), the population of Lincoln County is 100-percent rural. It has a population density of only 0.15 people per square kilometer (0.4 people per square mile) (DIRS 173530-Bureau of Census 2005, all). A rail line along the Caliente rail alignment would begin in or near Caliente, Lincoln County's only incorporated city. The 2005 population of the City of Caliente accounted for more than one-fourth of the county's population (DIRS 177656-Nevada State Demographer's Office 2006, p. 6).

Nye County is the second most populous county in the region of influence. According to the U.S. Bureau of Census (DIRS 173530-Bureau of Census 2005, all), in 2005 the county had a population density of

0.69 people per square kilometer (1.8 people per square mile); according to population estimates and rural figures from the Nevada State Demographer's Office (DIRS 173564-Nevada Small Business Development Center 2003, p. 1), 55 percent of the population is considered rural. The largest town in Nye County is unincorporated Pahrump, which accounts for 80 percent of the county's population. Although Pahrump is not in the immediate vicinity of the Caliente rail alignment, it is reasonably foreseeable that some construction and operations workers would live in Pahrump, based on historical and current patterns of workers at the Nevada Test Site and the Yucca Mountain Site.

Table 3-58. County and place-level personal income, poverty, and unemployment.[a]

County, city/community	Median household income in 1999 (dollars)[b]	Poverty in 1999 (percent)[b]	Unemployment in 2000 (percent)[b]	Unemployment in 2005 (percent)[c]
County				
Lincoln	31,979	16	5.2	5.1
Nye	36,024	11	7.1	5.2
Clark	44,616	11	6.6	4.0
Esmeralda	33,203	15	3.3	5.3
City/community				
Tonopah	38,029	11	7.9	No data available
Pahrump	35,313	9	7.5	No data available
Goldfield	32,969	12	3.2	No data available
Caliente	26,458	22	9.1	No data available
Amargosa Valley	34,432	15	3.2	No data available
Beatty	41,076	13	5.6	No data available

a. The U.S. Census Bureau defines poverty based on estimates of how much money families need to meet their nutritional needs for 1 year. Poverty thresholds and a more thorough definition of poverty are available from the U.S. Census Bureau at http://www.census.gov/acs/www/UseData/Def/Poverty.htm, all.
b. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 7, 13, and 15.
c. Source: DIRS 177755-BLS [n.d.], all.

Table 3-59. County and community populations, Caliente rail alignment, 1990 to 2005.[a]

County	City/ community	1990 population[b]	2000 population	2005 population	1990 to 2000 change (percent)	2000 to 2005 change (percent)
Lincoln		3,810	4,165	3,886	9	-7
	Caliente	1,146	1,123	1,015	-2	-10
Nye		18,190	32,978	41,302	81	25
	Tonopah	3,671	2,833	2,607	-23	-8
	Amargosa Valley	724	1,167	1,383	61	19
	Beatty	1,662	1,152	1,032	-31	-10
	Pahrump	7,430	24,235	33,241	226	37
Esmeralda		1,350	1,061	1,276	-21	20
	Goldfield	672	424	438	-37	3
Clark		770,280	1,394,440	1,815,700	81	29

a. Source: DIRS 177656-Nevada State Demographer's Office 2006, all.
b. 1990 estimates for Tonopah, Amargosa Valley, Beatty, Pahrump, and Goldfield were not available through the Nevada State Demographer's Office; therefore, subdivision-level data for these locations were taken from the U.S. Census DP-1 (DIRS 179132-Bureau of Census [n.d.], all). The Census data reflect a different time series than the Governor's Certified Estimates.

Nye County also includes the communities of Tonopah, Beatty, and the Town of Amargosa Valley, all of which are near the Caliente rail alignment. Tonopah is the most populated of these communities.

Esmeralda County is the least populated of the counties in the Caliente rail alignment region of influence. Esmeralda is also the least densely populated county, with a density of 0.11 people per square kilometer (0.3 people per square mile) (DIRS 173534-Bureau of Census 2005, all) and a 100-percent rural population (DIRS 173566-Nevada Small Business Development Center 2003, p. 1). The community of Goldfield is close to the Caliente rail alignment, and its population accounts for more than one-third of Esmeralda County's population.

Clark County, which includes Las Vegas, is the most populated county in Nevada. It has a population density of 67 people per square kilometer (173.9 people per square mile) (DIRS 173533-Bureau of Census 2005, all), and a rural population of only 2 percent (DIRS 173567-Nevada Small Business Development Center 2003, p. 1). No part of the Caliente rail alignment is in or near Clark County; the closest part of the alignment would be common segment 6, 48 kilometers (30 miles) west of the Clark County boundary, in Nye County. However, a substantial proportion of the rail line construction workforce would probably come from Clark County.

In terms of population change, southern Nevada has been and continues to be among the fastest-growing areas in the United States (DIRS 155970-DOE 2002, p. 3-84). In the Caliente rail alignment region of influence, Lincoln and Nye Counties both experienced population increases from 1990 to 2000, with Nye County's growth of 81 percent being considerably greater than Lincoln County's growth of 9 percent. The population of Esmeralda County decreased between 1990 and 2000 by 21 percent. The growth and overall population of Clark County is substantial, with an increase of 81 percent during the same years.

Communities within these counties have also been undergoing population changes, though these shifts have not necessarily been in the same direction as the respective county. For example, Nye County experienced a substantial population increase (25 percent) between 2000 and 2005. The increase was largely fueled by population growth in Pahrump, while Tonopah's population declined by 8 percent, and Beatty's declined by 10 percent during the same period. The population of Goldfield in Esmeralda County increased by 3 percent between 2000 and 2005, which is consistent with the county's increase in population of 20 percent.

According to *Policy Insight* model baseline projections listed in Table 3-60, most of the counties in the region of influence are expected to grow through 2067, independent of potential project-related effects. These projections assume that current trends continue and incorporate county and state (that is, Nevada State Demographer's Office) demographic and economic data sources. Population projections for Lincoln, Nye, and Esmeralda Counties through 2026 are from the Nevada State Demographer's Office (DIRS 178807-Hardcastle 2006, all); population projections for these areas after 2026 assume constant growth at 2026 rates. Clark County projections to 2035 are from the University of Nevada Las Vegas Center for Business and Economic Research projections (DIRS 178806-CBER 2006, all), and projections to 2067 assume constant growth at 2035 rates. Because these projections assume a constant rate of growth over the period, rather than a growth rate that increases at a decreasing rate (which would be expected for population projections for Clark and Nye Counties), the projected populations are high estimates. This is a conservative assumption when analyzing for total radiological ***dose*** to resident populations, which is another use of the projections by the Yucca Mountain Project. By 2067, the population of Nye County is projected to increase by 187 percent over 2007 levels. Lincoln County's population is also projected to increase during the same period (63-percent increase over 2007 levels). Esmeralda County population is projected to decline by 2067 (11-percent decrease from 2007 levels). Clark County population is projected to increase by approximately 150 percent over 2007 levels.

Table 3-60. Projected values for population, employment, and economic variables, 2007 to 2067[a] (page 1 of 2).

Economic Parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Population														
Lincoln County	4,250	4,754	5,330	5,694	5,875	5,991	6,112	6,235	6,361	6,489	6,620	6,754	6,891	6,946
Nye County	45,737	51,971	60,803	67,707	73,155	78,364	84,005	90,053	96,535	103,484	110,933	118,919	127,480	131,074
Clark County	1,990,481	2,258,748	2,652,070	2,946,350	3,169,797	3,358,455	3,544,362	3,739,880	3,946,181	4,163,863	4,393,553	4,635,913	4,891,642	4,997,841
Esmeralda County	1,215	1,147	1,069	1,012	997	1,007	1,016	1,027	1,038	1,048	1,058	1,068	1,079	1,083
All of Nevada	2,745,469	3,064,179	3,539,284	3,902,058	4,185,507	4,431,901	4,680,591	4,943,171	5,221,096	5,515,255	5,826,285	6,155,203	6,503,050	6,647,735
Employment														
Lincoln County	2,169	2,253	2,345	2,416	2,446	2,477	2,513	2,567	2,612	2,677	2,731	2,786	2,843	2,866
Nye County	18,184	19,194	20,585	21,683	22,628	23,706	24,923	26,310	27,732	29,274	31,381	33,640	36,062	37,079
Clark County	1,150,594	1,239,364	1,325,133	1,391,701	1,453,024	1,524,248	1,601,285	1,692,833	1,778,852	1,860,856	1,963,506	2,071,818	2,186,105	2,233,566
Esmeralda County	475	466	451	442	436	434	432	435	438	443	447	452	456	458
All of Nevada	1,609,884	1,719,682	1,834,877	1,918,883	1,996,005	2,085,078	2,182,024	2,299,188	2,409,726	2,518,704	2,659,417	2,808,145	2,965,352	3,030,717
Gross regional product[b,c]														
Lincoln County	0.936	0.105	0.122	0.138	0.151	0.166	0.183	0.201	0.220	0.242	0.247	0.252	0.257	0.259
Nye County	1.164	1.302	1.550	1.798	2.052	2.340	2.664	3.037	3.447	3.903	4.184	4.485	4.808	4.943
Clark County	95.392	109.494	131.517	151.836	172.974	197.204	224.494	256.596	291.013	327.876	345.963	365.047	385.184	393.546
Esmeralda County	0.026	0.027	0.029	0.032	0.035	0.039	0.042	0.046	0.050	0.056	0.057	0.057	0.058	0.058
All of Nevada	129.036	147.283	177.133	204.369	232.647	264.813	300.888	343.229	388.550	437.450	461.921	487.785	515.120	526.484

Table 3-60. Projected values for population, employment, and economic variables, 2007 to 2067[a] (page 2 of 2).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Government spending[b,c]														
Lincoln County	0.039	0.047	0.055	0.061	0.064	0.068	0.070	0.074	0.076	0.078	0.080	0.082	0.083	0.084
Nye County	0.174	0.202	0.252	0.291	0.323	0.356	0.390	0.427	0.466	0.503	0.539	0.578	0.620	0.637
Clark County	7.269	8.460	10.543	12.146	13.427	14.617	15.780	17.043	18.266	19.411	20.482	21.612	22.804	23.299
Esmeralda County	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
All of Nevada	10.592	12.085	14.762	16.841	18.541	20.159	21.769	23.523	25.226	26.830	28.335	29.925	31.607	32.307
Real disposable income[b,c]														
Lincoln County	0.094	0.103	0.115	0.124	0.131	0.138	0.146	0.156	0.166	0.186	0.190	0.194	0.198	0.199
Nye County	1.117	1.250	1.439	1.605	1.775	1.969	2.203	2.466	2.768	3.132	3.358	3.599	3.858	3.967
Clark County	60.731	68.974	79.836	89.500	99.788	111.517	124.864	140.518	156.612	173.027	182.571	192.642	203.269	207.682
Esmeralda County	0.029	0.030	0.033	0.035	0.037	0.041	0.043	0.047	0.050	0.054	0.054	0.055	0.055	0.056
All of Nevada	85.032	95.636	110.205	123.098	136.861	152.183	169.418	189.600	210.290	232.015	245.035	258.799	273.350	279.400

a. Source: DIRS 178610-Bland 2007, all; DIRS 178806- CBER 2006, all; DIRS 178807- Hardcastle 2006, all.
b. Values from *Policy Insight* (DIRS 182251-REMI 2007, all), converted to 2006 dollars using the ratio of the 2000 annual Consumer Price Index (CPI) and the annual CPI from 2006.
c. 2006 dollars in billions.

3.2.9.3.3 Housing

Table 3-61 lists housing characteristics in the Caliente rail alignment region of influence in 2000. The housing stock in Lincoln County and in Caliente consists mostly of single-family homes. Almost a fifth of housing units in Caliente are vacant. The *Lincoln County Master Plan* (DIRS 185538-Lincoln County 2007, all) identifies a potential new community development planned for the former Aerojet Nevada lands along the southern county border along U.S. Highway 93. Coyote Springs Investment owns an estimated 120 square kilometers (30,000 acres) of land in the area that is currently under development. Impacts of Coyote Springs are discussed in Chapter 5, Cumulative Impacts. The residential component of the development could house workers associated with the proposed rail line who might otherwise live in Caliente. Compared to Lincoln County, Nye County has a much larger housing stock, most of which is mobile (manufactured) homes; the housing stock in the Beatty ***Census County Division*** and the Amargosa Census County Division consists primarily of mobile homes. In Tonopah, almost one-third of the housing units are vacant, particularly in the rental segment.

Esmeralda County has the smallest housing stock. More than half the county's housing units are in Goldfield, where 48 percent are mobile homes, and 49 percent of all units were vacant in 2000. The housing stock of Clark County in 2000 reflects an increase of slightly more than 75 percent over the 1990 count (DIRS 173531-Bureau of Census 2000, Table DP-5 STF3). This increase is accounted for by the large population and employment growth in Clark County, which has spurred housing construction. Vacancy rates in both the homeowner and rental segments in Clark County tend to be lower than the rates in the other counties in the region of influence, with the exception of Lincoln County.

As shown in Table 3-62, in 2000 the median values of housing in Lincoln County and Esmeralda County were considerably below the median value in Nye County and Clark County. Similarly, rent levels in Lincoln and Esmeralda Counties were approximately half of those for Clark County and approximately two-thirds those of Nye County. Housing values in all of Southern Nevada rose rapidly between the 2000 Census and 2005. A Las Vegas-based housing research firm reported that the median price of the recorded new homes in the area in November 2005 was $301,519, which was a 5.9 percent annual increase. Omitting apartment conversions, the median price for new homes was $336,645, or an 18.2-percent annual increase (DIRS 176007-Home Builders Research 2005, all). Lodging options along U.S. Highway 95 between Goldfield and the Yucca Mountain Site are in and around Goldfield, Beatty, and the Town of Amargosa Valley. Visitors to Goldfield can stay in the Goldfield recreational vehicle park, which has 20 spaces (DIRS 182379-Nevada Commission on Tourism 2004, all). Beatty has a much higher accommodation capacity. It has six motels with a total of 275 rooms, and three recreational vehicle parks with a total of 63 spaces (DIRS 182381-Nevada Commission on Tourism 2004, all; DIRS 182384-Nevada Commission on Tourism 2004, all). Town of Amargosa Valley features a combined 60-room hotel and 51-space recreational vehicle park, one additional motel (17 rooms), and one additional recreational vehicle park (97 spaces) (DIRS 182380-Nevada Commission on Tourism 2004, all; DIRS 182383-Nevada Commission on Tourism 2004, all).

3.2.9.3.4 Public Services

This section summarizes conditions for health care, education, fire protection, and law enforcement. Section 3.2.11, Utilities, Energy, and Materials, describes utilities-related public services.

3.2.9.3.4.1 Health Care. While Lincoln, Nye, and Esmeralda Counties have some health care facilities, all three counties are federally designated as health professional shortage areas for primary, dental, and mental health care (DIRS 173558-State of Nevada [n.d.], all; DIRS 173559-State of

Table 3-61. Housing characteristics in the Caliente rail alignment region of influence, 2000.[a]

Geographic area	Total housing units	Single-family homes	Multiple-family homes	Mobile homes	Occupied housing units	Vacant housing units	Vacancy rate (percent)	
							Homeowner	Rental
Lincoln County[b]	2,178	1,365	196	617	1,540	638	4.0	9.2
Caliente Census County Division[c]	536	337	77	122	437	99	4.2	11.8
Nye County[d]	15,934	6,383	1,014	8,537	13,309	2,625	3.4	17.9
Tonopah Census County Division[c]	1,608	766	385	457	1,152	456	3.6	32.3
Beatty Census County Division[c]	746	181	97	468	548	198	2.6	33.0
Amargosa Census County Division[c]	536	73	7	456	422	114	2.4	17.9
Pahrump[c]	8,206	3,660	479	4,067	7,234	972	3.2	11.8
Esmeralda County[e]	833	269	121	443	455	378	4.4	40.5
Goldfield Census County Division[c]	429	162	61	206	224	205	5.7	43.8
Clark County[f]	559,799	321,801	203,411	34,587	512,253	47,546	2.6	9.7

a. Total Housing Units, Occupied Housing Units, and Vacant Housing Units counts were taken from Summary File 1 U.S. Census Bureau data, and Single Family Homes, Multiple Family Homes, and Mobile Homes counts were taken from Summary File 3 U.S. Census data. Because Summary File 1 data are collected from all households, while Summary File 3 data are compiled from a sample of approximately 19 million housing units (approximately 1 in 6 households), total housing counts differ slightly from the sum of "Single Family Homes, Multiple Family Homes, and Mobile Homes." DIRS 173565-Nevada Small Business Development Center 2003 contains a detailed explanation of variations between Summary File 1 and Summary File 3 data.
b. Source: DIRS 173565-Nevada Small Business Development Center 2003, p. 55.
c. Source: DIRS 173535-Bureau of Census 2000, all.
d. Source: DIRS 173564-Nevada Small Business Development Center 2003, p. 55.
e. Source: DIRS 173566-Nevada Small Business Development Center 2003, p. 55.
f. Source: DIRS 173567-Nevada Small Business Development Center 2003, p. 55.

Table 3-62. Median housing values and gross rents in the Caliente rail alignment region of influence, 2000.[a]

Geographic area	Median value (dollars)[b]	Median monthly gross rent (dollars)
Lincoln County	80,300	328
Caliente Census County Division	65,200	359
Nye County	122,100	541
Tonopah Census County Division	78,200	478
Beatty Census County Division	93,700	368
Amargosa Valley Census County Division	80,800	380
Pahrump	135,100	614
Esmeralda County	75,600	381
Goldfield Census County Division	71,300	389
Clark County	139,500	716

a. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 25 and 29.
b. Median value applies to owner-occupied units.

Nevada [n.d.], all; and DIRS 173560-State of Nevada [n.d.], all). Health care services in the region of influence are concentrated in Clark County, particularly in the Las Vegas area.

Lincoln County has one hospital in Caliente, the Grover C. Dils Medical Center, near U.S. Highway 93. The service area for this facility is all of (and limited to) Lincoln County (DIRS 174545-Arcaya 2005, all). The hospital employs two full-time-equivalent physicians, two full-time-equivalent physician assistants, and eight licensed nurses (DIRS 175508-Arcaya 2005, all). In addition to providing all medical services and staffing a 24-hour emergency room at Grover C. Dils Medical Center, the hospital's physicians and physician assistants are responsible for staffing a medical clinic in Alamo, Nevada (DIRS 175508-Arcaya 2005, all). Sixteen of the beds at Grover C. Dils Medical Center are designated for long-term care and 4 are reserved for acute cases (DIRS 175508-Arcaya 2005, all). The Grover C. Dils hospital is not licensed for surgery. All patients in need of surgical procedures are referred to Valley View Medical Center in Cedar City, Utah, about 155 kilometers (96 miles) from Caliente; Dixie Regional Medical Center in St. George, Utah, about 177 kilometers (110 miles) from Caliente; or Las Vegas, about 241 kilometers (150 miles) from Caliente (DIRS 175508-Arcaya 2005, all). There is a state-funded community health nurse in Lincoln County and there are physical therapy services available. Lincoln County continues to be a medically underserved area and a health professional shortage area, although hospital-use data in Table 3-63 show the capacity of the health care system improving overall from 1995 to 2000. Lincoln County emergency services are considered by county representatives as overextended.

Table 3-63. Hospital use in Lincoln and Nye Counties.

County	1995	1998	2000
Lincoln[a]			
Average number of beds	4	4	20
Beds per 1,000 residents	1	0.95	4.8
Patient days	360	300	No data available
Nye[b]			
Average number of beds	21	10	44
Beds per 1,000 residents	0.86	0.33	1.3
Patient days	1,900	560	No data available

a. Source: DIRS 175508-Arcaya 2005, all.
b. Source: DIRS 174732-Arcaya 2005, all.

According to a Nye County assessment, emergency service (county-wide medical and Pahrump's fire protection) personnel are currently overextended (DIRS 174548-Abaris Group 2004, pp. 2 and 3). Nye County medical services are widely distributed and consist of a mixture of public and private clinics.

The communities of Beatty, Pahrump, and Town of Amargosa Valley all have access to ambulance service, and are served by preventive care clinics staffed by physician assistants or community health nurses. These clinics focus on women's health, immunizations, and sexually transmitted diseases. They are funded in part by the State Rural Health Division (DIRS 174736-Arcaya 2005, all). Pahrump has a pediatric physician who runs a separate clinic in the community, a Veterans Administration clinic, and several private dermatologists, dentists, and chiropractors (DIRS 174736-Arcaya 2005, all; DIRS 174972-Arcaya 2005, all).

Additionally, Desert View Regional Medical Center (DVRMC), Pahrump's first hospital, opened in April 2006. The hospital has 24 beds and a 24-hour emergency room. The facility has a maternity ward, full-service lab and radiology services, as well as physical therapy services (DIRS 181897-Desert View Regional Medical Center [n.d.], all).

Nye County is also served by the Nye Regional Medical Center, a small, private hospital in Tonopah that has ambulance services. The center has 44 beds, 26 of which are long-term-care beds reserved for the hospital's nursing-home wing. Two full-time-equivalent physicians provide coverage for both the 24-hour emergency room and all other patients. The hospital's nursing home maintains 24-hour coverage consisting of one registered nurse and one certified nursing assistant. The Nye Regional Medical Center is able to perform diagnostic imagery and to provide services from its on-site laboratory, pharmacy, and outpatient clinic. However, the facility is not licensed for surgery. Nye County patients in need of more advanced care than can be provided at Tonopah's hospital are transported by helicopter to Reno or Las Vegas by Flight for Life, a medical air service (DIRS 174732-Arcaya 2005, all).

Although Nye County continues to be a medically underserved area and a health professional shortage area, Table 3-63 shows that the capacity of the health care system in Nye County improved between 1995 and 2000, with increases in the average number of beds and the number of beds per 1,000 residents.

Esmeralda County had no practicing doctors or dentists in 2005 (DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). The U.S. Health Resources and Services Administration designated Esmeralda County as both a health professional shortage area and a medically underserved population for primary health, dental, and mental-health care for 2004 (DIRS 173560-State of Nevada [n.d.], all). Because Esmeralda County has no health-care facilities, the county has prepared a proposal to fund a new facility (DIRS 175507-McCorkel et al. 2005, all).

Clark County has 13 general acute-care medical centers with a combined total of 3,439 beds (1.9 beds per 1,000 residents) and 2,729 active, licensed physicians practicing throughout the county in 2005 (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). Sunrise Hospital and Medical Center in Las Vegas is the largest hospital in Nevada, with 701 beds (DIRS 178100-State of Nevada 2006, p. v). It is also capable of providing all medical services and staffs a 24-hour emergency room. Of the remaining 12 hospitals in Clark County, eight (Desert Springs Hospital, Mountain View Hospital, North Vista Hospital, Southern Hills Hospital and Medical Center, Spring Valley Hospital Medical Center, Summerlin Hospital and Medical Center, University Medical Center, and Valley Hospital and Medical Center) are in Las Vegas, two (St. Rose Dominican Hospital and St. Rose Siena Campus) are in Henderson, one (Boulder City Hospital) is in Boulder City, and one (Mesa View Regional Hospital) is in Mesquite (DIRS 178100-State of Nevada 2006, p. v).

3.2.9.3.4.2 Education. Lincoln County has a total of nine elementary, middle, and high schools. During the 2005 to 2006 school year, Lincoln County schools had a total enrollment of 1,001 students and

a graduation rate for the class of 2005 of 83 percent (DIRS 177758-Lincoln County School District [n.d.], all). The average student-to-teacher ratio for kindergarten through eighth grades was 14 to 1 (DIRS 177758-Lincoln County School District [n.d.], all). This is consistent with the 2003 national average student-to-teacher ratio of 16 to 1 across elementary and secondary grade levels (DIRS 177757-Snyder, Tan and Hoffman 2006, Table 62). Caliente has an elementary school that serves Lincoln County students and a middle and high school that exclusively serves troubled youth (DIRS 174735-Arcaya 2005, all). Other middle- and high-school-aged students in Caliente are transported by bus approximately 24 kilometers (15 miles) to Lincoln County High School in Panaca (DIRS 174545-Arcaya 2005, all). Lincoln County High School had an enrollment of 173 students from Panaca, Caliente, Pioche, and outlying areas for the 2005-2006 school year. Lincoln County High School is functioning below maximum design capacity, with the building able to accommodate up to 240 students (DIRS 175973-Arcaya 2006, all). This is consistent with a 2000 *Assessment of Capacity and Student Loads* study that showed the district was operating at approximately 50 percent capacity at the time (DIRS 185245-Intertech Services Corporation, 2000, all). A more recent report, the *Lincoln County Master Plan*, indicates that the school district is operating at 93 percent of capacity (DIRS 185538-Lincoln County 2007, all). The University of Nevada, Reno, has a Cooperative Extension Center in Caliente.

During the 2005-2006 school year, Nye County had approximately 6,088 students. The county's 2005 graduation rate was 60 percent (DIRS 177759-Nye County School District [n.d.], all). The average student-to-teacher ratio for kindergarten through fifth grades was 20 to 1 (DIRS 177759-Nye County School District [n.d.], all). Tonopah has elementary, middle, and high school facilities.

Nye County's school system experienced approximately a 10-percent increase in enrollment in the 2004-2005 school year over the previous year. Most of this growth was due to increases in Pahrump's population. Pahrump is home to four elementary schools, one middle school, and one high school. Table 3-64 lists enrollment for each school. All of these schools are functioning at or above maximum design capacity (that is, they are all holding as many, or more, students than they were originally built to accommodate). To alleviate overcrowding, all six schools were scheduled to receive modular units over the summer of 2005 that would each hold two additional classes. A bond for a new elementary school is also under consideration for the area, with a timeline of roughly 18 months for discussion and a decision on the bond. The new elementary school would likely be designed to hold between 400 and 600 students, making it roughly equal in size to the four existing elementary schools (DIRS 174737-Arcaya 2005, all).

Table 3-64. Enrollment in Pahrump-area schools, 2004-2005.[a]

School name	Type	Enrollment, 2004-2005
Pahrump Valley	High school	987
Rosemary Clark	Middle school	1,122
Hafen	Elementary school	560
JG Johnson	Elementary school	555
Mt. Charleston	Elementary school	574
Manse	Elementary school	478

a. Source: DIRS 174737-Arcaya 2005, all.

In Nye County, the Pahrump Valley Branch Campus of Great Basin College provides postsecondary school education. The nearest major university to southern Nye County is the University of Nevada, Las Vegas, 105 kilometers (65 miles) from Pahrump. The University of Nevada, Reno, is the closest major university to northern Nye County. In addition, the University of Nevada, Reno, has Cooperative Extension Centers in Pahrump and Tonopah.

In Esmeralda County, 86 students were enrolled in school during the 2005-2006 school year (DIRS 177760-Esmeralda County School District [n.d.], all). Three schools in the county (in Dire, Silver Peak,

and Goldfield) serve kindergarten through eighth grade students. The average student-to-teacher ratio was 12 to 1 (DIRS 177760-Esmeralda County School District [n.d.], all). The county employs seven certified teachers and one certified literacy coordinator (DIRS 174970-Arcaya 2005, all). There is no high school in Esmeralda County; high school students from Esmeralda County attend school in Tonopah, Nye County (DIRS 155970-DOE 2002, p. 3-156).

3.2.9.3.4.3 Fire Protection. Lincoln and Nye Counties meet fire suppression needs with volunteers from the individual communities in the counties. Lincoln County has four locations with all-volunteer fire departments: Caliente, Pahranagat Valley, Panaca, and Pioche. Caliente's fire department has 25 volunteers and owns three fully equipped fire trucks with a combined tank capacity of 10,600 liters (2,800 gallons). The Panaca Fire Department has a force of 25 volunteers and owns several firefighting vehicles, with a combined tank capacity of 9,500 liters (2,500 gallons). The Pioche Fire District has 20 volunteers and owns two outdated firefighting vehicles: a tanker with a 3,800-liter (1,000-gallon) tank and a vehicle with a 1,900-liter (500-gallon) foam tank, and extrication equipment. The Pahranagat Valley Fire District has a force of 25 volunteers and owns three firefighting vehicles, with a total tank capacity of 6,800 liters (1,800 gallons). All four locations have access to ambulance services (DIRS 174973-Arcaya 2005, all). In addition to these four fire departments, Lincoln County commissioners are currently forming a county-wide fire district. This new district would increase fire protection for places at high risk for fires, such as the Mount Wilson area (DIRS 174971-Arcaya 2005, all). There are no plans for Caliente to increase fire protection services, but Caliente and the other three fire departments in the county are currently able to meet their communities' needs, although Lincoln County emergency services are considered overextended. On a scale of 1 to 10 under its Public Protection Classification Program, with 1 being the highest rating, the Insurance Service Organization rates the Caliente, Panaca, and Pioche communities as Class 7, 5, and 6, respectively (DIRS 185453-Bland 2008, all). Lincoln County fire departments maintain a stream of citizens in training to become new volunteers (DIRS 174973-Arcaya 2005, all).

Nye County has 11 volunteer fire departments, including one in Beatty and one in Town of Amargosa Valley. The only paid fire department within the county is located in Pahrump. The county recently spent $2.5 million to upgrade its fire trucks and has adequate fire protection in all areas of the county except for Pahrump, which is overextended (DIRS 174731-Arcaya 2005, all). A 2004 audit of the Pahrump Valley Fire-Rescue Service commissioned by the Pahrump Town Board found that "the community is currently underserved by fire suppression and emergency medical services operational staff" and suggested that staff be added to the service, specifically an additional daily three-person team (DIRS 174548-Abaris Group 2004, p. 3). The audit also noted that Pahrump has no overall fire suppression and emergency medical services master plan, and recommended that one be developed.

As of October 2006, Nye County did not have an agreement with DOE to provide fire protection services to the Yucca Mountain Site. At present, the Nevada Test Site provides these services. The Nevada Test Site has two active fire departments that operate 24 hours a day, 7 days a week. One of the fire departments is in Mercury, Nevada (Area 23), and the other is in Area 6 on the Nevada Test Site. The Yucca Mountain Site has two paramedics, a small medical facility, and an ambulance for emergency response. The site also has two fully trained underground rescue teams available any time underground work is underway (DIRS 177762-Gormsen 2006, all).

The BLM Las Vegas and Battle Mountain Field Offices supplement Nye County's fire-protection resources by providing wildfire suppression services to all the public lands within Nye County that are managed by the BLM and the U.S. Forest Service (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all). The Las Vegas Field Office provides fire suppression resources for wildfires during peak fire season, which is generally from April through October. The Battle Mountain Field Office provides fire suppression support from three locations in northern Nye County: Austin, Eureka, and

Battle Mountain. In addition to firefighters, the fire-suppression resources available through these locations include Type-4 and Type-3 wildfire engines, a Type-3 helicopter, Type-3 incident commanders, and single engine air tanker and air attack bases (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all).

In Esmeralda County, Goldfield has nine volunteer firefighters and three fire trucks; Gold Point has eight volunteer firefighters and three fire trucks; Silver Peak has six volunteer firefighters and three fire trucks; and Fish Lake Valley has 16 volunteer firefighters and three fire trucks (DIRS 180977-Gormsen 2007, all). The community fire departments have access to the county's road department vehicles, if needed.

3.2.9.3.4.4 Law Enforcement. The Lincoln County Sheriff's Office employs eight full-time patrolmen, one captain, one sheriff, five corrections officers, two civilian dispatchers, and one administrative assistant, which yields a ratio of 2.6 officers per 1,000 residents. This force serves an area of 27,500 square kilometers (10,600 square miles). The Lincoln County Sheriff's Office relies heavily on federal grants for equipment, including vehicles, dispatch software systems, and communications systems (DIRS 178099-Arcaya 2006, all). However, none of the support is ongoing, so the county reapplies for federal grant assistance each year.

The Nye County Sheriff's Office has 105 sworn officers (85 street-patrol officers and 20 corrections and detention officers) (DIRS 174974-Arcaya 2005, all). This yields a ratio of 2.2 patrol officers per 1,000 residents. The Nye County Sheriff's Office receives some funding in the form of occasional grants from state and federal agencies (DIRS 177756-Gormsen 2006, all).

The Esmeralda County Sheriff's Office has 14 employees – six officers that handle patrol (one sheriff, one sergeant, two resident deputies, and two full-time street deputies), three corrections officers, four full-time dispatchers, and one part-time civilian dispatcher (DIRS 174753-Arcaya 2005, all). This yields a ratio of 5 officers per 1,000 residents in Esmeralda County. By comparison, the national officer-to-population ratio is 2.4 officers per 1,000 residents (DIRS 155970-DOE 2002, p. 3-92). The Esmeralda County Sheriff's Office receives limited state and federal support in the form of occasional equipment grants (DIRS 178094-Arcaya 2006, all). The county does not receive on-going state or federal grant support or training.

As Table 3-65 shows, crime rates for Lincoln, Nye, and Esmeralda Counties are below the national average, and have decreased or stayed constant between 2003 and 2005.

Table 3-65. Crime rates in the Caliente rail alignment region of influence, 2003 to 2005.

Area	Crime rate[a]		
	2003[b]	2004[c]	2005[d]
Lincoln County	18	13	13
Nye County	35	35	31
Esmeralda County	13	10	7
Clark County	51	51	51
National	45	44	Not available

a. The crime rate is based on the occurrence of an offense per 1,000 residents.
b. Source: DIRS 173399-State of Nevada 2004, all.
c. Source: DIRS 177747-State of Nevada 2005, all.
d. Source: DIRS 177748-State of Nevada 2006, all.

3.2.9.3.5 Transportation Infrastructure

This section describes the public roadways and mainline railroads in the area around the Caliente rail alignment.

3.2.9.3.5.1 Public Roadways. Because the Caliente rail alignment region of influence for transportation resources is primarily in remote and rural areas, the rail line would cross mostly low-usage unpaved roads, including county roads, private roads, and off-road vehicle trails. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these roads are not heavily traveled. Section 4.2.10, Occupational and Public Health and Safety, describes safety issues concerning public road–rail crossings, and road traffic related to construction and operation of the proposed rail line.

In addition to the state and federal roads discussed below, there are three paved roads near the Caliente rail alignment: Cedar Pipeline Ranch Road in southern Reveille Valley and two Nevada Test and Training Range access roads (one approximately 19 kilometers [12 miles] east of Tonopah off U.S. Highway 6 and the other off U.S. Highway 95 between Scottys Junction and Beatty).

Generally, the main roads within the region of influence are two-lane highways with very little daily traffic. Table 3-66 lists annual average daily traffic volumes along primary roads in the region of influence, which DOE obtained from the Nevada Department of Transportation's 2005 annual traffic report (DIRS 178749-NDOT [n.d.], all). These traffic volumes indicate that roadways near the Caliente rail alignment are not congested.

All references to ***levels of service*** of roads shown in Table 3-66 are defined by the Highway Capacity Manual 2000, which is an industry standard for traffic engineering published by the Transportation Research Board (DIRS 176524-Transportation Research Board 2001, all). This manual defines six levels of service that reflect the level of traffic congestion and qualify the operating conditions of a roadway. The six levels are given letter designations ranging from A to F, with A representing the best operating conditions (free flow, little delay) and F the worst (congestion, long delays) (DIRS 176524-Transportation Research Board 2001, all). Various factors that influence the operation of a roadway or intersection include speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The Highway Capacity Manual describes the levels of service as follows:

- Level of service A describes completely free-flow conditions. Individual drivers are virtually unaffected by the presence of other vehicles in the traffic stream.
- Level of service B also indicates free flow, but the presence of other vehicles becomes more noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from level of service A.
- Level of service C is in the range of stable flow, but marks the beginning of the range of flow in which operation of individual drivers becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by others and maneuvering requires substantial vigilance on the part of the driver.
- Level of service D represents high density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience.
- Level of service E represents operating conditions at or near capacity. All speeds are reduced to a low, but relatively uniform, value.
- Level of service F indicates a breakdown of traffic flow or stop-and-go traffic. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can cross the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

Levels of service A, B, and C are typically considered good operating conditions in which motorists experience minor or tolerable delays of service. Based on the traffic counts listed in Table 3-66, U.S. Highway 93, State Route 318, and State Route 375 are operating at a level of service A. All of U.S. Highway 95 within the Caliente rail alignment region of influence is operating at a level of service B, except for a portion that is operating at a level of C. Sections 3.2.10 and 4.2.10, Occupational and Public Health and Safety, discuss highway accidents and fatalities.

3.2.9.3.5.2 Mainline Railroads. Two major freight railroads, both Class I, serve Nevada: the Union Pacific Railroad and the Burlington Northern and Santa Fe Railway. Union Pacific is the dominant carrier of the two in terms of tonnage of freight hauled and miles of track. The Union Pacific mainlines

consist of two northern routes and one southern route that cross Nevada east to west. At present, approximately 28 trains every 24 hours pass through Caliente on the Union Pacific Railroad Mainline (DIRS 178017-Holder 2006, all). Sections 3.2.10 and 4.2.10, Occupational and Public Health and Safety, discuss rail transportation in relation to public safety.

Table 3-66. Annual average daily traffic counts in southern Nevada (2005).[a]

Roadway and location of traffic count station	Legend in Figure 3-114	Vehicles per day[b]	Level of service
U.S. Highway 93			
Near the northern city limits of Caliente (Lincoln County)	a	1,300	A
State Route 318			
7.2 kilometers (4.5 miles) north of Hiko (Sunnyside Road) (Lincoln County)	b	1,050	A
(Sunnyside Road) near Nye/White Pine county line (Nye County)	c	1,050	A
State Route 375			
0.8 kilometers (0.5 miles) west of State Route 318 at Crystal Springs (Warm Springs Road) (Lincoln County)	d	210	A
61 meters (200 feet) south of U.S. Highway 6 (Warm Springs Road) (Nye County)	e	150	A
U.S. Highway 6			
61 meters (200 feet) west of State Route 375 (Warm Springs Road) (Nye County)	f	290	A
U.S. Highway 95			
0.3 kilometer (0.2 mile) south of U.S. Highway 6 in Tonopah (Nye County)	g	5,550	C
At the Nye-Esmeralda county line south of Tonopah (Esmeralda County)	h	2,100	B
Just south of the town of Goldfield (Esmeralda County)	i	1,950	B
0.2 kilometer (0.1 mile) south of State Route 266 at Lida Junction (Esmeralda County)	j	2,150	B
1.6 kilometers (1 mile) north of State Route 374 (Death Valley Road) (Nye County)	k	2,400	B
0.2 kilometer (0.1 mile) south of State Route 374 (Death Valley Road) (Nye County)	l	3,400	B
0.3 kilometer (0.2 mile) north of State Route 373 (Nye County)	m	2,600	B

a. Source: DIRS 178749-NDOT [n.d.], all.
b. See Figure 3-114 for location of traffic counts.

3.2.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes the affected environment for occupational and public health and safety related to construction and operation of a railroad along the Caliente rail alignment. Section 3.2.10.1 describes the nonradiological, radiological, and transportation regions of influence; Section 3.2.10.2 describes the nonradiological health and safety environment considered in estimating potential nonradiological health and safety impacts, excluding transportation impacts; Section 3.2.10.3 describes the environment considered in estimating potential radiological health and safety impacts related to operation of the railroad, including transportation; Section 3.2.10.4 describes ***background radiation*** in the vicinity of the Yucca Mountain Site; and Section 3.2.10.5 describes the environment considered in estimating potential nonradiological health and safety impacts from transportation accidents.

The discussion of the radiological health and safety environment is related to the potential impacts to workers from occupational ***exposure to radiation*** during operation of the railroad, and potential impacts to workers and the public from ***incident-free transportation*** of spent nuclear fuel and high-level waste and under accident scenarios and acts of sabotage or terrorism.

The discussion of the nonradiological health and safety environment relates to potential impacts to workers during construction and operation of the railroad from workplace physical hazards, exposure to nonradiological ***hazardous chemicals***, and exposure to other nonradiological hazards such as biological hazards.

The discussion of the nonradiological transportation health and safety environment relates to the nonradiological transportation impact analysis, which includes potential impacts to workers and the public from roadway and railway transportation ***accidents*** that do not involve releases of ***radiation***.

3.2.10.1 Region of Influence

3.2.10.1.1 Nonradiological Region of Influence

The nonradiological region of influence is the environment considered in estimating the potential for occupational nonradiological impacts to workers from the construction and operation of the railroad. (Because the public would not be involved in the construction and operation of the railroad, the public is not considered in delineating this region of influence.) The nonradiological region of influence includes:

- The nominal width of the Caliente rail alignment construction right-of-way
- Public roads in Lincoln, Nye, and Esmeralda Counties that the railroad workforce would use during railroad construction and operations
- Railroad construction and operations support facilities including access roads, water wells, and quarries, where workers would perform construction, operations, or maintenance activities; operations support facilities include the following:
  - Interchange Yard
  - Staging Yard
  - Maintenance-of-Way Facilities
  - Satellite Maintenance-of-Way Facilities
  - Rail Equipment Maintenance Yard
  - Cask Maintenance Facility
  - ***Nevada Railroad Control Center*** and National Transportation Operations Center

- Construction support facilities include the following:
  - Quarries
  - Concrete batch plants
  - Construction camps
  - Water wells

The region of influence for potential occupational nonradiological impacts to workers includes the rail line right-of-way and construction and operations support facilities where the proposed workforce would work.

3.2.10.1.2 Radiological Region of Influence

The region of influence for potential occupational radiological impacts to workers during incident-free operation of the railroad includes the physical boundaries of railroad operations support facilities, where workers would perform activities involving the inspection, handling, and transportation of ***spent nuclear fuel*** and ***high-level radioactive waste***. Operations support facilities within the radiological region of influence include only the Interchange Yard, the Staging Yard, the Rail Equipment Maintenance Yard, and the Cask Maintenance Facility because DOE anticipates that the potential for workers to be exposed to ***ionizing radiation*** from ***radioactive*** materials will occur only at those facilities. Radioactive materials would not be handled at the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Headquarters Facility, the Satellite Maintenance-of-Way Facilities, or the Maintenance-of-Way Trackside Facility. Radioactive materials also would not be handled at any of the construction support facilities.

The region of influence for potential radiological impacts to members of the public during incident-free transportation involves the area 0.8 kilometer (0.5 mile) on either side of the centerline of the Caliente rail alignment, which, for purposes of analysis, includes operation of cask trains and repository construction and supplies trains from Caliente or Eccles to the Rail Equipment Maintenance Yard. The members of the public assumed to be present in this region of influence are residents and other people located within the region of influence of the Caliente rail alignment, including people who live within 0.8 kilometer of either side of the centerline of the rail alignment from Caliente or Eccles to the Rail Equipment Maintenance Yard. For the public radiological impact analysis, DOE evaluated four specific alignments: the alignment that would have the largest population within the region of influence, the shortest alignment, the longest alignment, and the alignment with the smallest population within the region of influence (Table 3-67). Populations considered for the four evaluated alignments would include:

- Populations within 0.8 kilometer of either side of the centerline of the rail alignment. These populations are based on 2000 Census data.
- Populations within 0.8 kilometer of the Interchange Yard and the Staging Yard. These populations are also based on 2000 Census data. Based on the three possible locations of the Staging Yard, DOE anticipates that there could be members of the public within the region of influence for the facility. The populations considered within 0.8 kilometer of the Interchange Yard and Staging Yard footprint for the three locations would include:
  - The population around Eccles-North location for the Staging Yard
  - The population around Caliente-Indian Cove location for the Staging Yard
  - The population around Caliente-Upland location for the Staging Yard
- Individuals at locations such as residences or businesses near the rail alignment.

The region of influence for radiological impacts to workers and the public from radiological accidents and acts of sabotage or terrorism includes the area within 80 kilometers (50 miles) on either side of the

centerline of the rail alignment. The populations assumed to be present in this area are based on 2000 Census data. This region of influence is the same as the region of influence in the Repository SEIS.

DOE used the radiological region of influence to identify the population potentially affected by exposure to radiation from routine operation of the railroad and in the event of an accident. The 0.8-kilometer (0.5-mile) distance DOE applied in this Rail Alignment EIS to estimate the potentially affected population for incident-free transportation of spent nuclear fuel casks (see Appendix K, Section K.2.1.1) and the 80-kilometer (50-mile) distance to estimate the potentially affected population for accident analyses (see Appendix K, Section K.2.4) are standard distances that the Department has used in radiological transportation risk assessments (DIRS 185281-ACE 1972, all).

Table 3-67. Caliente rail alignments evaluated for radiological impacts to members of the public.[a]

Alignment with the largest population	Alignment with the smallest population	Longest alignment	Shortest alignment
279 people	78 people	112 people	213 people
335 miles	329 miles	336 miles	328 miles
Caliente alternative segment	Eccles alternative segment	Eccles alternative segment	Caliente alternative segment
Caliente common segment 1	Caliente common segment 1	Caliente common segment 1	Caliente common segment 1
Garden Valley alternative segment 2	Garden Valley alternative segment 3	Garden Valley alternative segment 3	Garden Valley alternative segment 1
Caliente common segment 2	Caliente common segment 2	Caliente common segment 2	Caliente common segment 2
South Reveille alternative segment 3	South Reveille alternative segment 2	South Reveille alternative segment 3	South Reveille alternative segment 2
Caliente common segment 3	Caliente common segment 3	Caliente common segment 3	Caliente common segment 3
Goldfield alternative segment 4	Goldfield alternative segment 1	Goldfield alternative segment 4	Goldfield alternative segment 1
Caliente common segment 4	Caliente common segment 4	Caliente common segment 4	Caliente common segment 4
Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3	Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3
Common segment 5	Common segment 5	Common segment 5	Common segment 5
Oasis Valley alternative segment 3	Oasis Valley alternative segment 1	Oasis Valley alternative segment 3	Oasis Valley alternative segment 1
Common segment 6	Common segment 6	Common segment 6	Common segment 6

a. Populations based on 2000 Census data.

3.2.10.1.3 Nonradiological Transportation Region of Influence

The region of influence for the analysis of potential nonradiological roadway and railway transportation accidents includes public roadways in the vicinity of the Caliente rail alignment upon which workers and materials associated with the construction and operation of the rail line and facilities would be transported, and the Caliente rail line right-of-way and the rail alignment itself, upon which spent nuclear fuel, high-level radioactive waste, and other materials would be transported. The region of influence for the analysis of potential roadway and railway transportation accidents is primarily in remote and rural areas of Nevada, and there are no other operating railroads along the Caliente rail alignment or that intersect the Caliente rail alignment. Although the existing Union Pacific Railroad Mainline that serves southern Nevada is used as a point of comparison for the analysis in Section 4.2.10, this Rail Alignment EIS does not assess the impacts to the Union Pacific Railroad Mainline from the Proposed Action.

During railroad construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. Most of the Caliente rail alignment would be within Nevada Department of Transportation District 1 and would cross Lincoln, Nye, and Esmeralda Counties. The region of influence focuses on the vicinity of the Caliente rail alignment, but also includes other public roadways that DOE could use to supply materials, equipment, and workers during the construction phase. During construction, completed segments of the rail line could be used to transport goods and services to construction sites and camps.

3.2.10.2 Nonradiological Health and Safety Environment

Nonradiological occupational health and safety considers potential recordable incidents, lost time accidents, and worker fatalities resulting from potential exposure of workers to physical hazards and nonradiological hazardous chemicals in their work environment during railroad construction and operations. The affected environment for nonradiological occupational health and safety also includes potential occupational health effects from exposure to exhaust emissions from vehicles and heavy equipment, including, for example, earth-moving equipment.

Nonradiological public health and safety addresses potential exposure of members of the public to nonradiological chemical hazards and vehicle emissions that would result from railroad construction and operations. Section 3.2.4, Air Quality and Climate, and Section 3.2.8, Noise and Vibration, describe the affected environments for potential public exposure to criteria and nonradiological ***hazardous air pollutants***, including vehicle emissions, and potential exposure to noise and vibration from railroad construction and operations.

The types of potential nonradiological health and safety hazards to construction workers and operations and maintenance workers under the Proposed Action include:

- Incidents resulting from physical hazards, such as occupational injuries and illnesses resulting in reportable cases, ***lost workday cases***, and fatalities. Fatalities could occur on or off the work site as a result of an incident or illness experienced on the work site. Physical hazards could include the potential for falls, excavation and confined-space entry hazards, mechanical hazards, electrical hazards, ergonomic hazards, heavy construction equipment (not passenger vehicles) hazards, and illnesses related to workplace exposure to chemical hazards.
- Off-site vehicle emissions-related health effects, such as health effects related to off-site vehicular emissions from transportation of construction workers, equipment, and materials and wastes to and from the construction sites.
- On-site vehicle and heavy equipment-related health effects, such as health effects related to diesel-engine exhaust emissions from vehicles and heavy equipment operated by construction workers on the construction sites. These health effects encompass workers who could be exposed to vehicular and heavy equipment emissions.
- Incidents resulting from other nonradiological chemical hazards, such as occupational exposure to chemicals (such as solvents and lubricants), dust (such as silica dust), and other nonradiological substances from railroad construction and operations. The U.S. Department of Labor Bureau of Labor Statistics incident rates include occupational illnesses and fatalities that could result from nonradiological chemical exposure. However, the Bureau of Labor Statistics incident rates do not include a breakdown by incident type (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).
- Noise hazards, such as short-term or long-term occupational exposure to noise that could impair hearing.

- Biological hazards that workers could encounter, such as venomous animals, West Nile Virus, Valley Fever, Hantavirus, and rabies.

3.2.10.3 Radiological Health and Safety Environment

There are ambient levels of radiation in the vicinity of the Caliente rail alignment, just as there are around the world. All people are inevitably exposed to the three sources of ionizing radiation: sources of natural origin unaffected by human activities, sources of natural origin but affected by human activities (called enhanced natural sources), and manmade sources. Natural sources (natural background radiation) include ***cosmic radiation*** from space, ***cosmogenic radionuclides*** produced when cosmic radiation interacts with matter in the atmosphere or ground, and naturally occurring, long-lived ***primordial radionuclides*** in the Earth's mantle. Enhanced natural sources include those that can increase exposure as a result of human actions, deliberate or otherwise. For example, a mill tailings pile from a uranium extraction process probably would contain concentrated levels of naturally occurring ***radionuclides***. A variety of radiation exposures, generally smaller than those caused by natural sources, result from manmade sources including nuclear medicine, medical ***X-rays***, and consumer products.

Natural background radiation is the largest contributor to the average radiation dose of individuals. The natural occurrence of cosmic radiation, cosmogenic radionuclides, and primordial radionuclides varies throughout the world depending on such factors as altitude and geology. External radiation comes from all three of these natural sources, but cosmic radiation and radiation from primordial radionuclides are the largest contributors to dose. Cosmic radiation consists of charged particles (primarily protons from extraterrestrial sources) that have sufficiently high energies to generate secondary particles that have direct and indirect ionizing properties. The three main primordial radionuclide contributors to external terrestrial gamma radiation are potassium-40 and the members of the thorium and uranium ***decay series***. Most external terrestrial gamma radiation comes from the top 20 centimeters (8 inches) of soil, with a small contribution from airborne radon ***decay*** products.

Internal radiation dose from natural sources comes primarily from the primordial radionuclides and their ***decay products***. The largest individual source of internal dose comes from the inhalation of radon-222 and its decay products, which are all members of the uranium-238 decay series. This exposure comes mainly from inhalation of these radionuclides in indoor air, coming from the soil underneath buildings. All of the primordial radionuclides are in the body in various concentrations, incorporated by ingesting or inhaling these radionuclides in air, water, and all types of food products. Although of smaller importance to natural internal dose than the other mechanisms, four cosmogenic radionuclides, tritium (hydrogen-3), beryllium-7, carbon-14, and sodium-22, produce quantifiable internal doses. Table 3-68 lists estimated radiation doses to individuals from natural sources in the region of influence and other locations in the United States. The radiation doses shown in the table are in terms of ***effective dose equivalent***, which is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body. Effective ***dose equivalent*** has units of ***rem***.

Table 3-68 lists the background radiation results for Tonopah, Las Vegas, Goldfield, Beatty, Caliente, and Town of Amargosa Valley. DOE obtained cosmic and terrestrial background radiation for these Nevada locations from the Desert Research Institute Community Environmental Monitoring Program (DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all) based on radiological monitoring data from September 1999 through 2006. The average background radiation for the United States, including terrestrial and cosmic radiation, radon exposure, and natural radiation in the body, is 300 millirem per year, with radon exposure comprising 200 millirem per year, cosmic and terrestrial radiation comprising 55 millirem per year, and natural body radiation comprising 39 millirem per year (DIRS 100473-National Research Council 1990). The background radiation for Las Vegas (the closest large city

to the Caliente rail alignment region of influence) is 327 millirem per year, with cosmic and terrestrial radiation doses resulting in a slightly higher total annual dose than the average for the United States (DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all). The background radiation for the reported locations within the region of influence range from 327 millirem per year to 399 millirem per year. Background data include background radiation resulting from fallout.

The Yucca Mountain FEIS includes a detailed discussion (DIRS 155970-DOE 2002, pp. 3-95 to 3-101) of the natural radiation levels, mineral-related radiation risks, and historical activities in the Yucca Mountain region that might have resulted in radiation effects to workers and the public.

Table 3-68. Radiation exposure from natural sources.

	Annual dose in millirem (effective dose equivalent)							
Source[a]	National	Tonopah	Las Vegas	Caliente	Beatty	Amargosa Valley	Goldfield	Yucca Mountain
Cosmic and terrestrial	55	143	88[b]	133[b]	150[b]	107[b]	130[b]	160[b]
Radon in homes (inhaled)[c]	200	200	200	200	200	200	200	200
Naturally occurring radiation in the body	39	39	39	39	39	39	39	39
Totals[d]	300	382	327	372	389	346	369	399

a. Sources: DIRS 100473-National Research Council 1990, p. 18, Table 1-3; DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all.
b. Combined cosmic and terrestrial radiation sources.
c. Value for radon is an average for the United States.
d. Totals might differ from sums of values due to rounding.

3.2.10.4 Background Radiation at the Yucca Mountain Site

Ambient radiation levels from cosmic and terrestrial sources in the Yucca Mountain region are higher than the United States average. The higher elevation at Yucca Mountain results in higher levels of cosmic radiation because there is less ***shielding*** by the atmosphere. The United States average for cosmic and terrestrial radiation exposures is 55 millirem per year (DIRS 100473-National Research Council 1990, p. 18, Table 1-3). The exposures at the Yucca Mountain ridge and Yucca Mountain surface facilities are about 160 and 150 millirem per year, respectively. Moreover, there are higher amounts of naturally occurring radionuclides in the soil and parent rock of this region than in some other regions of the United States, which also results in higher radiation doses

Sources of Radiation Exposure

Nationwide, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade sources. The relative contributions by radiation source to people living in the United States are (DIRS 155970-DOE 2002, p. F-4):

- Radon in homes and buildings: 200 millirem per year
- Medical radiation: 53 millirem per year
- Internal radiation from food and water: 40 millirem per year
- Terrestrial (external radiation from rocks and soil): 28 millirem per year
- Cosmic (external radiation from outer space): 27 millirem per year
- Consumer products: 10 millirem per year
- Other sources: Less than 1 millirem per year

Radiation: Radiation is energy travelling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. In this Rail Alignment EIS the word "radiation" refers to ionizing radiation. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.

Cosmic radiation: A variety of high-energy particles including protons that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level where the Earth's atmosphere is most dense and provides the greatest protection.

Cosmogenic radionuclides: Radioactive nuclides generated when the upper atmosphere interacts with many of the cosmic radiations. Despite their short half-lives, they are found in nature because their supply is always being replenished.

Decay product: A nuclide resulting from the radioactive decay of a parent isotope or precursor nuclide. The decay product might be stable or it might decay to form a decay product of its own.

Decay series: The succession of elements initiated in the radioactive decay of a parent, as thorium or uranium, each of which decays into the next until a stable element, usually lead, is produced.

Effective dose equivalent: Often referred to simply as dose, it is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body.

Half-life: The time in which half the atoms of a radioactive substance decay to another nuclear form. Half-lives range from millionths of a second to billions of years depending on the stability of the nuclei.

Primordial radionuclides originate mainly from the interiors of stars and are still present because their half-lives are so long that they have not yet completely decayed.

3.2.10.5 Transportation Health and Safety Environment

3.2.10.5.1 Public Roadways

Because the region of influence includes public roads primarily located in remote and rural areas, the Caliente rail alignment would cross areas with relatively low traffic volumes. Section 3.2.9, Socioeconomics, describes the public road infrastructure and baseline traffic conditions along the Caliente rail alignment in more detail. In summary, the Caliente rail alignment would cross paved highways with low traffic volumes and unpaved roads with low traffic volumes. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these unpaved roads are not heavily traveled.

Table 3-69 lists the paved highways the Caliente rail alignment would cross. Figure 2-4 shows the locations of these crossings (DIRS 180916-Nevada Rail Partners 2007, Table D-1 to D-2). Additionally, the primary paved highways near the Caliente rail alignment are U.S. Highway 93 and State Route 318 in the eastern portion of the rail alignment; State Route 375 in the central portion; and U.S. Highway 95 in the western portion. Overall highway safety statistics for Nevada show that the fatality rate per 100 million vehicle-miles traveled is approximately 1.28 (1.65 in rural areas). The national average is approximately 40 percent lower at 0.91 fatalities per 100 million vehicle-miles traveled (1.42 in rural areas) (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2).

Table 3-69. Potential rail line crossings of main highways.

Segment	Highway	County
Caliente and Eccles alternative segments; Caliente common segment 1	U.S. Highway 93	Lincoln
Caliente common segment 1	State Route 318	Lincoln
Caliente common segment 2	State Route 375	Nye
Goldfield 4 alternative segment	U.S. Highway 95 (at two locations)	Esmeralda

3.2.10.5.2 Railroad Accidents

This section describes the general characteristics of railroad accidents in the United States and in the State of Nevada. DOE commissioned a railroad study – *The Nevada Railroad System: Physical, Operational, and Accident Characteristics* (DIRS 104735-YMP 1991, all) (the Nevada railroad study), which covers the period between 1979 and 1988. Because the number of annual rail-related accidents and incidents in Nevada is very small, it is difficult to draw conclusions about how the safety of rail operations in Nevada has changed since 1988. However, the study is the most comprehensive and relevant rail-accident study to date regarding the State of Nevada and it provides some insights into the general characteristics of rail accidents in Nevada and the United States. The study presented information on types, causes, and frequency of railroad accidents; accident locations; and some of the more significant accidents from 1979 through 1988. The important findings of the Nevada railroad study were:

- Numbers and types of accidents. During the study period, the numbers of reported rail accidents in Nevada and the entire United States were 208 and 48,256, respectively. The most common accident types for Nevada and the rest of the United States were derailment and rail–highway crossing collision.
- Causes of rail accidents. Track/roadbed conditions caused proportionately more accidents in the rest of the United States than in Nevada, and mechanical/electrical failure caused proportionately more accidents in Nevada than in the rest of the United States. Nevada showed a higher proportion of its reported accidents in the higher speed ranges than did the rest of the Nation.
- Speeds at times of accidents. In general, most rail accidents happened at very low speeds. Approximately half of all reported accidents in Nevada occurred at speeds of 16 kilometers (10 miles) per hour or less, and 40 percent of all accidents in Nevada were at 8 kilometers (5 miles) per hour or less. Nationally, 73 percent of all accidents occurred at 16 kilometers per hour or less, and 53 percent of all rail accidents occurred at 8 kilometers per hour or less.
- Elapsed time on duty. The Nevada railroad study showed that about 45 percent of all accidents occurred within the first 4 hours on duty, approximately 41 percent occurred between 4 to 8 hours on duty, and approximately 14 percent occurred after 8 hours on duty.
- Weather and time of day. In Nevada, approximately 73 percent of all accidents reported occurred in clear weather, while approximately 19 percent occurred in cloudy weather. Rain, fog, and snow accounted for lower proportions. In Nevada, approximately half (49 percent) of all rail accidents occurred at night. Nationally, approximately 42 percent of all accidents occurred at night.
- Locations of accidents. The Nevada railroad study revealed that accidents occur at slightly higher rates at switchyard tracks.
- Rail–highway ***at-grade crossing*** accidents. Excluding the switching and handling incidents, rail accidents seemed to occur at random locations. The notable exception was rail–highway at-grade

crossings. In the United States, rail–highway at-grade crossings in general were a higher accident location.

- Fatal rail accidents. Fewer accidents occurred at the higher speeds, but the chance that an accident, once it did occur, produced a fatality increased as speed increased. Comparing the total number of accidents at each speed interval to the total number of fatal accidents at each speed interval revealed that an accident occurring at more than 97 kilometers (60 miles) per hour was 31 times more likely to cause a fatality than an accident occurring at 8 kilometers (5 miles) per hour or less.

With the exception of accident causes, the Nevada railroad study found that rail-accident characteristics in Nevada were not markedly different from rail-accident characteristics in the rest of the United States. The most apparent differences related to the relatively large proportion of Nevada rail lines in open country where higher operating speeds are maintained, compared to the United States as a whole. Most rail accidents, both in Nevada and in the rest of the United States, happened at very low speeds. Nevada showed a slightly higher number of high-speed accidents compared to the national average. The Nevada railroad study also showed that Nevada had a larger percentage of accidents caused by equipment failure and human factors and that for accidents involving only rail equipment, there were no classical "high" accident locations as there typically are with highway transport. Instead, minor accidents tended to happen in rail yards and during switching operations. More severe accidents, occurring at higher speeds on open track, seemed to happen at random.

Railroads are required by law to submit accident/incident reports within 30 days after the end of the month to which they pertain. The Federal Railroad Administration annually publishes *Railroad Safety Statistics*, which contains statistical data, tables, and charts based on railroad accident reporting. In this publication, the terms "accidents" and "incidents" are used to describe the entire list of reportable events, which includes collisions, derailments, and other events involving the operation of on-track equipment and causing reportable damage above an established threshold; impacts between railroad on-track equipment and highway users at crossings; and all other incidents or exposures that cause a fatality or injury to any person, or an occupational illness to a railroad employee. As defined in *Railroad Safety Statistics*, accidents/incidents are divided into three major groups for reporting purposes:

- Train accident. A safety-related event involving on-track rail equipment (both standing and moving), causing monetary damage to the rail equipment and track above a prescribed amount.
- Highway–rail grade crossing incident. Any impact between a rail and highway user (both motor vehicles and other users of the crossing) at a designated crossing site, including walkways, sidewalks, and the like, associated with the crossing.
- Other incident. Any death, injury, or occupational illness of a railroad employee that is not the result of a train accident or highway–rail incident.

Table 3-70 summarizes rail accident data from the *Railroad Safety Statistics – Annual Report 2004* for the years 2000 through 2004 (DIRS 178016-DOT 2005, pp.13 and 17). Accident and incident rates are not available for Nevada because train-mile data is only available on a nationwide basis.

The data listed in Table 3-70 reflect rail operations involving general freight service. ***Dedicated train*** service, which would be used to move cask railcars to the Yucca Mountain Repository, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, because shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, accident and incident rates for dedicated train service are expected to be lower than the ones listed in Table 3-70.

Table 3-70. Rail accidents in Nevada and the United States (2000 through 2004).[a]

	2000	2001	2002	2003	2004
Train accidents (excluding highway–rail crossing incidents)					
Nevada	12	14	9	8	17
United States	2,983	3,023	2,738	2,997	3,296
Train accidents rate (accidents per train-mile) (excluding highway–rail crossing incidents)					
Nevada	NA[b]	NA	NA	NA	NA
United States	4.1×10^{-06}	4.2×10^{-06}	3.8×10^{-06}	4.0×10^{-06}	4.3×10^{-06}
Total highway–rail incidents at public crossings[c]					
Nevada	1	2	1	1	2
United States	3,032	2,843	2,709	2,610	2,644
Total highway–rail incident rates (incidents per train-mile) at public crossings[c]					
Nevada	NA	NA	NA	NA	NA
United States	4.2×10^{-06}	4.0×10^{-06}	3.7×10^{-06}	3.5×10^{-06}	3.4×10^{-06}

a. Source: DIRS 178016-DOT 2005, pp. 13 and 17.
b. NA = Not available.
c. Any impact, regardless of severity, between railroad on-track equipment and any user of a public or private crossing site must be reported to the U.S. Department of Transportation, Federal Railroad Administration, on Form F 6180.57. The crossing site includes sidewalks and pathways at, or associated with, the crossing. Counts of fatalities and injuries include motor vehicle occupants, people not in vehicles or on the trains, and people on the train or railroad equipment.

3.2.11 UTILITIES, ENERGY, AND MATERIALS

This section describes the affected environment for public-service utilities (water, wastewater treatment, telecommunications, and electricity), energy (fossil fuels), and construction materials within the Caliente rail alignment region of influence.

Section 3.2.11.1 describes the regions of influence for utilities, energy resources, and construction materials; Section 3.2.11.2 describes public-service utilities in the region of influence; Section 3.2.11.3 describes energy resources (not related to public-service utilities) in the region of influence; and Section 3.2.11.4 describes resources for construction materials in their regions of influence.

3.2.11.1 Regions of Influence

3.2.11.1.1 Regions of Influence for Utilities

The regions of influence for public water systems, wastewater treatment, telecommunications, and electricity differ and are described below.

- Public water systems: The region of influence for public water systems is Lincoln, Nye, and Esmeralda Counties and communities within those counties.
- Wastewater treatment**:** The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lincoln, Nye, and Esmeralda Counties and communities within those counties. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], DOE would recycle treated wastewater, and there is no associated region of influence.)
- Telecommunications: The region of influence for telephone and fiber-optic telecommunications is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc.
- Electricity: The region of influence for electric-power resources includes areas serviced by the southern Nevada electrical grid operated by Caliente Public Utilities, Lincoln County Power District No. 1, Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc.

3.2.11.1.2 Region of Influence for Energy Resources (Fossil Fuels)

The description of the affected environment for energy resources focuses on consumption of fossil fuels. For purposes of this analysis, the region of influence for fossil fuels is limited to regional suppliers within the State of Nevada.

3.2.11.1.3 Regions of Influence for Construction Materials

Construction materials include concrete, ballast, subballast, steel, steel rail, and general building materials. The region of influence for each material is defined by the distribution networks and suppliers of that material to the general project area.

The region of influence for cast-in-place concrete and subballast is limited to the State of Nevada. Subballast, sand, and gravel would be generated from available sources within the rail roadbed earthwork area, overburden at quarries, and borrow sites near the rail alignment. There is a high likelihood DOE would also find subballast, sand, and gravel along cuts for the rail line on alluvial fans. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 183643-Shannon & Wilson 2007, pp. 24 to 26).

DOE would obtain ballast rock from potential quarry sites close to the rail line construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase.

Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete, could be procured and shipped on a national level. Therefore, the region of influence for these materials is national.

3.2.11.2 Utilities

3.2.11.2.1 Utility Corridors and Rights-of-Way

Section 3.2.2, Land Use and Ownership, describes the major utilities and utility corridor networks in the Caliente rail alignment region of influence.

3.2.11.2.2 Public Water Systems

Figure 3-115 shows the locations of ***public water systems*** in Lincoln, Nye, and Esmeralda Counties. There are more than 100 regulated public water systems in these counties, including the 31 ***community water systems*** listed in Table 3-71.

Public water system: A water system that provides water for human consumption for an average of at least 25 persons per day (or 15 or more service connections) and is in use for at least 60 days each year.

Community water system: A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Non-transient, non-community water system: A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.

Source: 40 CFR 141.2.

Within the Caliente rail alignment region of influence, public water systems are generally in or near the City of Caliente, and the unincorporated towns of Town of Armargosa Valley, Beatty, and Pahrump. In addition, although not a community water system, the Yucca Mountain Site has a regulated public water system (NV0000867). This system is classified as a ***non-transient, non-community public water system***.

3.2.11.2.3 Wastewater-Treatment Facilities

DOE would treat wastewater using municipal wastewater-treatment facilities, on-site portable wastewater-treatment facilities (***package plants***), or a combination of the two.

Most communities in southern Nye County rely primarily on individual dwelling or small communal wastewater-treatment systems, with the exception of Beatty, which has municipal sewer service. For example, Pahrump has no community-wide wastewater-treatment system. Several wastewater-treatment units serve parts of the town, such as the dairy and the jail, but most households have septic-tank and drainage-field systems, which are likely to be typical of the small communities in southern Nye County.

Municipalities with wastewater-treatment facilities include Caliente, Goldfield, Beatty, Tonopah, and Round Mountain. Table 3-72 lists the capacity of each system and the current load.

In 2003, a grant from the U.S. Department of Agriculture, Rural Development Nevada, allowed the City of Caliente, in Lincoln County, to complete the rehabilitation of its wastewater-collection system. Infiltration to the collection line and overflows to sewage treatment ponds made this rehabilitation necessary (DIRS 173561-USDA 2004, p. 9).

In Esmeralda County, Goldfield's sewage collection system was built in the 1940s and 1950s, and some of the system's original terra-cotta pipes are deteriorating. There are two lagoons, each 4,000 square

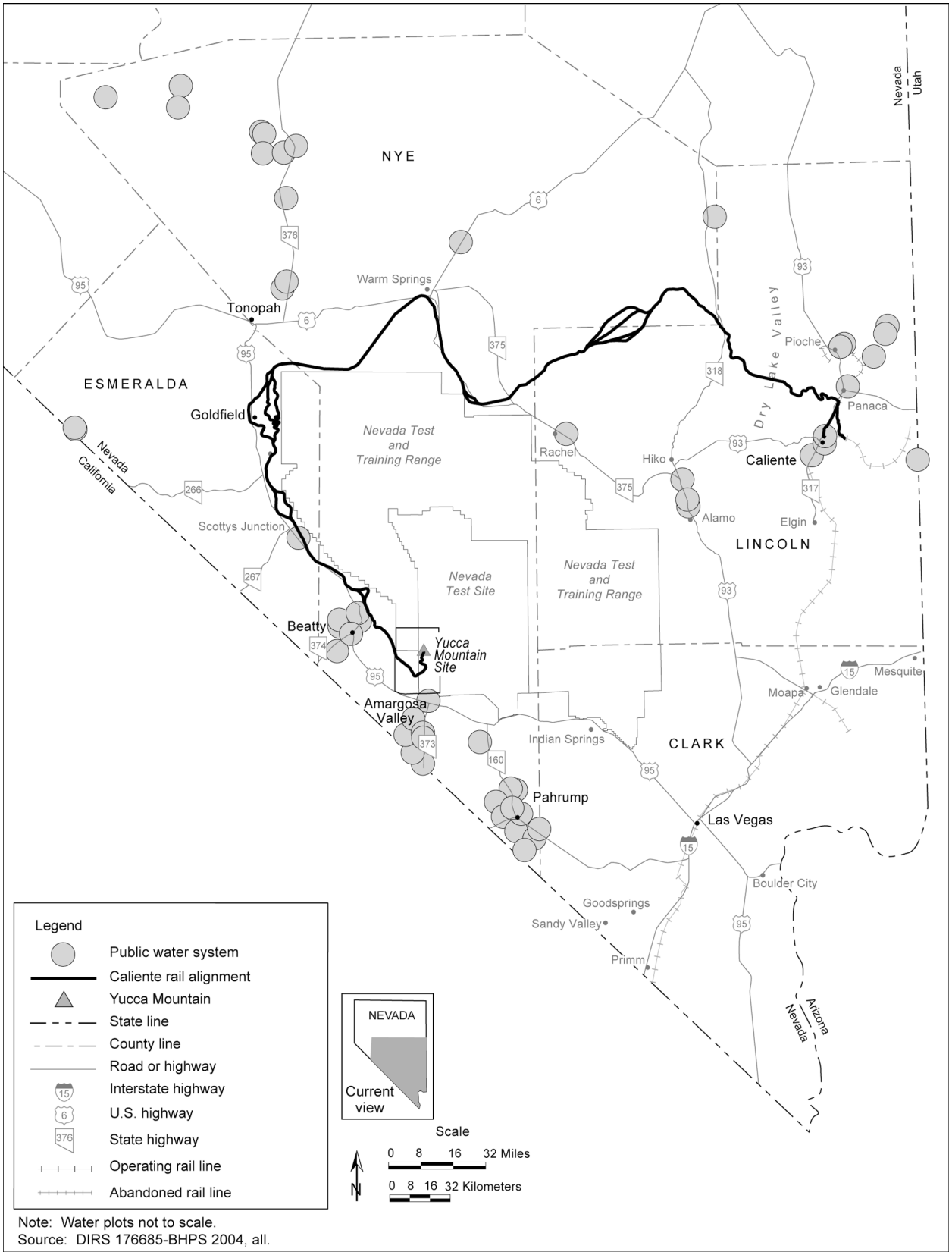


Figure 3-115. Public water systems in Lincoln, Esmeralda, and Nye Counties.

Table 3-71. Community water systems in Lincoln, Nye, and Esmeralda Counties.[a]

County	Public water supply identification number	Name
Lincoln	NV0000005	Alamo Sewer and Water
	NV0000013	Caliente Public Utilities
	NV0000185	Panaca Farmstead Water Association
	NV0000186	Pioche Public Utilities
	NV0000187	Pioche Public Utilities Castelton
Nye	NV0002558	Amargosa Valley Water Association
	NV0005033	Anchor Inn Mobile Home Park
	NV0000009	Beatty Water and Sanitation District
	NV0000362	Big Five Parks
	NV0000369	Big Valley Mobile Home Park
	NV0002538	C Valley Mobile Home Park
	NV0002589	Calvada North, Utilities Inc. of Central Nevada
	NV0000218	Carver Smokey Valley Recreational Vehicle and Mobile Home Park
	NV0005032	Country View Estates, Utilities Inc. of Central Nevada
	NV0000831	Desert Mirage Home Owners Association
	NV0000300	Desert Utilities
	NV0002552	Escapee Co-Op of Nevada
	NV0000063	Gabbs Water System
	NV0004074	Hadley Subdivision
	NV0000926	Hafen Ranch Estates
	NV0000175	Manhattan Town Water
	NV0000920	Mountain Falls Water System
	NV0005067	Mountain View Mobile Home Park, Utilities Inc. of Central Nevada
	NV0000183	Pahrump Mobile Home Park
	NV0005028	Shoshone Estates Water Company
	NV0000359	Shoshone Water Company
	NV0005066	Sunset Mobile Home Park
	NV0000237	Tonopah Public Utilities
	NVU0000270	Utilities Inc. of Central Nevada
Esmeralda	NV0000072	Goldfield Town Water
	NV0000363	Silver Peak Water System

a. Source: DIRS 176686-BHPS 2004, all.

Table 3-72. Municipal wastewater-treatment facilities in the Caliente rail alignment region of influence.

Location	Capacity (gallons per day)[a]	Existing load (gallons per day)
Alamo, Lincoln County	70,000[b]	60,000[b]
Caliente, Lincoln County	400,000[b]	260,000[b]
Panaca, Lincoln County	40,000[b]	80,000[b]
Pioche, Lincoln County	90,000[b]	90,000[b]
Beatty, Nye County	150,000[b]	110,000[b]
Gabbs, Nye County	50,000[b]	50,000[b]
Tonopah, Nye County	1,000,000[b]	420,000[b]
Round Mountain (Hadley Subdivision), Nye County	160,000[c]	70,000[c]
Goldfield, Esmeralda County	20,000[b]	30,000[b]

a. To convert gallons to liters, multiply by 3.78533.
b. Source: DIRS 178590 EPA 1999, all.
c. Source: DIRS 178697-Kaminski 2003, all.

meters (1 acre) in area, and a rapid infiltration system 1.6 kilometers (1 mile) north of Goldfield. The community has recently been awarded a $3 million grant under the Water Resource Development Act of 2000 (114 Stat. 2472) to renovate and upgrade the system. These renovations will allow Esmeralda County to increase the number of users served by its sewer system (DIRS 174751-Arcaya 2005, all).

3.2.11.2.4 Telecommunications Services

Local telephone service in the Caliente rail alignment region of influence is provided by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc. (DIRS 173401-Nevada Telecommunications Association 2005, all). One or more broadband providers (such as Comcast Cable and Bandwidth T1) serve Caliente, Tonopah, Goldfield, and Amargosa Valley (DIRS 176453-FCC 2005, pp. 348 to 350).

Wireless communication (cellular phones) is an increasingly important element in telecommunications. Among the national providers, only Verizon identifies much of the area containing the Caliente alignment as within its coverage area. That would include the alignment from Caliente north of Caliente. However, much of the alignment from where the alignment turns to the west is outside any coverage area, until just east of the Tonopah area. The Verizon coverage area picks up again and continues down the U.S. Highway 95 corridor. Actual signal strength between towns is variable and there may not be an available signal. Of the other national carriers, Cellular One identifies the U.S. Highway 95 corridor as not a primary coverage area but one where roaming charges may not apply for their national subscribers. Other national carriers identify the Caliente alignment area as having no coverage (Sprint) or areas where roaming may apply (Cingular and T-Mobile).

3.2.11.2.5 Electrical Services

Nevada Power Company is the electric utility serving most customers in southern Nevada, covering a territory of 12,000 square kilometers (4,600 square miles). Its customer base includes approximately 730,000 residential customers. The utility has 3,500 megawatts of generating capacity and purchases additional power to meet peak load demands of 6,300 megawatts. Nevada Power Company forecasts a 2.1 percent average annual rate of growth in peak-load demand through 2026. Total electricity sales in 2007 were expected to be 23 million megawatt-hours (DIRS 185100-Nevada State Office of Energy 2007, pp. 33 to 34).

Sierra Pacific Power Company serves 310,000 residential electricity customers in a 130,000-square-kilometer (50,000-square-mile) territory that encompasses Carson City, Reno, Winnemucca, Elko, and Tonopah in Nevada, as well as the Lake Tahoe area in northeastern California. The utility has 1,000 megawatts of generating capacity and purchases additional power to meet peak load demands of 1,800 megawatts. Sierra Pacific Power Company forecasts a 2.1 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2007 were expected to be 8.6 million megawatt-hours (DIRS 185100-Nevada State Office of Energy 2007, pp. 14 to 16). Both Nevada Power Company and Sierra Pacific Power Company are wholly owned subsidiaries of Sierra Pacific Resources.

Valley Electric Association, Inc., and Lincoln County Power District No. 1 are members of the Nevada Rural Electric Association. Nevada Rural Electric Association members are customer-owned, not-for-profit electric utilities with no generating capacity. They purchase power from other sources to supply rural customers.

Valley Electric Association, Inc., distributes power to southern Nye County, including the Pahrump Valley, Amargosa Valley, Beatty, and the Nevada Test Site. The Western Area Power Administration allocates a portion of the lower-cost hydroelectric power from the Colorado River dams to Valley Electric Association, Inc. The private power market supplies the supplemental power necessary to meet the needs of the members. Valley Electric Association, Inc., sales in 2005 were about 400,000 megawatt-hours to more than 19,000 members (DIRS 181273-VEA 2005, p. 3).

Lincoln County Power District No. 1 is a general improvement district that supplies power to about 800 customers, totaling more than 72,000 megawatt-hours per year (DIRS 185100-Nevada State Office of Energy 2007, p. 46). Its maximum peak load has been 16 megawatts. All of this power normally comes from the Hoover Dam, although a supplemental agreement with Nevada Power Company allows Lincoln County Power District No. 1 to buy extra energy when Colorado River levels are too low to support demand. Although demand has remained relatively steady over the past several years (growing by 1 to 2 percent per year), Lincoln County Power District No. 1 has plans to increase long-term supply by buying into the planned coal-fired Intermountain Power Project plant in Delta, Utah. This plant could be running as early as 2010, and Lincoln County would purchase 15 megawatts of additional capacity (DIRS 175509-Kahn 2005, all).

A small municipal utility, Caliente Public Utilities, purchases and then resells electricity to customers in Caliente. It sells less than 10,000 megawatt-hours annually and the reported peak load demand is 3 megawatts (DIRS 173383-Nevada State Office of Energy 2005, p. 39).

3.2.11.3 Energy

Existing fossil-fuel supplies within the Caliente rail alignment region of influence are available from nearby communities, mainly from relatively highly populated towns such as Tonopah, and along busy highways, such as on U.S. Highway 6 between Warm Springs and Tonopah. The regional supply system can respond flexibly to demand. Table 3-73 lists sales of distillate fuel oils (diesel fuel) in Nevada from 1997 through 2004. Fuel consumption remained fairly constant through 2003. The recent upward trend reflects current population growth in southern Nevada as a key determinant of total energy consumption closely linked to rising demand for housing, services, and travel.

Table 3-73. Sales of distillate fuel oils in Nevada, 1997 through 2004.

Year	Annual sales of distillate fuel oils (millions of gallons)[a]
1997	434[b]
1998	404[b]
1999	418[c]
2000	428[c]
2001	410[d]
2002	418[d]
2003	400[e]
2004	478[e]

a. To convert gallons to liters, multiply by 3.78533.
b. Source: DIRS 178588-EIA 1999, Table 4
c. Source: DIRS 178609-EIA 2001, Table 4.
d. Source: DIRS 173384-EIA 2003, Table 4.
e. Source: DIRS 176397-EIA 2005, Table 4.

3.2.11.4 Construction Materials

Most of the Caliente rail alignment area would be in the remote Nevada countryside, but would be within the southern Nevada supply chain for construction materials.

The region of influence for cast-in-place concrete is the State of Nevada, where annual production in 2004 equaled approximately 16 million metric tons (18 million tons) (DIRS 173400-NRMCA 2004, p. 2).

Precast concrete is available nationally, and annual national production in 2003 equaled approximately 15 million metric tons (17 million tons) (DIRS 173392-van Oss 2003, Table 15). Annual national production of pre-cast concrete railway ties was about 720,000 ties in 2004 and is projected to grow to about 1,180,000 ties by 2007 (DIRS 173573-Gauntt 2004, p. 17).

Ballast for rail roadbed construction is generally obtained locally because of the costs associated with transporting large volumes of these materials. Within the Caliente rail alignment region of influence there are large areas of public lands that contain materials suitable for use as ballast. DOE has identified six potential quarry sites near the Caliente rail alignment (see Chapter 2, Table 2-16) of which the Department could develop up to four. Following construction, the DOE-developed quarries would be closed. During the operations phase, DOE would obtain ballast for track maintenance commercially. The nearest active quarry to the region of influence is in Milford, Utah. The Milford Quarry is on the Union Pacific Railroad route that travels from Salt Lake City, Utah, to Los Angeles, California, and processes much of the high-quality ballast for the Union Pacific Railroad lines throughout the southwest. There is an active quarry at Oroville, California, approximately 650 kilometers (400 miles) west-northwest of Caliente, which is a commercial source of ballast in the western United States. Suitable sands and gravels would likely be available along cuts for the rail line and from overburden at potential quarry rock and borrow sites.

The steel market is worldwide in scope, but the region of influence DOE considered for steel supply is national. Raw production of carbon steel in the United States in 2003 equaled 86 million metric tons (95 million tons) (DIRS 173387-Fenton 2003, Table 1). Steel rail production equaled 540,000 metric tons (600,000 tons) in 2002 and 520,000 metric tons (570,000 tons) in 2003 (DIRS 173387-Fenton 2003, Table 3).

3.2.12 HAZARDOUS MATERIALS AND WASTE

This section describes existing facilities in Nevada that could receive and dispose of ***hazardous waste*** derived from hazardous materials, ***low-level radioactive wastes***, and nonhazardous waste associated with constructing and operating the proposed railroad along the Caliente rail alignment. Section 3.2.12.1 describes the region of influence for hazardous materials and wastes. Section 3.2.12.2 describes landfills for the disposal of nonhazardous, nonrecyclable, nonreusable wastes; Section 3.2.12.3 describes disposal facilities for hazardous wastes; and Section 3.2.12.4 describes the disposal of low-level radioactive wastes. Hazardous materials DOE might use during construction and operation of the proposed railroad are described throughout Section 4.2.12.

Hazardous waste: Waste designated as hazardous by U.S. Environmental Protection Agency or State of Nevada regulations. Hazardous waste, defined under the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq*.), is waste that poses a potential hazard to human health or the environment when improperly treated, stored, or disposed of. Hazardous wastes appear on special Environmental Protection Agency lists or possess at least one of the following characteristics: ignitability, corrosivity, toxicity, or reactivity.

Low-level radioactive waste: Radioactive waste that is not classified as high-level radioactive waste, transuranic waste, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries (42 U.S.C. 108).

3.2.12.1 Region of Influence

The region of influence for the use of hazardous materials and the generation of hazardous and nonhazardous wastes includes the nominal width of the rail line construction right-of-way, and the locations of railroad construction and operations support facilities.

The region of influence for the disposal of hazardous wastes includes the entire continental United States because commercial hazardous waste disposal vendors could utilize facilities throughout the country.

The region of influence for the disposal of nonhazardous waste includes the disposal facilities in Lincoln, Nye, Esmeralda, and Clark Counties in Nevada.

The region of influence for the disposal of low-level radioactive wastes includes DOE low-level waste disposal sites, sites in Agreement States, and U.S. Nuclear Regulatory Commission-licensed sites.

Industrial and special wastes: Construction debris and other ***solid waste***, such as tires, that have specific management requirements for permitted landfill disposal.

Solid waste: For purposes of this analysis, defined as nonhazardous general household waste.

3.2.12.2 Nonhazardous Waste Disposal

DOE would dispose of nonhazardous, nonrecyclable, nonreusable wastes in municipal landfills in Nevada. Nevada has 20 operating municipal landfills that combined accept more than 17,000 metric tons (19,000 tons) of waste per day (DIRS 184969-Nevada Division of Environmental Protection 2007, Appendix 3). According to the *Solid Waste Management Plan* (DIRS 184969-Nevada Division of Environmental Protection 2007, p. 7), Nevada municipalities have landfill capacity well into the future. Table 3-74 lists the capacities the Nevada Division of Environmental Protection reported in 2007 (DIRS 184969-Nevada Division of Environmental Protection 2007, Appendices 2 and 3) for the active landfills in Lincoln, Nye, Esmeralda, and Clark Counties. All of these landfills have permits to accept ***industrial and special wastes***.

DOE would utilize a contractor for the disposition of recyclable materials.

Table 3-74. Capacities of active landfills in Lincoln, Nye, Esmeralda, and Clark Counties.[a]

County	Facility name[b]	Operator	Capacity (cubic yards)[c]	Per day disposal rate (tons)[d]	Projected closure (year)
Lincoln	Crestline Class II	NORCAL Waste Systems	720,000	23	2063
	Mesquite Class I	City of Mesquite	1,900,000	130	2015
	Western Elite Class III	Western Elite, Inc.	12,520,000	NA[e]	2071
Nye	Round Mountain Class II	Nye County	700,000	15	2043
	Tonopah Class II	Nye County	290,000	21	2013
Esmeralda	Goldfield Class II	Esmeralda County	280,000	4	2123
Clark	Apex Regional Class I	Republic Services	865,000,000	11,650	2150
	Laughlin Class I	Republic Services	62,550,000	100	2022
	Wells Cargo Class III	Wells Cargo	40,880,000	1,330	2050
Totals			982,940,000	13,273	

a. Source: DIRS 184969-Nevada Division of Environmental Protection 2007, Appendices 2 and 3.
b. Class I landfills receive 20 tons or more of waste per day; Class II landfills receive less than 20 tons of waste per day; and Class III landfills receive only industrial waste. Each of these landfills accepts solid and industrial and special waste.
c. To convert cubic yards to cubic meters, multiply by 0.76456.
d. To convert tons to metric tons, multiply by 0.90718.
e. NA = data not available.

3.2.12.3 Hazardous Waste Disposal

The U.S. Ecology Treatment and Disposal Site in Beatty, Nevada, is a Nevada-permitted hazardous waste disposal site (DIRS 173918-American Ecology Corporation 2005, all). This facility treats and disposes of hazardous wastes and nonhazardous industrial wastes. Safety-Kleen Systems, Inc., operates a hazardous waste-permitted treatment, storage, and disposal facility in North Las Vegas, Nevada, and Philip Services Corporation operates a similar facility in Fernley, Nevada (DIRS 177662-NDEP 2006, all). Hazardous waste disposal capacity in western states has been estimated to be 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50).

3.2.12.4 Low-Level Radioactive Waste Disposal

Low-level radioactive wastes would be generated during operation of the Cask Maintenance Facility. Site-generated, low-level radioactive waste would be controlled and disposed of in a DOE low-level radioactive waste disposal site, in an Agreement State site, or in a U.S. Nuclear Regulatory Commission-licensed site subject to the completion of the appropriate review pursuant to the National Environmental Policy Act. Disposal in an Agreement State site or in a U.S. Nuclear Regulatory Commission-licensed site would be in accordance with applicable portions of 10 CFR Part 20. The Nevada Test Site accepts low-level radioactive waste for disposal and has an estimated disposal capacity of 3.7 million cubic meters (130 million cubic feet). DOE has estimated that approximately 1.1 million cubic meters (39 million cubic feet) of low-level radioactive wastes will be disposed of at the Nevada Test Site by 2070

from all potential sources, but not including Cask Maintenance Facility-generated wastes (DIRS 155970-DOE 2002, Section 3.1.12.4).

Commercial disposal capacity for low-level radioactive wastes is currently available in the United States. In addition to the Nevada Test Site, there are three existing commercial low-level radioactive waste disposal facilities in the United States: EnergySolutions Barnwell Operations in Barnwell, South Carolina; U.S. Ecology in Richland, Washington; and EnergySolutions Clive Operations in Clive, Utah. These facilities are in Agreement States and accept waste from all or parts of the Nation. The Nuclear Regulatory Commission evaluates Agreement State programs every 2 to 4 years to ensure consistency in the Nation's materials and safety programs. There are current or anticipated limitations associated with these three commercial disposal sites. EnergySolutions Barnwell Operations is scheduled to be closed to out-of-state waste in 2008; U.S. Ecology generally accepts waste only from sites in the regional compact that includes the State of Washington; and EnergySolutions Clive Operations is licensed to accept only Class A wastes. The regional compact that includes Washington has a contract for receiving low-level waste from the regional compact that includes Nevada but, if Barnwell closes, the U.S. Ecology facility would be the only licensed commercial facility available for disposal of Class B and C low-level waste.

3.2.13 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470), as amended, requires federal agencies to take into account the effects of their undertakings on historic properties. The procedures established by the Advisory Council on Historic Preservation, described in 36 CFR Part 800, define how federal agencies meet these statutory responsibilities. The section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation between the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess effects, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

Identification of sites eligible for listing on the *National Register of Historic Places* is a primary component of historical preservation work. Evaluation of archaeological sites with the purpose of determining National Register significance is accomplished through the application of eligibility criteria identified in 36 CFR Part 60, as follows:

> The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, material, workmanship, feeling and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Prehistoric archaeological sites are most often found eligible under criterion (d), while archaeological sites containing historical deposits and some prehistoric sites are also often considered under other criteria. For example, ordinarily, cemeteries, birthplaces or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories: (a) a religious property deriving primary significance from architectural or artistic distinction or historical importance; (b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; (c) a birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life; (d) a cemetery that derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; (e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; (f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or (g) a property achieving significance within the past 50 years if it is of exceptional importance.

Likewise, historic structures (as opposed to archaeological sites) are assessed under a variety of National Register criteria.

While nearly all sites have the potential to yield information useful in addressing a limited number of research questions, this limited potential is not considered sufficient to qualify a site for inclusion on the National Register under criterion (d). By establishing guidelines, agencies have clearly set the precedent that not all information is important, and thus, not all sites are important. Federal guidelines encourage the use of a set of research questions that are generally recognized as important research goals as a means of evaluating significance. If a site contains information that is demonstrably useful in answering such questions, it can be considered an important site. National Register evaluation guidelines state that a site must retain integrity to be considered eligible under one or more of the criteria.

The *National Register of Historic Places* describes buildings, structures, objects, sites, and districts that are at least 50 years old, or have achieved significance within the past 50 years. Archaeological resources are prehistoric or historic remains of human lifeways or activities that are at least 50 years old, and include artifact concentrations or scatters, whole or fragmentary tools, rock carvings or paintings, and buildings or structures. Resources that incorporate geographic areas, including both cultural and natural features, and that are associated with historic events or other cultural values include ***traditional cultural properties***, cultural landscapes (DIRS 174501-Birnbaum 1994, all), ***ethnographic landscapes*** (DIRS 155897-Parker and King 2002, all), rural historic landscapes (DIRS 155896-McClelland et al. 1990, all), and historic mining landscapes (DIRS 175489-Noble and Spude 1997, all).

For purposes of analysis in this Rail Alignment EIS, DOE has completed a sample inventory of the Caliente rail alignment alternative segments and common segments, which provides a thorough characterization of the nature and distribution of resources along the rail alignment. The Department would perform an intensive cultural resource inventory before starting construction of any specific alternative segment or common segment, and would compile a data recovery plan that would include prudent and feasible practices and measures to avoid or reduce potential adverse impacts to archaeological and historical resources.

This section focuses on cultural resources in the Caliente rail alignment region of influence, including those associated with the American Indian culture. Section 3.4 further identifies and discusses American Indian interests in the region. This section summarizes information obtained through a review of available data from federal, state, and local agencies, and findings of data-gathering efforts and field investigations.

Section 3.2.13.1 describes the region of influence for cultural resources along the Caliente rail alignment; Section 3.2.13.2 describes the methodology DOE used to identify such sources; Section 3.2.13.3 is a general description of the cultural resources setting and characteristics; Section 3.2.13.4 describes site-specific cultural resources; and Section 3.2.13.5 describes cultural resources for each Caliente alternative segment and common segment, including those associated with American Indian culture.

3.2.13.1 Region of Influence

The region of influence for the cultural resources analysis includes two levels of coverage that incorporate areas where construction or other land disturbances could directly or indirectly affect cultural resources:

- Level I – The first level of coverage is the nominal width of the construction right-of-way, the area where ground disturbance could have direct or ***indirect impacts*** on cultural resources. Under Section 106 of the National Historic Preservation Act, the Level I region of influence would comprise the project's Area of Potential Effect.
- Level II – The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment, and includes the area of potential disturbances that could have indirect impacts on cultural resources. Unless otherwise noted, references to historic and archaeological sites in the text that

follows refer to the Level II region of influence. For example, impacts could extend beyond this area where railroad operations and maintenance activities could have an aesthetic, auditory, or visual impact on a potentially significant historic or ***ethnographic*** vista.

3.2.13.2 Methodology

DOE prepared cultural resource documents to support the description of the affected environment and the impacts assessments for the Caliente rail alignment. For this analysis, the Department used the following methods to evaluate known and potential resources in the Caliente rail alignment region of influence:

- ***Class I inventory***. Reviewing existing cultural resource files, examining the literature, and interviewing knowledgeable people to identify potentially significant resources within the Level II region of influence of the alternative segments and common segments. DOE compiled the results into an historic context baseline report on cultural resources (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all) that establishes the basis for the analytical methodology and the results of the site-file and literature reviews. This report also lists all published and unpublished documents and archival sources DOE consulted during the analysis.
- ***Class II inventory***. Conducting a statistical sample field survey (DIRS 174691-BLM 1990, all) of the Level I region of influence for the alternative segments and common segments. The Class II inventory involved intensive inspection of 184 sample units that measured 122 meters (400 feet) by 800 meters (2,625 feet), centered on the rail alignment. This inventory was guided by a research design prepared in consultation with the BLM and State Historic Preservation Office and was designed to provide a 20-percent sample of the length of common segments and alternative segments. The results of this effort provide a predictive view of the possible types of cultural resources that might be expected to occur along the alternative segments and common segments and an evaluation of the possible significance of potential historic properties. To augment the Class II inventory and help to minimize later resource conflicts, DOE performed additional preliminary archaeological reconnaissance in locations of potential ballast quarries and areas of restricted construction right-of-way. The Class II survey report summarizes the results of this effort (DIRS 174689-HRA Conservation Archaeology 2005, all).
- Consultation with American Indians with regional ties. Interactions with American Indian tribes and organizations that have ties to the region to identify traditional cultural places within the Level I and II regions of influence that are important to American Indian cultural and religious values and beliefs, and to identify other resources, such as plants and animals, that might have historic or current uses. The perspectives of American Indian tribes and organizations that have traditional ties to the region of influence are compiled in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all), which assesses American Indian interests.

As previously noted, DOE prepared cultural resource reports to support the description of the affected environment and the impacts assessments for this Rail Alignment EIS. The reports include detailed information about the methods and investigative approaches DOE utilized and about evaluation of the findings. Preparation of the baseline resource reports involved consulting and citing a large number of published and unpublished sources, and contacting knowledgeable people, institutions, and offices holding relevant data.

DOE is using a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b)2, to identify specific cultural resources along a final alignment. Under this approach, DOE has completed Class I and Class II inventories of rail alignment alternative and common segments. The

Department would perform final field surveys (BLM Class III intensive inventories) of the actual right-of-way and centerline, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, p. 15). In the interim, the 20-percent Class II inventories have provided more than enough information to characterize the nature and distribution of cultural resources along the Caliente rail alignment alternative segments and common segments. Before starting any ground-disturbing activities that could affect cultural resources, the Department would perform the intensive ***Class III inventory*** of the selected alternative segments, site evaluations, impact assessments, and implement impacts reduction or prevention measures, as appropriate.

3.2.13.3 General Environmental Setting and Characteristics

Sections 3.2.13.3.1 through 3.2.13.3.4 summarize the prehistoric, American Indian, and Euroamerican cultural history of southern Nevada. Additional detail, including sources and references, is presented in the historic context report prepared in support of this Rail Alignment EIS (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all).

3.2.13.3.1 Prehistoric Period

Native people inhabited the region that encompasses the Caliente rail alignment for thousands of years and left artifacts and traces of their settlement and subsistence patterns and religious beliefs. The prehistoric archaeological record in the vicinity of the Caliente rail alignment is subdivided into the following three cultural periods:

- Pre-Archaic (11,500 to 7,500 years before present). The Pre-Archaic cultural period is marked by relatively few people, who traveled in small bands hunting game and gathering food. Archaeological sites dating to this period are commonly preserved on gravel bars and other landforms associated with ***pluvial lakes***, marshes, and riparian zones. These sites and their artifacts indicate a reliance on wetlands, with an emphasis on hunting large game. Isolated finds of distinctive fluted points associated with the Clovis and Folsom groups of people have a wide but sporadic distribution throughout the region.
- Early to Middle Archaic (7,500 to 1,500 years before present). During the Early to Middle Archaic cultural period, a shift occurred to a wider use of the environment, including sites near springs, perennial streams, caves, and rockshelters. A gradual increase in populations was marked by the use of plant seeds and nuts, along with hunting small game. Seventeen rockshelters dating to this period and the Late Archaic period have been investigated in the vicinity of the Caliente rail alignment.
- Late Archaic (1,500 to 150 years before present). Hallmarks of the Late Archaic cultural period include ceramics and small projectile points, along with the bow and arrow. Settlement patterns and subsistence practices continued from the earlier period, with sites in a variety of settings but clustered around permanent springs and riparian settings.

3.2.13.3.2 American Indian Historic Period

The Caliente rail alignment would cross lands historically occupied by two indigenous ethnic groups, the Western Shoshone and the Southern Paiute. Other neighboring groups, such as the Owens Valley Paiute and Shoshones from adjacent regions, had strong kinship ties and occasionally visited the region.

Both the Western Shoshone and the Southern Paiute were characterized by local subgroups, defined by slight language or dialectical differences, traditional centers of residential occupation, more or less regular home ranges or districts, and closeness of kin ties. Local subgroups clustered around small oases

scattered throughout the desert where springs and flowing streams could be found. Mountains and surrounding valleys were important resource collection areas, but seasonal changes in food availability prevented areas from being occupied year-round. Figure 3-116 shows areas occupied by these subgroups.

The Caliente rail alignment would cross or be adjacent to the territories of several American Indian subgroups. Western Shoshone areas include the Oge'pi District near Beatty; the Piadoya District in the Kawich Range, extending into Stone Cabin Valley and Reveille Valley; the Lida-Goldfield area; and other subgroups in Ralston Valley, Hot Creek Valley, and Railroad Valley. The eastern part of the rail alignment was inhabited by two Southern Paiute subgroups, the Pahranagat of the Pahranagat Valley and Pahroc Range areas, and the Panaca of Meadow Valley Wash near the present-day City of Caliente and town of Panaca. The Ash Meadows area was also traditionally a Southern Paiute District; after the contact period, large numbers of Western Shoshone intermarried into this area and the villages of Ash Meadows became mixed Southern Paiute/Western Shoshone settlements. The people of Ash Meadows maintained very close ties with Southern Paiute in the Pahrump Valley.

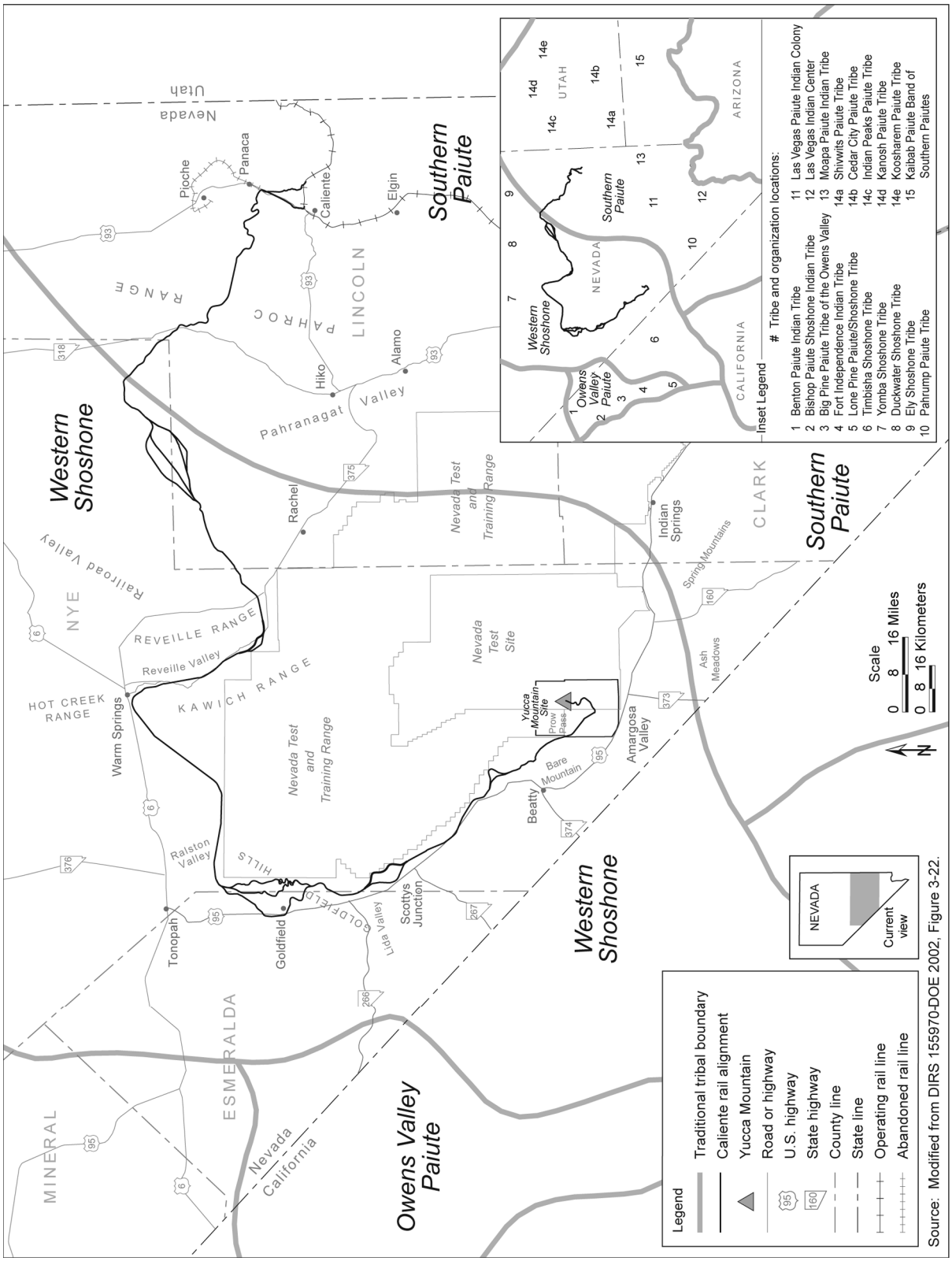
Following initial contact by European Americans in the early to middle 1800s, native people in central and southern Nevada began to adapt to changing conditions as settlement and development by miners, prospectors, and ranchers rapidly encroached on the landscape. As their essential resources were being lost to the Euroamerican expansion, both the Western Shoshone and the Southern Paiute were forced to confine their activities to selected reservations carved out of small portions of their traditional lands. Given the difficulties of making a living on these restricted areas, many responded by providing labor and other services to mining and ranching ventures, oftentimes living in mining towns or at ranches. In the vicinity of the region of influence, there were Indian encampments at mining communities in the Beatty-Bullfrog, Goldfield, Tonopah, Reveille Valley, and Panaca-Pioche areas. There was another Western Shoshone village on the eastern side of Stone Cabin Valley, where American Indians worked as ranch hands and laborers for the Reeds Ranch and the Reeds United Cattle and Packing Company, which operated over 12,000 square kilometers (3 million acres) between 1906 and 1940. American Indian children attended small schools set up at places such as Reeds Ranch and the Reveille Mill.

3.2.13.3.3 Euroamerican Historic Period

Initial forays by European Americans (settlers and explorers) into the region of influence began in 1849 along the Jayhawker's Emigrant Trail to California, which the eastern part of the Caliente rail alignment would cross. The alignment would also cross areas of later exploratory surveys by Lt. John C. Fremont, in 1854, and Lt. George Wheeler, in 1869 and 1872.

Settlement of the area began with Mormon colonization of Meadow Valley and Pahranagut Valley in the eastern part of the rail alignment. These efforts began in the late 1850s and involved both mining, primarily for silver and gold, and agricultural developments. Another early mining center was developed in the Reveille Range in the 1860s, with a mill built in Reveille Valley in 1869. Later mining districts that developed in the early 1900s include the Freiberg District in the northern Worthington Mountains and the Harriman, Eden, Clifford, Horseshoe, Bellehellen, Golden Arrow, and Blake's Camp Districts in the Kawich Range. Of these districts, only the Clifford District would be within the Caliente rail alignment region of influence, although resources that were common to mining, such as roads, might also be present. More extensive mining developments took place in the Goldfield area and in the vicinity of Beatty.

Contemporaneous with mining was widespread ranching that took advantage of the valley floors and adjacent mountain ranges for grazing of cattle and sheep. Within the Caliente rail alignment region of influence, early historic ranching operations are found in Reveille Valley, Stone Cabin Valley, and upper Oasis Valley along the Amargosa River drainage.



Source: Modified from DIRS 155970-DOE 2002, Figure 3-22.

Figure 3-116. Traditional boundaries and locations of federally recognized tribes.

3.2.13.3.4 Cultural Landscapes

Based on the literature review of the cultural history of the region of influence, DOE identified several examples of potential cultural landscapes reflecting significant ethnographic, mining, ranching, and railroading activities within the Level II region of influence that might be eligible for listing on the *National Register of Historic Places* (DIRS 174688-AGEISS 2005, all). These include:

- Ethnographic. Historic period Western Shoshone villages and surrounding use areas in Oasis Valley, the Goldfield area, Stone Cabin Valley, and Reveille Valley
- Rural historic. Early cattle ranching operations in Oasis Valley, Stone Cabin Valley, Reveille Valley, and Railroad Valley, sheep ranching in northern Garden Valley and Coal Valley (including the neighboring Quinn Canyon, Golden Gate, and Seaman Mountain Ranges), and the early Mormon settlement of Meadow Valley Wash
- Historic mining districts in the Goldfield, Clifford, and Reveille areas

3.2.13.4 Site-Specific Cultural Resources

The corridor through which the rail alignment would pass demonstrates a history of diverse prehistoric and historic land-use patterns. Native peoples occupied this area for many thousands of years, as exhibited by the archaeological sites identified in the area. These sites include campsites, rockshelters, rock-art sites, quarries, ***lithic scatters***, rock rings and alignments, and trail systems. Important residential camps dating to the early contact and ethnographic periods are also known. Euroamerican presence in the area is largely limited to the past 150 years or so, and is characterized by diverse activities represented at a wide variety of site types. Recorded and anticipated sites include early exploration and transportation features such as trails, wagon and stage roads; railroads and railroad camps and sidings; early ranching features such as homesteads, farms, and ranches; cattle and sheep camps, enclosures, and other features; mining features such as claim markers and mines, mills, and mining camps; and wells, pipelines, and irrigation systems. Isolated features and artifacts related to all of these activities can also be anticipated.

This section presents data on both previously recorded cultural resources and known, but unrecorded, properties along the Caliente rail alignment. This section first presents the results of the Class I site-file search of the Level II region of influence and the Class II inventory (field survey) of the Level I region of influence for the entire Caliente rail alignment, including alternative segments. The results are followed by a segment-by-segment discussion for each of the alternative segments and common segments. DOE based individual segment analyses on three data sources: (1) the known-site file search and literature review (DIRS 174688-AGEISS 2005, all); (2) the Class II inventory (DIRS 174689-HRA Conservation Archaeology 2005, all); and (3) information from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all). All references consulted or used in the different analyses can be found in those reports.

3.2.13.4.1 Previously Recorded Prehistoric Resources

A Class I site-file search for archaeological sites within the Level II region of influence identified 432 prehistoric recorded sites and ***isolates*** (Table 3-75). Of this total, 107 (25 percent) are isolated artifacts that were previously assigned archaeological site numbers. Although isolates are generally considered not eligible for listing on the *National Register of Historic Places*, they indicate, along with other types of sites, the presence of prehistoric people in the region of influence. A total of 118 (27 percent) of the sites and isolates have been recorded within the current ***Yucca Mountain Site boundary***, where there have been more intensive field surveys. Site-type terminology reflects the site classification system employed in the BLM Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, Section 3.9).

Table 3-75. Previously recorded prehistoric archaeological sites in the Level II region of influence.[a]

Site type	Number of sites and isolates	Eligible[b]	Not eligible	Unevaluated
Specialized activity areas (campsites)	23	12	4	7
Rockshelters	17	6	1	10
Rock-art sites	4	3	0	1
Toolstone sources and quarry sites	19	2	11	6
Specialized activity areas (lithic scatters)	254	7	207	40
Isolates[c]	107	0	103	4
Other:				
Rock ring	2	0	0	2
Rock features	5	0	5	0
Hearth	1	0	0	1
Unknown	0	0	0	0
Totals	432	30	331	71

a. Source: Data from a site-file search at Southern Nevada Site Survey Repository, Harry Reid Center for Environmental Studies, University of Nevada, Las Vegas (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for listing on the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system. Isolates are generally considered ineligible for listing on the *National Register of Historic Places*.

In total, 30 sites are considered eligible for listing on the *National Register of Historic Places*, including five prehistoric specialized activity area sites within the Level I region of influence.

3.2.13.4.2 Previously Recorded Historic Euroamerican Resources

A Class I site-file and literature search for historical Euroamerican sites within the Level II region of influence identified 147 historic sites and isolates (see Table 3-76). Of this total, 17 (11 percent) are isolated artifacts that were previously assigned site numbers and 47 (32 percent) sites have both prehistoric and historic components.

In total, 23 sites are considered eligible for listing on the *National Register of Historic Places*, and two of these sites, the Goldfield downtown district and the Caliente Union Pacific Depot, are listed on the National Register. Of the 23 eligible sites within the Level II region of influence, seven are within the Level I region of influence. Historic resources identified as being either within the Level I region of influence or adjacent thereto include the following:

- Caliente Union Pacific Depot, listed on the *National Register of Historic Places*. The depot is within the Caliente alternative segment.
- Meadow Valley. Early Mormon colonization; the Caliente and Eccles alternative segments would cross this valley.

Table 3-76. Previously recorded historic Euroamerican sites in the Level II region of influence.[a]

Site type	Number of sites	Eligible[b]	Not eligible	Unevaluated
Historic town sites	3	3 Goldfield downtown district listed on the *National Register of Historic Places*	0	0
Historic railways	10	5 Caliente Union Pacific Depot listed on the *National Register of Historic Places*	3	2
Historic mining sites	27	4	21	2
Historic ranching sites	4	1	1	2
Campsite	1	1	0	0
Historic roads	2	0	2	0
Historic cemetery	2	0	0	2
Historic debris scatters	34	1	30	3
Sites with both historic and prehistoric components	47	8	27	12
Isolates[c]	17	0	16	1
Totals	147	23	100	24

a. Source: Data from site-file search at Southern Nevada Site Survey Repository, Harry Reid Center for Environmental Studies, University of Nevada, Las Vegas (DIRS 174688-AGEISS 2005, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system.

- Historic railroads. The Las Vegas and Tonopah, Tonopah and Goldfield, and Union Pacific railroads, including the present-day mainline and the abandoned Caliente and Pioche spur line. The Caliente alternative segment would follow the Caliente and Pioche spur line for most of the segment's 18-kilometer (11-mile) length and Caliente common segment 4 would intersect or follow many segments of the Las Vegas and Tonopah line for 11 kilometers (7 miles), south of Goldfield. In these locations, DOE would refurbish the historic rail beds for use with the proposed rail line.
- Clifford Mine. In Stone Cabin Valley, within the Caliente common segment 4 Level II region of influence.
- Beatty Cattle Company Ranch and Colson Ranch, with associated Western Shoshone villages, Oasis Valley. One site is within the Oasis Valley alternative segment 3 Level II region of influence; the other is within the Oasis Valley alternative segment 1 Level II region of influence.

3.2.13.4.3 Known American Indian Resources

Previous American Indian studies and consultations associated with the Yucca Mountain Project, the Nevada Test Site, the Nevada Test and Training Range, and other projects have yielded significant information on the concerns of modern-day American Indians regarding traditional and cultural values (DIRS 174205-Kane et al. 2005, all). These concerns include evidence of their ancestors' occupation and use of traditional homelands, and their feelings about natural resources and geologic formations in the

region, such as plants, animals, and natural landforms that mark important locations. Opportunities for the identification of traditional cultural properties and additional places of concern to American Indians will remain open through the consultation process.

Based on past studies and research for this Rail Alignment EIS, DOE has obtained information regarding the following potentially eligible historic properties that could be of cultural value for American Indians:

- Hot springs, rockshelters, plant resources, and trails used by Southern Paiutes in the Caliente area, including Meadow Valley and Clover Creek. Within the Level II region of influence.
- Black Rock Spring Campsite in North Pahroc Range. Within the Level II region of influence.
- ***Petroglyphs***. Within the Level II region of influence.
- Western Shoshone camp in Reveille Valley. Within the Level II region of influence.
- Western Shoshone winter camp in the vicinity of Warm Springs. Within the Level II region of influence.
- Western Shoshone winter village of Hugwapagwa in Stone Cabin Valley. Within the Level II region of influence.
- Rabbit Spring Rock shelter camp near Goldfield. Within the Level II region of influence.
- Winter village, probable site of a Western Shoshone village named Matsum in the vicinity of Willow Springs. Within the Level II region of influence.
- Beatty area petroglyphs. Within the Level II region of influence.
- Western Shoshone Ogwe'pi District, a cluster of winter villages along the upper Oasis Valley and the headwaters of the Amargosa River, including two probable villages. Within or adjacent to Level II region of influence.
- Black Cone site, a place of religious significance near the Crater Flat area. Within the Level II region of influence.
- Significant crossroad where numerous traditional American Indian trails came together near Fortymile Wash. Within the Yucca Mountain Site boundary.
- Rock art near Busted Butte. Within the Yucca Mountain Site boundary.
- Prow Pass. Within the Yucca Mountain land withdrawal area.
- Cot Cave. Within the Yucca Mountain land withdrawal area.

3.2.13.5 Cultural Resources by Alternative Segments and Common Segments

Sections 3.2.13.5.1 through 3.2.13.5.12 describe the cultural resources for each of the Caliente rail alignment common segments and alternative segments, including data from the previously recorded Class I site-file and literature search (DIRS 174688-AGEISS 2005, all), the results of the Class II inventory (DIRS 174689-HRA Conservation Archaeology 2005, all), and associated American Indian interactions (DIRS 174205-Kane et al. 2005, all).

3.2.13.5.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline

3.2.13.5.1.1 Caliente Alternative Segment. The Class I site-file search identified 11 previously recorded cultural resources along the Caliente alternative segment. These resources include three prehistoric sites (two rockshelters and a campsite), three isolated artifacts, and five historic sites

(two railroad features, two trash scatters, and a cemetery). The search revealed that one site, the Caliente Union Pacific Railroad Depot, is listed on the *National Register of Historic Places* and two sites, the Caliente-Panaca Railroad ***berm*** and a prehistoric rockshelter site, are evaluated as eligible for listing on the *National Register of Historic Places.* The rails have been removed from the eligible railroad berm, but the proposed rail line would cover several undocumented wooden and metal bridges that remain. Additionally, the Caliente Union Pacific Railroad Depot, listed on the *National Register of Historic Places*, is in the middle of town, south of the proposed rail line departure point. Historic maps and photographs indicate several buildings, including a depot and a roundhouse, that existed in the area. It is probable that subsurface historical Euroamerican remains exist even though the structures have been removed.

Also in the vicinity of the Interface with the Union Pacific Railroad Mainline is the potential historic property of the Caliente Hot Springs Motel and Bath (Figure 3-117). The City of Caliente has other potential historic sites, including a hotel. Also of note, the hot springs were known to have been used by American Indian people for medicinal purposes.

The area known as Indian Cove, just north of the City of Caliente, through which the Caliente alternative segment would pass, has evidence of prehistoric use in the form of a previously recorded rockshelter (evaluated as eligible for listing on the *National Register of Historic Places*), an unevaluated rock-art panel, and lithic scatters and isolates.

Nearly the entire length of this segment would lie in the potential early Mormon colonization cultural landscape along Meadow Valley Wash. Examples of architecture typical of early Mormon farming ventures can still be found in the ranches and communities in this area. This segment is also characterized as a historic railroad alignment, but DOE could not inventory this area because the Department did not have the access to private property necessary to perform the inventory.

Most of the lands along the Caliente alternative segment are privately owned, but sufficient data have been collected on the area to characterize archaeological sensitivity. If DOE selected the Caliente alternative segment, the Department would complete the cultural resources inventory of this segment before starting construction.

There is a potential quarry site (CA-8B) along the Caliente alternative segment on the eastern exposure of a rocky ridge overlooking Meadow Valley Wash. Preliminary archaeological reconnaissance of the location did not identify any cultural materials or other evidence of prehistoric or historic activities.

3.2.13.5.1.2 Eccles Alternative Segment. The Class I site-file search identified three previously recorded cultural resources along the Eccles alternative segment. These resources include two prehistoric rockshelter sites and one isolated artifact. One rockshelter site is located in the Level I region of influence. If DOE selected the Eccles alternative segment, the Department would complete the cultural resources inventory along the segment, much of which lies on private property, prior to construction. However, there are two previously recorded but unevaluated prehistoric rockshelters in the vicinity of the proposed location of the Staging Yard (Eccles-North). The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also indicates that Clover Valley is a culturally important place with associated songs, plants and animals, and water resources.

DOE inventoried three Class II survey sample units along this segment, a total of 2.4 kilometers (1.5 miles). No sites were recorded, but five isolated artifact occurrences were found. In the area of the Meadow Valley Wash at the northern end of the segment, there is a potential early Mormon colonization cultural landscape.

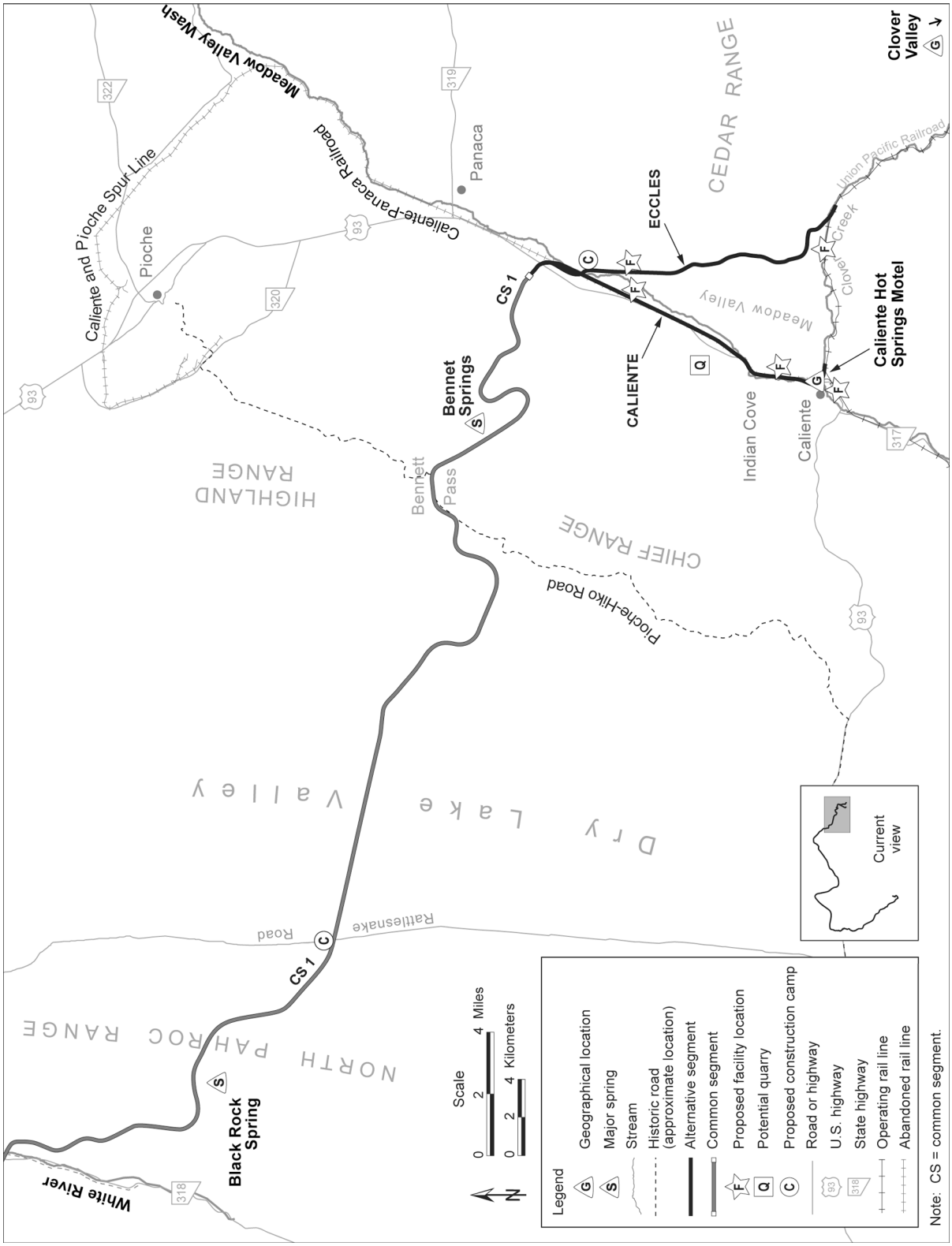


Figure 3-117. Major historic and geographical locations within map area 1.

3.2.13.5.2 Caliente Common Segment 1 (Dry Lake Valley Area)

The Class I site-file search identified 39 previously recorded cultural resources along Caliente common segment 1 (see Figure 3-118), including nine within the Level I region of influence. These resources include 11 prehistoric sites (a toolstone quarry locale and 10 lithic scatters), seven historic sites (three ranching campsites, three trash scatters, and Old State Route 38 along the White River), one site with both prehistoric and historic components, and 20 isolated artifacts. One site with both historic and prehistoric components, located in the Level II region of influence, has been evaluated as eligible for listing on the *National Register of Historic Place*s. The site is in the vicinity of Black Rock Spring and includes a prehistoric campsite with abundant lithics and ceramics, and an early historic-period habitation site. This spring is one of three in the vicinity, and field reconnaissance of the place indicates that there are archaeological sites associated with each of the springs.

DOE surveyed 23 sample units during the Class II effort, a total of 19 kilometers (12 miles). The survey recorded two sites, a prehistoric lithic scatter and an historic campsite; neither site was recommended as eligible for listing on the *National Register of Historic Places*. Seventeen isolated artifact occurrences were also recorded during the field survey along this segment.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any potentially significant American Indian resources in the Caliente common segment 1 region of influence. However, the American Indian Writers Subgroup notes that systematic ethnographic studies have not been conducted. The subgroup does note the significance of cultural resources in the White River Valley, such as the well-known White River Narrows rock-art sites, charcoal ovens, and the area of Pahranagat Valley. These resources would be several kilometers from the proposed rail alignment region of influence.

The eastern part of Caliente common segment 1 would begin in the potential early Mormon colonization cultural landscape and quickly leave it going westward. The segment from Meadow Valley Wash passing through Bennett Pass, Dry Lake Valley, the White River Valley, and eastward to Garden Valley is historically important as the route of one of the 1849 Jayhawkers Emigrant parties, the Bennett-Arcane Party. One of the leaders of this party, Asabel Bennett, left his name inscribed in rock at the pass. The 1849 party reportedly camped at Bennett Springs, about 1.6 kilometers (1 mile) from the common segment. The party also camped in the vicinity of Black Rock Spring before crossing the North Pahroc Range. The route the party followed, commonly referred to as the Lost ‘49er Trail, has not been physically identified but is known to have crossed Bennett Pass and Pahroc Summit. To date, no archaeological sites associated with the Bennett-Arcane Party are identified in the Caliente common segment 1 region of influence. In the 1870s, Bennett Pass became a well-traveled route between the silver mining communities of Pioche and Hiko. The Pioche-Hiko road remained a principal east-west route into the early 1900s.

3.2.13.5.3 Garden Valley Alternative Segments

3.2.13.5.3.1 Garden Valley Alternative Segment 1. The Class I site-file and literature search identified 10 previously recorded cultural resources along Garden Valley alternative segment 1 (Figure 3-119). These resources include five prehistoric sites (two rockshelters and three lithic scatters), four isolated artifacts, and one historic trash scatter. No sites have been evaluated as eligible for listing on the *National Register of Historic Places*. DOE surveyed five sample units during the Class II effort, a total of 4 kilometers (2.5 miles); only six isolated artifact occurrences were recorded.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) notes that Garden Valley had extensive American Indian trail systems used for trade, commerce, pilgrimage, and for

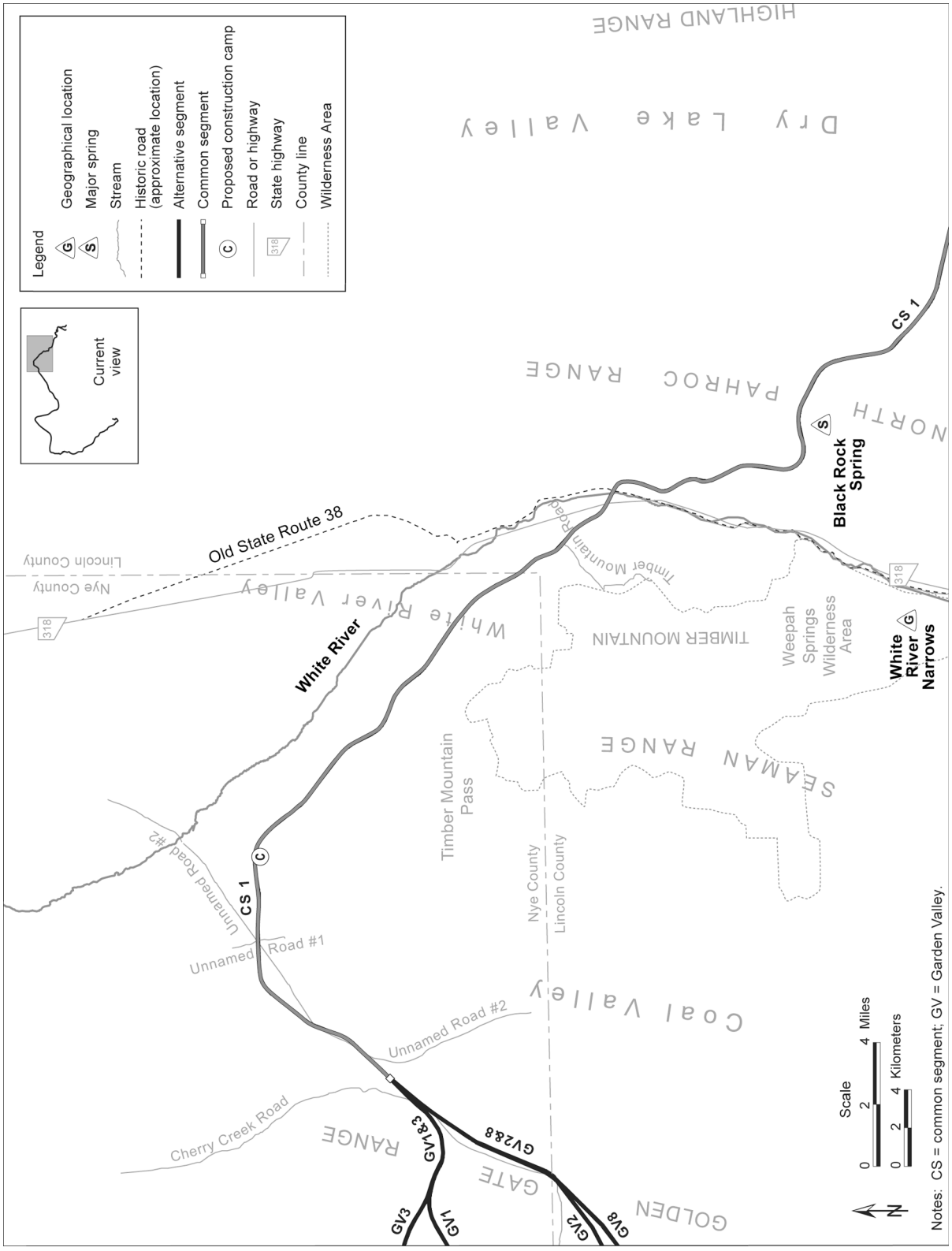


Figure 3-118. Major historic and geographical locations within map area 2.

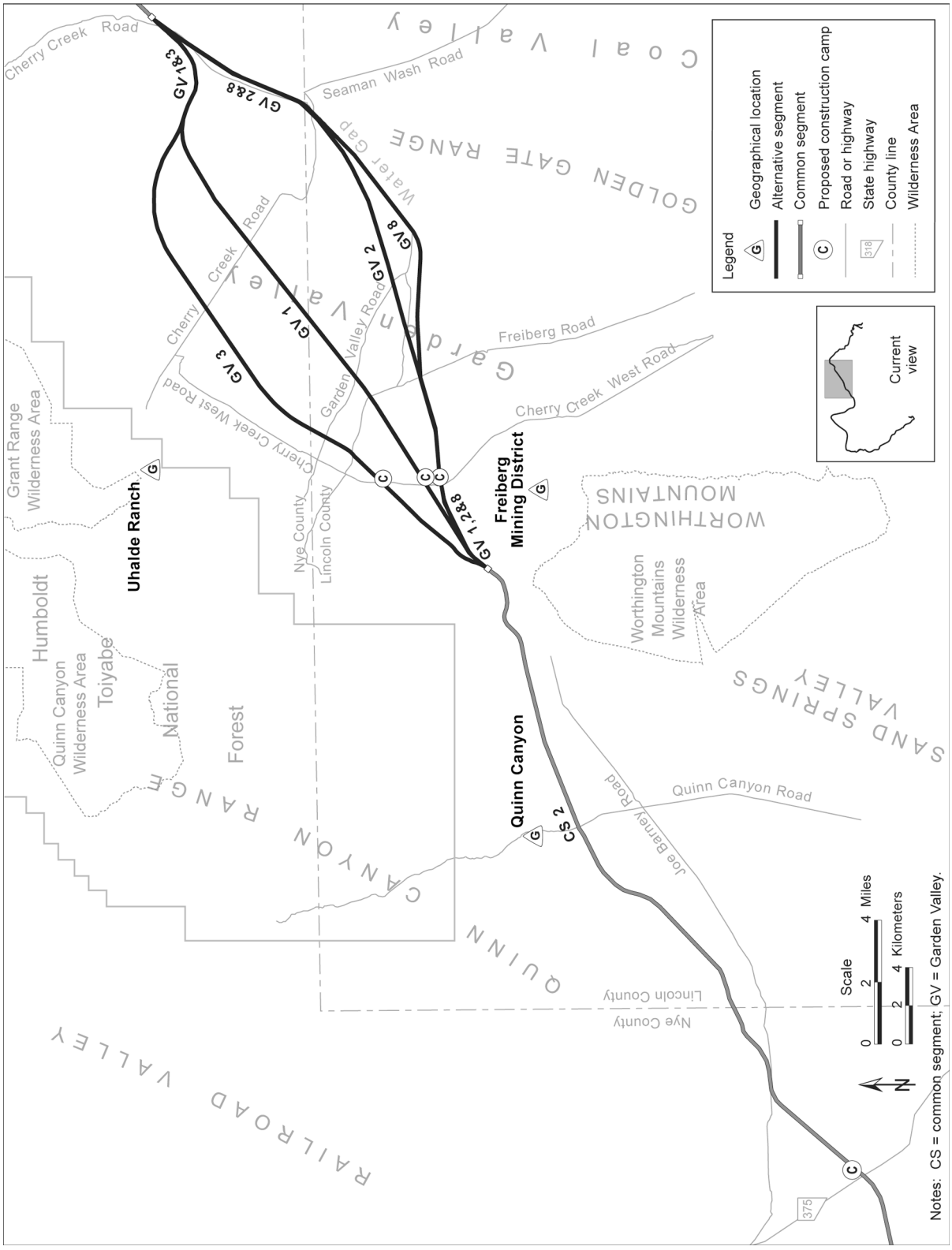


Figure 3-119. Major historic and geographical locations within map area 3.

access to mountain ranges. The Resource Document does not give specific locations for trails or other potential American Indian resources.

3.2.13.5.3.2 Garden Valley Alternative Segment 2. The Class I site-file search revealed 12 previously recorded cultural resources along Garden Valley alternative segment 2 (Figure 3-119). These resources include four prehistoric sites (two campsites and two lithic scatters) and eight isolated artifacts that include a prehistoric Folsom point reported in the vicinity of Water Gap. Three of these sites are evaluated as eligible for listing on the *National Register of Historic Places*, including the two campsites and a lithic scatter associated with a cluster of rock features. DOE surveyed four sample units during the Class II effort, a total of 3.2 kilometers (2 miles); two isolates were recorded.

The same comments from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) made for Garden Valley alternative segment 1 apply to this segment.

Of the four Garden Valley alternative segments, Garden Valley 2 would pass closest to the historic Freiberg Mining District in the northeast part of the Worthington Mountains. The segment would pass about 5 kilometers (3 miles) north of the district.

3.2.13.5.3.3 Garden Valley Alternative Segment 3. The Class I site-file search identified 17 previously recorded cultural resources along Garden Valley alternative segment 3 (Figure 3-119). These resources include two prehistoric sites (a rock feature and lithic scatter), 13 isolated artifacts, and two historic trash scatters. DOE surveyed four sample units during the Class II effort, a total of 3.2 kilometers (2 miles). Only two isolates were recorded.

The same comments from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) made for Garden Valley alternative segment 1 apply to this segment.

3.2.13.5.3.4 Garden Valley Alternative Segment 8. The Class I site-file and literature search identified five previously recorded cultural resources along Garden Valley alternative segment 8. These resources include three prehistoric lithic scatters and two isolated artifacts. DOE surveyed three sample units during the Class II effort, a total of 2.4 kilometers (1.5 miles); eight isolated artifacts were recorded.

The same comments from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) made for Garden Valley alternative segment 1 apply to this segment.

3.2.13.5.4 Caliente Common Segment 2 (Quinn Canyon Range Area)

The Class I site-file search identified eight previously recorded cultural resources along Caliente common segment 2 (Figure 3-119). These resources include seven prehistoric sites (two campsites, a rockshelter, and four lithic scatters) and one isolated artifact. DOE surveyed seven sample units during the Class II effort, a total of 5.6 kilometers (3.5 miles); three prehistoric sites and 16 isolated artifacts were recorded. Three sites are evaluated as eligible for listing on the *National Register of Historic Places*, including two lithic scatters and one locale with rockshelters and an associated scatter of artifacts. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) notes the rockshelter site as a culturally significant place, and refers to it as the "Black Top Archaeological Locality." Section 2.3 of the American Indian Resource Document also notes historical events important to American Indians occurred in the Quinn Canyon Range area, and specifically in Quinn Canyon itself.

The unrecorded historic Cedar Pipeline Ranch is at the western end of and about 1.6 kilometers (1 mile) south of Caliente common segment 2. This ranch was an element of the early vast holdings of the Reed Ranch and later part of the historic Twin Springs Ranching operations. Together, these ranches form a potential ranching cultural landscape that includes all of Reveille Valley and Stone Cabin Valley to the

west, along with the adjacent Reveille and Kawich Mountain Ranges. The vicinity of Cedar Pipeline Ranch also marks the intersection of Caliente common segment 2 with the trail explorer John C. Fremont followed in 1854.

3.2.13.5.5 South Reveille Alternative Segments

Because the Level II region of influence for the South Reveille alternative segments (Figure 3-120) overlap, they are discussed jointly for the Class I site-file search and the Class II survey. The Class I site-file search revealed the presence of three cultural resources along these segments. These resources include two recorded prehistoric lithic scatter sites and one historic mine prospect. Also in this vicinity are the Reveille Valley rock-art panels. This location was identified in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) as a culturally important site for American Indian people.

DOE examined two sample units for each of these alternative segments during the Class II field survey, a total of 1.6 kilometers (1 mile) or 8.5 percent of the segments. Only a single isolate was encountered along South Reveille 2. The Class II survey also recorded the rock-art site noted above.

A potential quarry (NN-9A) would be along South Reveille alternative segments 2 and 3. The potential NN-9A quarry site would occupy the top and eastern face of a broad, flat terrace, which drops steeply down to a wash along the eastern face. Preliminary archaeological reconnaissance of this site did not identify any cultural materials or other evidence of historic or prehistoric activities.

Another potential quarry (NN-9B) would be in south Reveille Valley, along South Reveille alternative segments 2 and 3. The NN-9B quarry site would occupy a long, narrow sandy ridge with frequent rocky outcrops. Preliminary archaeological reconnaissance of this site did not identify any cultural materials or other evidence of prehistoric or historic activities.

3.2.13.5.6 Caliente Common Segment 3 (Stone Cabin Valley Area)

Caliente common segment 3 (Figure 3-120) would pass close to a number of potentially important sites and through several potential cultural landscapes. The Class I site-file search identified 35 cultural resources along Caliente common segment 3. These resources include 29 prehistoric sites and six historic sites. The Class II survey examined 22 sample units, a total of 18 kilometers (11 miles). Three prehistoric sites are evaluated as eligible for listing on the *National Register of Historic Places*, including two lithic scatters within the Level I region of influence and a rock-art site within the Level II region of influence. Several potentially important cultural resources are found along Caliente common segment 3, although most are just outside the Level II region of influence.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) also notes the high significance of locations within this region to American Indian people. The entire Kawich Range, including the foothills along the eastern and western edges of the adjacent valleys, provided traditional homelands and use areas for Western Shoshone people. Especially important in these areas were a number of springs. Special reference is made in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) to the Warm Springs and Reveille Mill areas. As discussed in Section 3.4, American Indian Interests in the Proposed Action, American Indians still use the Warm Springs area and it is highly revered it for its healing power. In addition, a Western Shoshone man initially discovered the Clifford Mine.

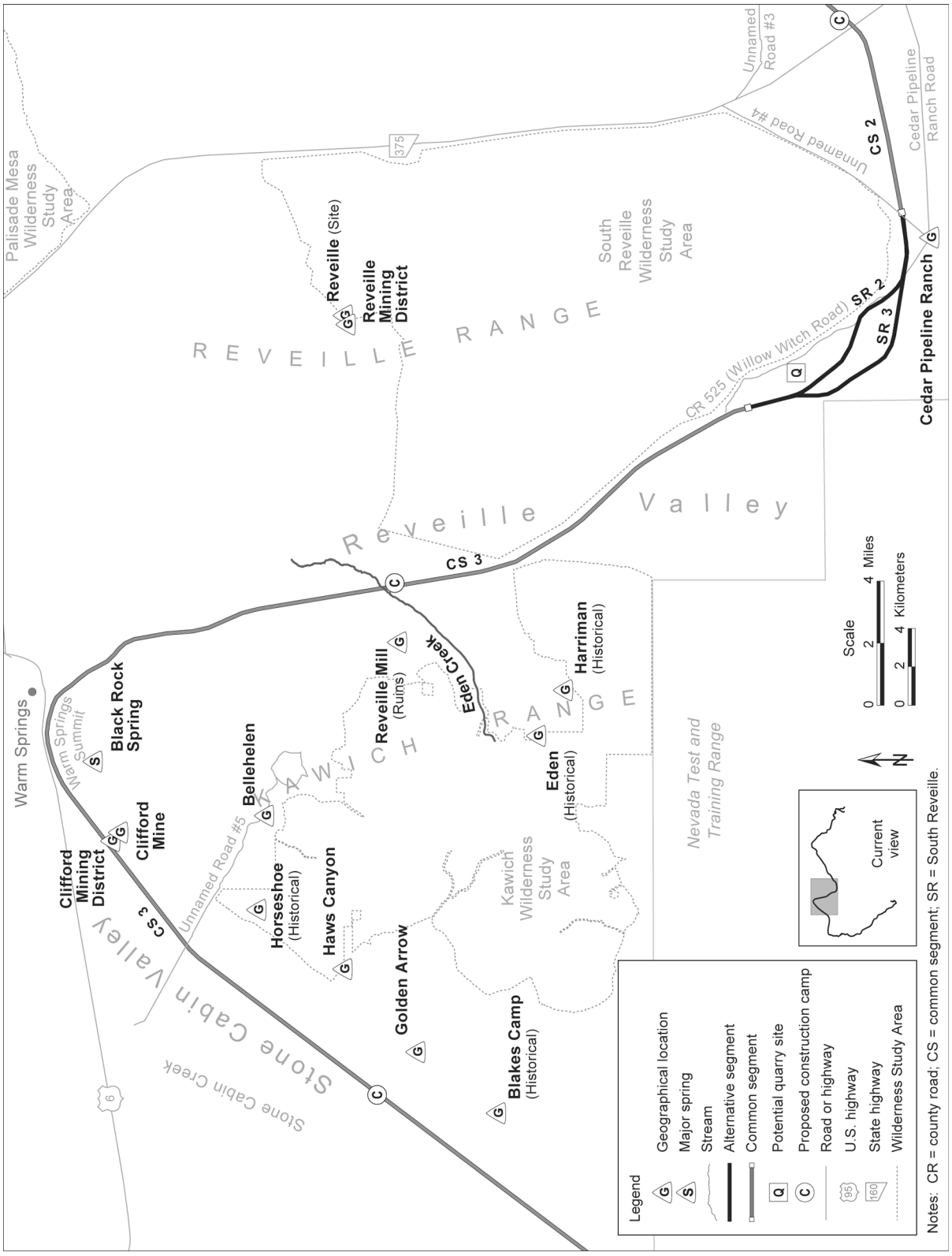


Figure 3-120. Major historic and geographical locations within map area 4.

3.2.13.5.7 Goldfield Alternative Segments

3.2.13.5.7.1 Goldfield Alternative Segment 1. The Class I site-file search identified four cultural resources within Goldfield alternative segment 1 (Figure 3-121). These resources include two prehistoric lithic scatters and two historic sites (a trash scatter and a campsite). The Class II survey examined six sample units along this segment, a total of 4.8 kilometers (3 miles), and 52 isolated artifacts were recorded. No sites are eligible for listing on the *National Register of Historic Places*.

Within this area, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies possible Western Shoshone camps east of Goldfield. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also notes the existence of a rockshelter along the shoreline of Mud Lake in the vicinity of Goldfield alternative segment 1, and states that this site retains a high level of cultural significance. There are also rock-art panels at this location. These locations are outside the Level II region of influence.

3.2.13.5.7.2 Goldfield Alternative Segment 3. The Class I site-file and literature review revealed three previously recorded cultural resources along Goldfield alternative segment 3 (Figure 3-121). These resources include two rockshelters and a prehistoric campsite. The Class II survey covered 2.4 kilometers (1.5 miles), and 13 isolated artifacts were recorded. The campsite is the same possible group of Western Shoshone winter camps discussed in the preceding section. The American Indian Resource Document discussion from Goldfield alternative segment 1 also applies for this segment.

A potential quarry (NS-3A) would occupy a large area on the crest and slopes of two adjacent ridges in the Goldfield Hills, south of Mud Lake, along Goldfield alternative segment 3. No cultural materials or other evidence of prehistoric or historic activities were noted during preliminary archaeological reconnaissance of the potential quarry NS-3A location. Access roads to this quarry location from Goldfield to the south and west would pass through recent and historic mining areas, but neither the quarry location nor the access roads would directly overlie the historic mining areas.

3.2.13.5.7.3 Goldfield Alternative Segment 4. Because of its proximity to the Goldfield community, there are numerous known historic sites in the vicinity of Goldfield alternative segment 4 (Figure 3-121). The Class I site-file search revealed 154 previously recorded cultural resources. These resources include 74 prehistoric sites, five isolated artifacts, and 71 historic sites. Sites that are evaluated as being *National Register of Historic Places*-eligible include the downtown section of Goldfield itself, which is National Register listed. Goldfield alternative segment 4 would pass through the National Register-eligible historic Goldfield town dump area and two mining sites. Other eligible sites outside the Level I region of influence include two town-related features, three mining sites, and three lithic scatters. In addition, several unrecorded prehistoric and historic sites are known to exist in the region of influence (see Section 3.2.13.1), based on literature reviews and field reconnaissance, along with an unmarked historic cemetery. The Class II field effort examined eight sample units along this segment, a total of 6.4 kilometers (4 miles), resulting in the identification of 69 isolates.

The American Indian Resource Document comments on the known presence of numerous American Indian resources in the vicinity of Goldfield alternative segment 4 (DIRS 174205-Kane et al. 2005, Section 2.3). Field reconnaissance by the American Indian Writers Subgroup noted the presence of several rockshelters, a boulder with rock art, and several unrecorded lithic scatters. Also of interest in the Level II region of influence is the presence of a grave marker in the paupers' section of the historic Goldfield Cemetery indicating that an American Indian woman was buried there in 1908.

A potential quarry (ES-7) would be near Goldfield alternative segment 4, west of the community of Goldfield. No cultural materials or other evidence of prehistoric or historic activities were noted during preliminary archaeological reconnaissance of the quarry area. However, recent mining-claim markers are

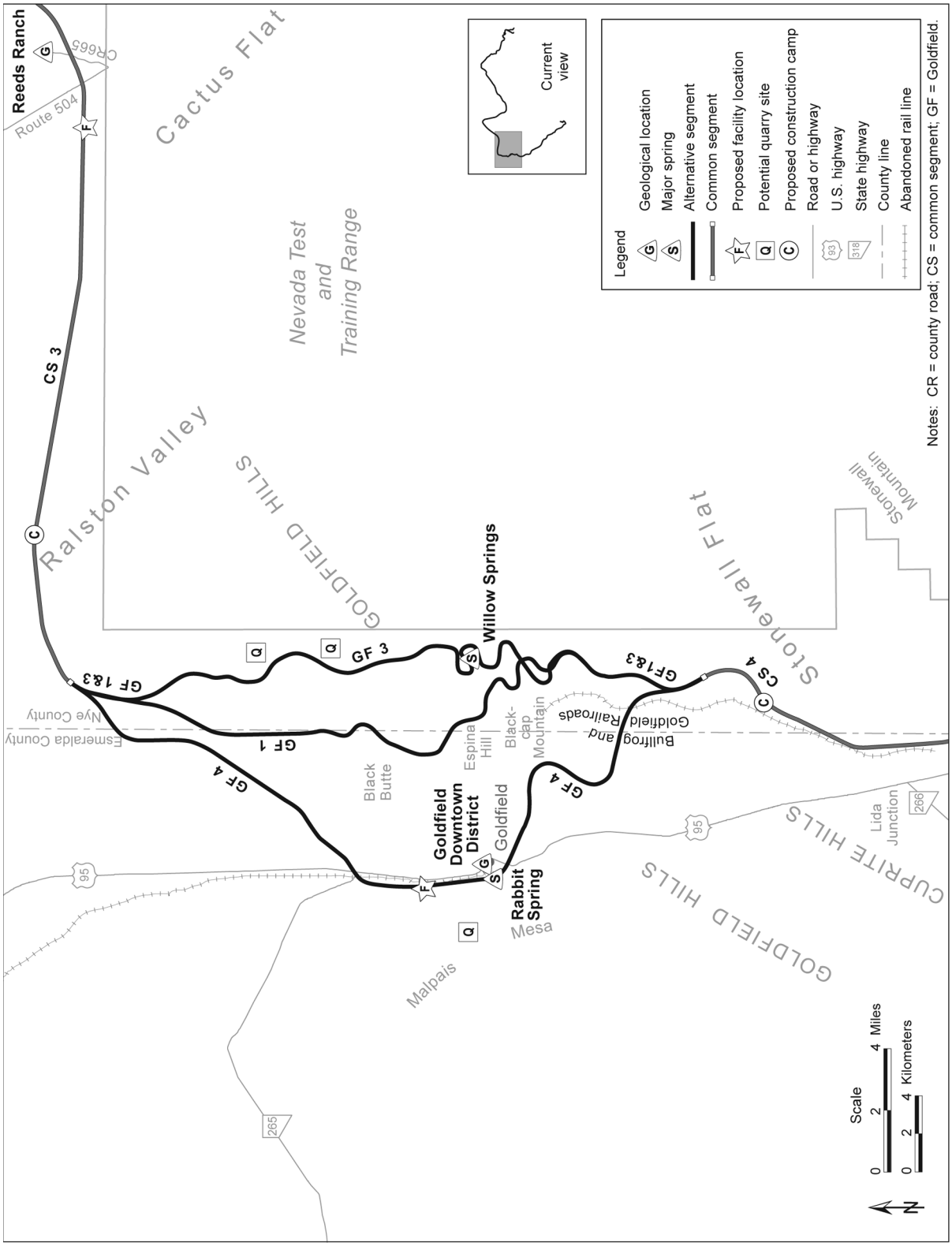


Figure 3-121. Major historic and geographical locations within map area 5.

present in the area. Access to this quarry from Goldfield would pass through recent and historic mining areas, but neither the potential quarry location nor the access road would directly overlie the historic mining areas.

3.2.13.5.8 Caliente Common Segment 4 (Stonewall Flat Area)

In Stonewall Flat, Caliente common segment 4 (Figures 3-121 and 3-122) would generally follow an abandoned historic rail line for much of its length to a place in Lida Valley. The Class I site-file search identified one previously recorded but unevaluated rockshelter site along this segment. The Class II survey examined four sample units, a total of 3.2 kilometers (2 miles). Eight isolates were recorded. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not note any specific areas of importance to American Indians.

There are unrecorded and unevaluated segments of historic rail roadbeds along Caliente common segment 4, although the rails were removed many decades ago. Of note is the unrecorded train stop of Ralston where limited commercial establishments once stood, along with railroad crew quarters and a water tower. Nothing remains of the architectural elements of Ralston, but historical archaeological features and artifacts are certain to exist.

3.2.13.5.9 Bonnie Claire Alternative Segments

DOE is considering two alternative segments in the area north of Scottys Junction – Bonnie Claire alternative segments 2 and 3 (Figure 3-122).

3.2.13.5.9.1 Bonnie Claire Alternative Segment 2. The Class I site-file search identified one cultural resource site along Bonnie Claire alternative segment 2. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II survey examined five sample units, a total of 4 kilometers (2.5 miles). Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and groundstone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

3.2.13.5.9.2 Bonnie Claire Alternative Segment 3. The Class I site-file search identified four cultural resources along Bonnie Claire alternative segment 3. These resources include four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences. The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles). One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

3.2.13.5.10 Common Segment 5 (Sarcobatus Flat Area)

The Class I site-file search identified 33 cultural resources within common segment 5 (Figures 3-122 and 3-123). These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for

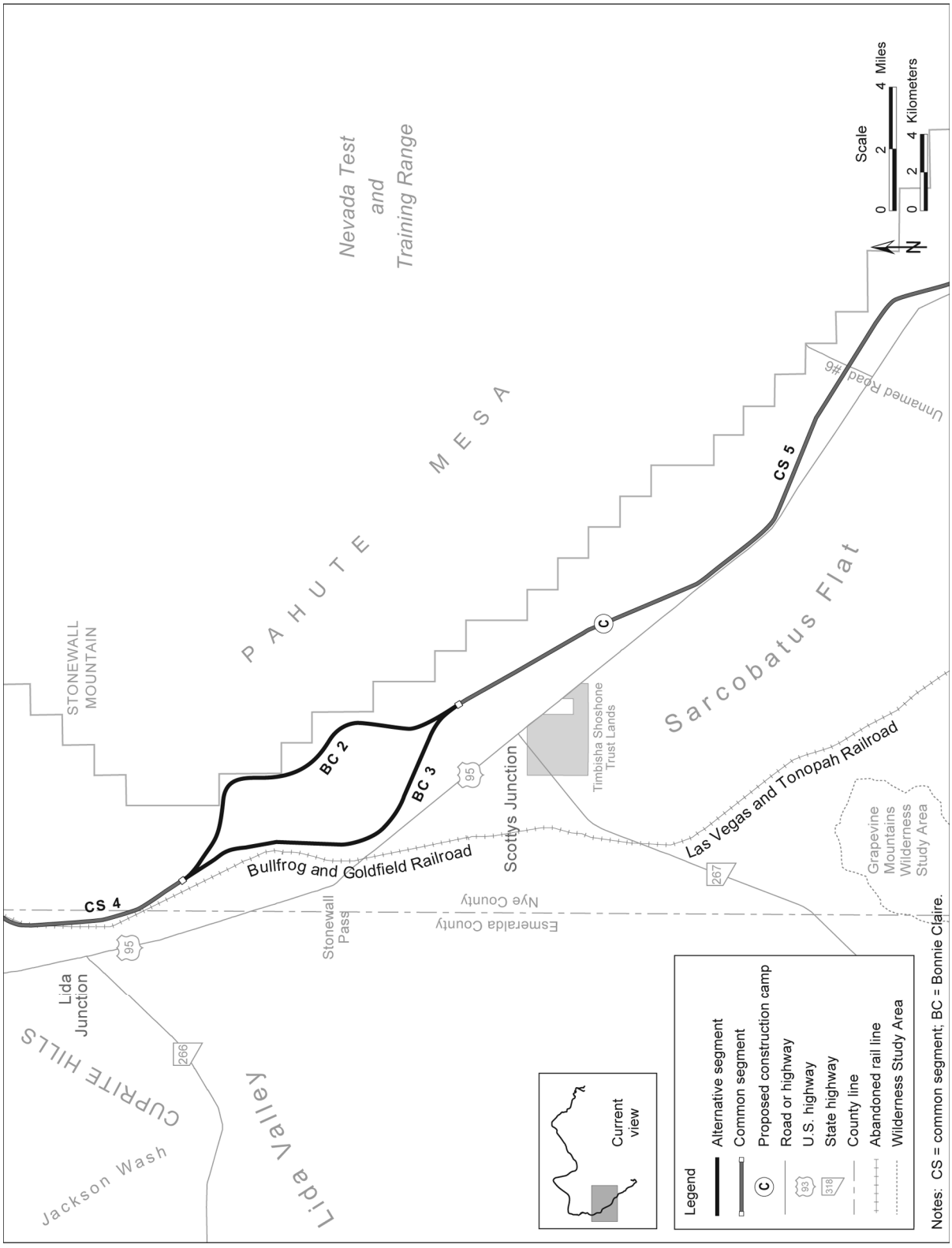


Figure 3-122. Major historic and geographical locations within map area 6.

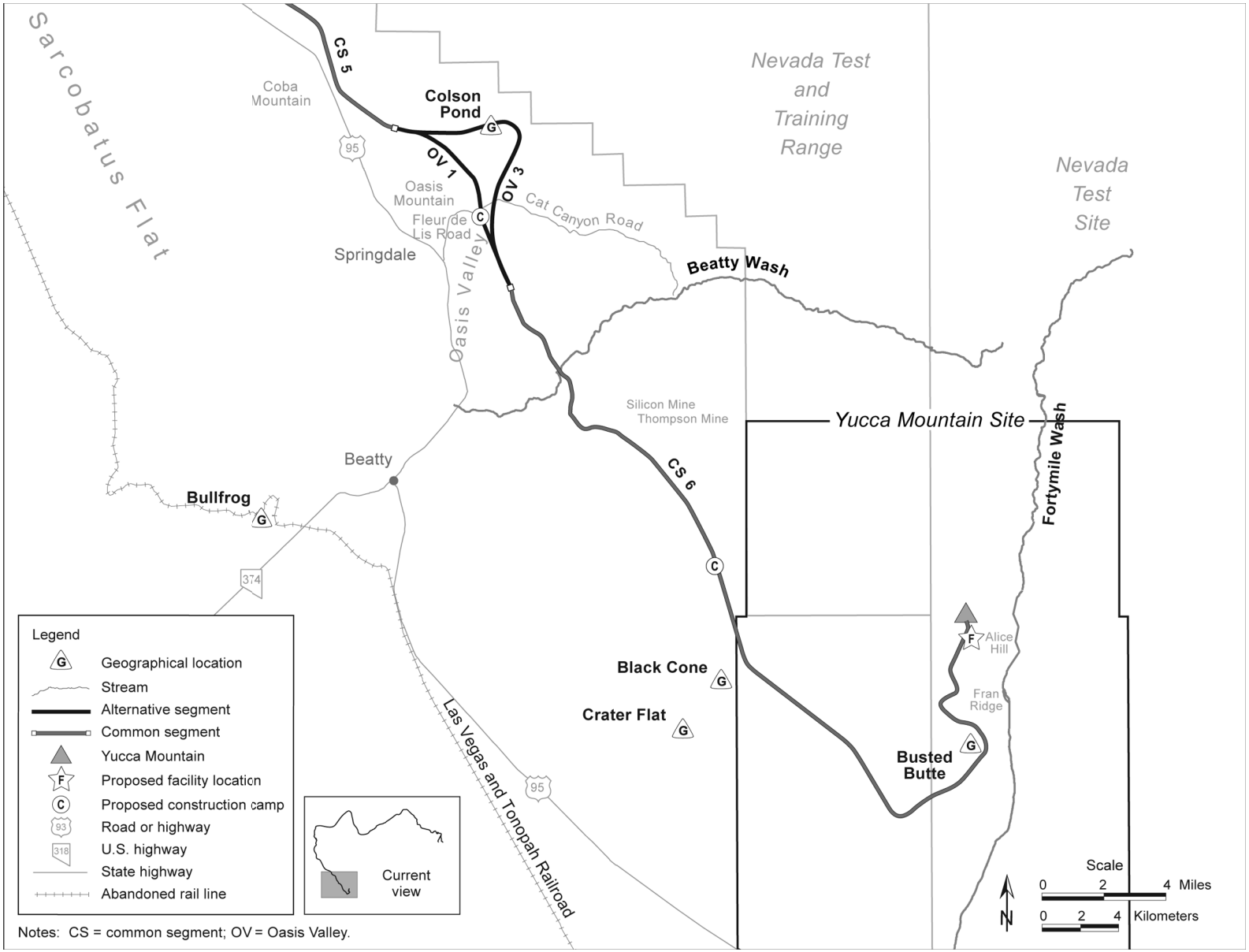


Figure 3-123. Major historic and geographical locations within map area 7.

listing on the *National Register of Historic Places*; 11 are not eligible, and 14 remain unevaluated. DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles). Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the three lithic scatters are not eligible. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this common segment.

3.2.13.5.11 Oasis Valley Alternative Segments

The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3 (Figure 3-123). These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places)* and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

3.2.13.5.11.1 Oasis Valley Alternative Segment 1. The Class II survey looked at three sample units along Oasis Valley 1, a total of 2.4 kilometers (1.5 miles). Two prehistoric sites (lithic scatters) and one historic mine site were recorded.

DOE surveyed three sample units along this segment for the Class II effort; 19 isolates were recorded. Oasis Valley alternative segment 1 would pass to the east of the historic ranch known today as the Beatty Cattle Company Ranch. In addition to being an unrecorded historic ranch, the area adjacent to the ranch is known to be the location of an early historic Western Shoshone winter camp. This camp has been partially recorded but has not been evaluated.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated with and supplied labor for the ranches.

3.2.13.5.11.2 Oasis Valley Alternative Segment 3. Oasis Valley alternative segment 3 would cross Oasis Valley farther to the east than Oasis Valley 1, but because of proximity, much of the discussion for Oasis Valley 1 applies to this alternative segment. During the Class II survey, DOE inspected four sample units, a total of 3.2 kilometers (2 miles); five sites and 28 isolates were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 also would cross the culturally sensitive Oasis Valley. It would pass just east of another historic ranch, the Colson or Indian Camp Ranch, which also has an early Western Shoshone winter camp adjacent to the ranch buildings. While both the ranch and Western Shoshone camp are unevaluated, rock lines (geoglyphs) were observed at the Indian camp area during field reconnaissance. These resources would be additional components of the potential Oasis Valley ethnographic and historic ranching cultural landscapes. Construction of the alternative segment could result in a visual intrusion to these cultural landscapes.

3.2.13.5.12 Common Segment 6 (Yucca Mountain Approach)

The Yucca Mountain area has been heavily analyzed in conjunction with repository site characterization studies. Intensive cultural resource studies related to the development of the repository site have been completed. Consequently, a large number of archaeological sites have been found along common

segment 6 (Figure 3-123). This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified a total of 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, three historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected 13 sample units, a total of 11 kilometers (7 miles). Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6 within the Yucca Mountain Site boundary, Desert Research Institute conducted a Class III supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary (DIRS 182290-Desert Research Institute 2007, all). This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that was previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Given the large number of cultural resources in the area, construction of common segment 6 could result in direct and indirect impacts to prehistoric and historic sites. Three National Register-eligible prehistoric quarry sites are in this area within the Level I region of influence. The Beatty Wash Petroglyphs Site, listed on the National Register, is in the vicinity of a proposed bridge over Beatty Wash. Direct and indirect impacts from construction activities would include vibration of the rock ***matrix*** exhibiting the rock-art panels and a potential for inadvertent or deliberate adverse impacts due to increased access and worker presence. The site holds important cultural value for American Indians. Over the long term, American Indians would likely view the bridge and operating trains as a visual and noise impact to the rock-art cultural landscape site.

After common segment 6 crossed onto the Yucca Mountain Site, it would cross an area that has undergone earlier intensive archaeological inventory and has been the subject of previous American Indian studies during repository characterization. As discussed in Section 4.2.13.1, DOE would consider identification, evaluation, and mitigation of potential impacts to these resources under a separate programmatic agreement with those along the proposed rail alignment. Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this common segment. Several of these fall inside the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty area rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

3.2.14 PALEONTOLOGICAL RESOURCES

Paleontology is a science that uses fossil remains to study life in past geological periods. DOE, the BLM, and other federal agencies recognize paleontological resources as a fragile and nonrenewable scientific record of the history of life on earth and consider them a critical component of America's natural heritage. Once such resources are damaged, destroyed, or improperly collected, their scientific and educational value could be greatly reduced or forever lost.

The BLM manages and protects paleontological resources under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*), and in accordance with 43 CFR 8365 and 43 CFR 3622. The BLM has developed policies and management actions to protect and manage paleontological resource areas of high scientific value consistent with the *Draft - Resource Management Plan/Environmental Impact Statement for the Ely District* (DIRS 174518-BLM 2005, all) and the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), while allowing casual and academic collecting of invertebrate (animals without backbones) fossils within the regulatory framework. Because of their relative rarity and scientific importance, vertebrate (animals with backbones) fossils may only be collected with a BLM permit and remain the property of all Americans in museums or other public institutions (*Collecting on Public Lands*, DIRS 180122-BLM [n.d.], all, and *Fossils on America's Public Lands*, DIRS 180123-BLM 2007, all).

Section 3.2.14.1 describes the region of influence for paleontological resources along the Caliente rail alignment, and Section 3.2.14.2 describes the paleontological resources within the region of influence, including the identification of previously recorded important fossil resources and the approaches for managing those resources.

3.2.14.1 Region of Influence

The region of influence for paleontological resources along the Caliente rail alignment is the nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities.

3.2.14.2 Affected Environment

BLM ranking of areas for their potential to contain paleontological resources (DIRS 176084-BLM 1998, pp. II-2 and II-3):

Condition 1 - Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

Condition 2 - Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

Condition 3 - Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

The BLM has established a classification system to rank areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils (*Paleontological Resource Management* and *General Procedural Guidance for Paleontological Resource Management*). The BLM uses these rankings (called ***Condition 1***, ***Condition 2***, and ***Condition 3***) in land-use planning and to identify areas that might warrant special management or special designation (DIRS 176085-BLM 1998, all; DIRS 176084-BLM 1998, all).

To determine the affected environment for paleontological resources along the Caliente rail alignment, DOE consulted the BLM and reviewed existing documentation of paleontological resources, including applicable BLM resource management plans.

A rail line along the Caliente rail alignment would cross large areas of volcanic rock and granite. It is not likely that there would be paleontological resources within these types of rock; fossils are more likely to be found in sedimentary rock. There are no known or likely occurrences of paleontological resources within the region of influence of the Caliente rail alignment alternative segments and common segments. However, there is one known paleontological resource near Caliente common segment 1.

Caliente common segment 1 would cross Bennett Pass. There is a Condition 1 paleontological resource within an area known as Ruin Wash, approximately 4.8 to 8 kilometers (3 to 5 miles) south of Bennett Pass. Ruin Wash contains outcrops of the fossil-rich Pioche Formation (DIRS 174204-Palmer 1998, all; DIRS 183644-Shannon & Wilson 2007, pp. 108 and 109; DIRS 174509-Russ 2005, all). Area outcrops of the Pioche Formation are among the most fossil-rich late Lower Cambrian and early Middle Cambrian (about 510 to 530 million years ago) outcrops in the western United States, and these fossil beds contain important scientific information regarding the timing of extinctions of many species (DIRS 174509-Russ 2005, all; DIRS 174204-Palmer 1998, all; DIRS 174518-BLM 2005, p. 3.10-1). These specimens of soft-bodied marine animals are scientifically important because of their completeness and excellent state of preservation.

There are other outcrops of the Pioche Formation within 2 kilometers (1.2 miles) of the Caliente rail alignment, also in the vicinity of Bennett Pass. The BLM has not fully evaluated these resources.

A rail line along the Caliente rail alignment would not cross any known fossil-rich rock outcrops. The possibility exists that beds containing fossils could be uncovered during construction in those few areas along the rail alignment containing sedimentary rock.

3.2.15 ENVIRONMENTAL JUSTICE

Minority individuals are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, and Hispanic.

A **low-income** household is one for which the household income is below the U.S. Census Bureau poverty thresholds.

Source: DIRS 155970-DOE 2002, Section 3.1.13.1.

To support the assessment of the potential for ***disproportionately high and adverse impacts*** on minority and low-income communities, this section provides the information on ***minority*** and ***low-income populations*** and communities in the Caliente rail alignment region of influence. Section 3.2.15.1 describes the region of influence, Section 3.2.15.2 describes the methodology DOE used to determine population groups, and Section 3.2.15.3 describes regional population characteristics for environmental justice considerations.

Executive Order 12898, *Federal Actions to Address Environmental Justice in* Minority Populations *and Low-Income Populations*, directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations, and provide access to public information on, and an opportunity for public participation in, matters relating to human health or the environment. Executive Order 12898 also directs agencies to provide opportunities for public input on the incorporation of environmental justice principles into federal agency programs or policies. Executive Order 12898, and associated implementing guidance, establishes the framework for characterizing existing conditions related to environmental justice. For this analysis, DOE uses the terms minority and low income in the context of environmental justice as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13.1) and *Poverty Thresholds* (DIRS 174625-Bureau of Census 2005, all).

3.2.15.1 Region of Influence

The Caliente rail alignment region of influence for environmental justice encompasses the regions of influence for all other resource areas because impacts in other resource areas could result in environmental justice impacts. Section 3.2 describes the regions of influence for the ***environmental resource areas*** analyzed in this Rail Alignment EIS. For some resource areas, the relevant region of influence is an area extending a given distance from the centerline of the rail alignment. For others, the relevant region of influence is not so precisely definable, but generally includes the landscape the rail line would cross. However, the widest region of influence is that defined for hazardous materials and waste (see Section 3.2.12), which considers a nationwide region of influence.

In addition to the regions of influence delineated via direct physical proximity to the Caliente rail alignment, the environmental justice region of influence includes populations that could be affected by the project that have cultural or religious ties in the area, even though the population may not have a physical presence. For a discussion of American Indian populations, and resulting region of influence, see Section 3.4, American Indian Interests in the Proposed Action, and *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all).

3.2.15.2 Methodology

For the Yucca Mountain FEIS, DOE followed the Council on Environmental Quality guidance (DIRS 177702-CEQ 1997, all) and the then-existing methodology of the U.S. Nuclear Regulatory Commission to identify low-income and minority communities (also called low-income and minority populations). However, since that time. the U.S. Nuclear Regulatory Commission methodology used in

the Yucca Mountain FEIS has been revised, and for this Rail Aligment EIS, DOE used the revised methodology to identify low-income and minority communities (69 *FR* 52048). The revised methodology is, in part:

> Under current NRC [Nuclear Regulatory Commission] staff guidance, a minority or low-income community is identified by comparing the percentage of the minority or low-income population in the impacted area to the percentage of the minority or low-income population in the County (or Parish) and the State. If the percentage in the impacted area significantly exceeds that of the State or the County percentage for either the minority or low-income population then EJ [environmental justice] will be considered in greater detail. 'Significantly' is defined by staff guidance to be 20 percentage points. Alternatively, if either the minority or low-income population percentage in the impacted area exceeds 50 percent, EJ matters are considered in greater detail.

In Nevada, the percentage of people below the poverty threshold, as characterized by the U.S. Bureau of the Census (DIRS 174625-Bureau of Census 2005, all), was approximately 11 percent at the last Decennial Census (DIRS 176856-U.S. Census Bureau 2003, Table 15). Thus, applying the U.S. Nuclear Regulatory Commission guidance, DOE identified for low-income communities as those affected areas (by census block groups), where the percentage of people characterized as below the poverty threshold exceeded 31 percent.

Because the percentage of minorities in Nevada is approximately 34 percent (DIRS 173533-Bureau of Census 2005, all), adding 20 percentage points would provide a threshold of 54 percent to identify minority communities. Instead, DOE identified minority communities as those affected areas (by census blocks) where the minority population exceeded 50 percent.

DOE followed the Council on Environmental Quality guidance to use the annual statistical poverty thresholds from the U.S. Census Bureau to identify low-income populations (DIRS 177702-CEQ 1997, p. 25). DOE used U.S. Census Bureau data for census block groups. The census block group, which typically consists of between 600 and 3,000 people with an optimum size of 1,500 people, is the smallest census unit for which the Census Bureau collects 100-percent data. Block groups on American Indian reservations, off-reservation trust lands, and special places must contain a minimum of 300 people. (Special places include correctional institutions, military installations, college campuses, workers' dormitories, hospitals, nursing homes, and group homes.) To identify minority populations, DOE used U.S. Census Bureau data for census blocks. The census block is the smallest census unit for which the Census Bureau collects 100-percent data. The Department assessed the population within 3 kilometers (1.8 miles) on either side of the centerline of the Caliente rail alignment, to be consistent with the Yucca Mountain FEIS.

A **census block** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block is the smallest geographic unit for which the Census Bureau tabulates 100-percent data.

A **census county division (CCD)** is a subdivision of a county that is a relatively permanent statistical area established cooperatively by the Census Bureau and state and local government authorities. It is used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments.

A **census block group** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block group is the smallest geographic unit for which the Census Bureau tabulates sample data. A block group consists of all the blocks within a census tract with the same beginning number.

A **census tract** is a small, relatively permanent statistical subdivision of a county delineated by a local committee of census data users for the purpose of presenting data. Designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time of establishment, census tracts average about 4,000 inhabitants.

Sources: DIRS 181904-U.S. Census Bureau 2007, all; DIRS 181905-U.S. Census Bureau [n.d.], all.

DOE developed these analyses by creating Geographic Information System (GIS) representations of the Caliente rail alignment alternative segments and common segments and creating a computer program to extract specific census data based on the 3-kilometer (1.8-mile) buffer distance. The specific census data required to develop the analyses included:

- Total population and number of minority people by census block
- Total population and number of individuals below the poverty level by census block group

For Census 2000, the Census Bureau used two forms, one short and one long. The Bureau sent the short form to every household, and sent the long form, containing the seven 100-percent questions plus the sample questions, to only a limited number of households. Generally, about one in every six households nationwide received the long form. The rate varied from one in two households in some smaller areas, to one in eight households for more densely populated areas. The long form requests information on the numbers and ages of members of each household and income received during the previous full year. From this information, the Census Bureau makes a determination of the poverty status of the individuals living in the household. The Census Bureau additionally uses school districts, child protective services, and social services to supplement the census data to develop estimates that more fully represent actual poverty status among all populations.

3.2.15.3 Regional Characteristics

3.2.15.3.1 Minority and Low-Income Populations

The Caliente rail alignment would affect portions of three counties in southern Nevada (Nye, Esmeralda, and Lincoln). Table 3-77 summarizes Census 2000 data on the relative size of minority and low-income populations within these general areas. The table includes specific county subdivisions and small population centers that encompass or are near the Caliente rail alignment. For comparison, the table includes statewide and county-wide minority and poverty data.

There are no census blocks in the region of influence with minority population percentages that are at or more than 50 percent. This calculation includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations. Based on Census 2000 estimates, the population living within 3 kilometers (1.8 miles) on either side of the Caliente rail alignment is approximately 1,800. Of that population, approximately 12 percent are minority people.

Census block groups, depending on their size, can be further divided into smaller sections and provided a number designation. For example, the population center of Caliente, the largest population center in census block group 2, which is part of census tract 9502 in Lincoln County, comprises more than 90 percent of the population of the block group. Of these people, 15 percent are members of minority groups. This percentage is lower than the percent of the minority population for the State of Nevada and is well within the percent of the minority population of counties along the Caliente rail alignment (10 to 19 percent).

Based on Census 2000 estimates, the population within 3 kilometers (1.8 miles) on either side of the centerline of the Caliente rail alignment for whom poverty status is determined is approximately 1,100. Of these, about 150, or 13 percent, are living below the poverty level. This percentage is higher than the percent of the population living in poverty for the State of Nevada as a whole (11 percent) and is generally lower than the population living in poverty in the counties along the Caliente rail alignment (11 percent to 17 percent) (see Table 3-77). There are no census block groups with poverty rates more than 20 percent above the state average (11 percent). Census block group 2 of census tract 9502 in Lincoln County has the highest percentage of low-income populations with 22 percent (250 people) of the population below the poverty level. The Department also used county subdivisions and population

Table 3-77. Minority and low-income populations in the jurisdictions and nearby areas potentially affected by construction and operation of the proposed rail line – Caliente rail alignment.[a]

Areas	Population	Percent minority	Percent low income
State of Nevada	2,000,000[b]	35	11
Counties			
Nye County	32,500	13	11
Esmeralda County	970	19	15
Lincoln County	4,200	10	17
County subdivisions			
Amargosa Valley Census County Division, Nye County, Nevada	1,100	28	15
Beatty Census County Division, Nye County, Nevada	1,090	11	13
Goldfield Census County Division, Esmeralda County, Nevada	450	4.5	12
Caliente Census County Division, Lincoln County, Nevada	1,200	15	22
Small population centers			
Beatty (Nye County)	1,090	11	13
Caliente (Lincoln County)	1,130	15	22
Within 3 kilometers (1.8 miles) of the rail alignment centerline	1,800	12	13

a. Source: DIRS 176856-U.S. Bureau of Census 2003, all.
b. The state population is rounded to 2 million for consistent analysis.

centers for comparative analyses. Based on the data in Table 3-77, most of the county subdivisions that would surround the Caliente rail alignment have a higher proportion of minority residents than the associated county-wide proportion of minority residents. The Amargosa Valley ***Census County Division***, a subdivision of Nye County, shows the widest percentage difference with a 28-percent minority population compared to only a 13-percent minority population for Nye County as a whole. As shown in Table 3-77, however, there are no minority populations that exceed the 50-percent threshold identified in Section 3.2.15.2.

As shown on Table 3-77, poverty rates in the affected county subdivisions tend to be higher than the associated county-wide poverty percentages, except in the Goldfield subdivision, where the poverty rate is lower than the Esmeralda County percentage (DIRS 176856-U.S. Bureau of Census 2003, all). In all cases, poverty rates in the county subdivisions are higher than the statewide figure of 11 percent. There are no low-income populations, however, that exceed the 31-percent benchmark identified in Section 3.2.15.2, as can been seen in Table 3-77.

Population centers are often assessed in relation to the county in which they are located. As shown in Table 3-77, Caliente has a higher minority population rate and higher poverty rate than Lincoln County. Compared to Nye County, Beatty has a slightly lower minority population rate but a higher poverty rate.

3.2.15.3.2 American Indian Perspectives

Section 3.4 addresses American Indian interests in potential impacts to the environment along the Caliente rail alignment. Section 3.4.2.4 provides a discussion of American Indian environmental justice concerns.

3.3 Mina Rail Alignment

This section describes the affected environment along the Mina rail alignment. The scope of the affected environment reflects the ***region of influence*** for each resource area. DOE expects that most potential impacts would occur within a certain distance from the centerline of the rail alignment and within the ***footprints*** of construction and operations support facilities. However, resource area regions of influence vary, depending on the nature and type of the resource. Each environmental resource section fully describes the region of influence for the resource. Table 3-78 summarizes the regions of influence for the Mina rail alignment analyzed in this Rail Alignment EIS.

The **region of influence** is the physical area that bounds the environmental, sociologic, economic, or cultural features of interest for analysis purposes.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 1 of 4).

Resource area	Region(s) of influence
Physical setting	All areas that would be affected by construction and operation of the proposed railroad. These areas include the nominal width of the rail line construction right-of-way, and the footprints of construction and operations support facilities beyond the nominal width of the construction right-of-way. See Section 3.3.1.1.
Land use and ownership	The nominal width of the construction right-of-way, including all private land (including patented mining claims), American Indian lands, and public land fully or partially within this area. Also includes the locations of construction and operations support facilities outside the nominal width of the construction right-of-way. See Section 3.3.2.1.
Aesthetic resources	The ***viewshed*** around all alternative segments, common segments, and proposed locations of construction and operations support facilities. DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of the rail alignment. See Section 3.3.3.1.
Air quality and climate	A small portion of Churchill County near Hazen, Nevada, and Lyon, Mineral (including the Walker River Paiute Reservation), Esmeralda, and Nye Counties. See Section 3.3.4.1.
Surface-water resources	The nominal width of the construction right-of-way for most analyses. In cases where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage patterns could carry eroded soil, sedimentation, or spills downstream, the region of influence extends to 1.6 kilometers (1 mile) on either side of the centerline of the rail alignment. See Section 3.3.5.1.
Groundwater resources	***Aquifers*** that would underlie areas of proposed railroad construction and operations, portions of groundwater aquifers DOE would use to obtain water for construction and operations support and that would be affected by these groundwater withdrawals, and nearby springs that might be affected by such groundwater withdrawals. The horizontal extent of the region of influence varies depending on the particular aspects of the specific project activity. See Section 3.3.6.1.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 2 of 4).

Resource area	Region(s) of influence
Biological resources	DOE used two areas of assessment to describe the affected environment for biological resources: a region of influence and a study area. *Region of influence*: Generally, the nominal width of the construction right-of-way. For facilities that would be outside the nominal width of the construction right-of-way (such as quarries), the footprint of the proposed facility. *Study area*: A 16-kilometer (10-mile)-wide study area, extending 8 kilometers (5 miles) on either side of the centerline of the proposed rail alignment, for use in database and literature searches to ensure the identification of sensitive ***habitat*** areas near the Mina rail alignment and transient or migratory wildlife, particularly special status species, that could pass through the region of influence. See Section 3.3.7.1.
Noise and vibration	The nominal width of the construction right-of-way out to variable distances, depending on several analytical factors (***ambient noise*** level, train speed, number of trains per day, and number of railcars). For construction and operations support facilities, the region of influence varies depending on the magnitude of noise that would be generated and ambient noise levels, which would affect how far away the noise might be heard. Therefore, the region of influence varies along the rail alignment. Also includes the locations of receptors that might be affected by noise, vibration, or both. See Section 3.3.8.1.
Socioeconomics	*Employment and income, population and housing, and public services:* Lyon, Mineral, Nye, Esmeralda, and Clark Counties, and the Walker River Paiute Reservation in Nevada. A second scenario includes Washoe County and Carson City. *Transportation resources:* Public roadways near the Mina rail alignment and the rail alignment itself. See Section 3.3.9.1.
Occupational and public health and safety	*Nonradiological region of influence* The region of influence for public nonradiological impacts includes: The nominal width of the construction right-of-way Public roads in Washoe, Douglas, Storey, Churchill, Lyon, Mineral, Esmeralda, and Nye Counties and the Walker River Paiute Reservation that the workforce would use during railroad construction and operations The railroad construction and operations support facilities including access roads, water wells, and quarries where workers would perform construction, operations, or maintenance activities *Radiological region of influence* The region of influence for radiological impacts for incident-free transportation includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the Mina rail alignment. The region of influence for occupational radiological impacts for incident-free operation also includes the physical boundaries of railroad operations support facilities, where workers would perform operations involving ***casks*** and ***cask cars***. Railroad operations support facilities within the radiological region of influence include only the ***Staging Yard***, the ***Rail Equipment Maintenance Facility***, and the ***Cask Maintenance Facility*** because DOE anticipates that ***radioactive*** materials would be managed only at those facilities.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 3 of 4).

Resource area	Region(s) of influence
Occupational and public health and safety (continued)	The radiological region of influence for public radiological impacts includes: • The population within the region of influence of the Mina rail alignment, including people who live within 0.8 kilometer (0.5 mile) of either side of the centerline of the rail alignment. For the public radiological impacts analysis, DOE evaluated four specific alignments: the alignment with the highest population, the shortest alignment, the longest alignment, and the alignment with the lowest population. • Individuals at locations such as residences or businesses near the rail alignment. • Individuals within the region of influence for radiological impacts for potential public exposure related to accidents and sabotage. This includes the area 80 kilometers (50 miles) on either side of the centerline of the rail line. See Section 3.3.10.1.
Utilities, energy, and materials	*Regions of influence for utilities and energy* • Public water systems: Lyon, Mineral, Esmeralda, and Nye Counties, communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions within Lyon and Churchill Counties. • Wastewater treatment: For wastewater transported offsite for treatment and disposal, the existing permitted treatment facilities in Lyon, Mineral, Esmeralda, and Nye Counties and communities within those counties, and the Walker River Paiute Reservation. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], treated wastewater would be recycled, and there is no associated region of influence.) • Telecommunications: For telephone and fiber-optic telecommunications, the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Verizon. • Electricity: Areas serviced by the southern Nevada electrical grid operated by Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc. *Regions of influence for materials* • The region of influence for cast-in-place concrete and ***subballast*** is limited to the State of Nevada. Subballast, sand, and gravel would be generated from ***overburden*** at quarries and ***borrow sites*** near the rail alignment. There is a high likelihood DOE would also find subballast, sand, and gravel along ***cuts*** for the proposed rail line on ***alluvial fans***. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate. • DOE would obtain ballast rock from potential quarry sites close to the construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase. • Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete could be procured and shipped from various national suppliers. Therefore, the region of influence for these materials is national. See Section 3.3.11.1.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 4 of 4).

Resource area	Region(s) of influence
Hazardous materials and waste	*Use of hazardous materials and the generation of hazardous and nonhazardous wastes*: The nominal width of the construction right-of-way, and the locations of rail line construction and operations support facilities beyond this area. *Disposal of low-level radioactive waste:* DOE low-level waste disposal sites, sites in ***Agreement States***, and U.S. Nuclear Regulatory Commission-licensed sites. *Disposal of hazardous wastes*: The entire continental United States. *Disposal of nonhazardous waste*: Disposal facilities in Mineral, Nye, Esmeralda, and Clark Counties in Nevada. See Section 3.3.12.1.
Cultural resources	Two levels of coverage, based on distance from the rail alignment: • Level I. The first level of coverage is within the nominal width of the construction right-of-way, the area where ground disturbance could directly or indirectly impact cultural resources. • Level II. The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment. This area includes the area of potential disturbances that could indirectly impact cultural resources. See Section 3.3.13.1.
Paleontological resources	The nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities. See Section 3.3.14.1
Environmental justice	An area encompassing the regions of influence for all other resource areas. Includes populations that could be affected by the project that have cultural or religious ties to the area. See Section 3.3.15.1.

3.3.1 PHYSICAL SETTING

This section describes physiography, geology, and soils along the Mina rail alignment. Characterization of the physical setting also identifies relationships to other resource areas described in this Rail Alignment EIS, such as aesthetics, land use, biological (vegetation) resources, and surface-water resources.

Section 3.3.1.1 describes the region of influence for physical setting along the Mina rail alignment; Section 3.3.1.2 describes the general physical setting and characteristics in the region of influence; and Section 3.3.1.3 describes the physical setting in more detail for the Mina rail alignment alternative segments and common segments.

3.3.1.1 Region of Influence

The region of influence for physical setting along the Mina rail alignment includes all areas that would be directly or indirectly affected by construction and operation of the proposed railroad. These areas include the nominal width of the ***rail line*** construction right-of-way, and the footprints of facilities outside the nominal width of the construction right-of-way.

3.3.1.2 General Setting and Characteristics

3.3.1.2.1 Physiography

The Mina rail alignment would cross the western Great Basin of the Basin and Range Physiographic Province. The terrain consists of relatively narrow mountain ranges separated by broad sediment-filled basins approximately 16 to 24 kilometers (10 to 15 miles) wide. The mountain ranges are mostly tilted, ***fault***-bounded crustal blocks that are as much as 120 kilometers (75 miles) long. Mountain ranges typically rise from 910 to 1,520 meters (3,000 to 5,000 feet) above the adjacent valley floors. As shown in Figure 3-124, from north to south, a rail line along the Mina rail alignment would use gaps, passes, and valleys to cross or travel near the following mountain ranges: Terrill Mountains, Calico Hills, Monte Cristo Range, Clayton Ridge, Montezuma Range, and Goldfield Hills.

From north to south, the rail line would cross Campbell Valley, Sunshine Flat, Long Valley, Soda Spring Valley, Rhodes Salt Marsh, Columbus Salt Marsh, Big Smoky Valley, Montezuma Valley, Clayton Valley, Stonewall Flat, Lida Valley, Sarcobatus Flat, Oasis Valley, Crater Flat, and Jackass Flats (see Figure 3-124). All lowlands, except for Campbell Valley, Oasis Valley, Crater Flat, and Jackass Flats have interior drainage to ***playas*** or dry washes and are therefore closed basins. The design of the rail alignment accounts for the locations of the playas in these basins to avoid them. Section 3.3.5 describes surface-water resources in the Mina rail alignment region of influence.

Alluvial fan: A low, outspread, relatively flat-to-gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or break valley.

Playa: A nearly level area at the bottom of a desert basin that does not drain to a river and is temporarily covered with water from heavy rains or snowmelts. Normally a dry lakebed that may contain water in response to seasonally high runoff.

Sediment in the valleys are composed of coarse to fine alluvial debris (boulders, cobbles, sand, silt, and clay) eroded from the adjacent mountains. Large alluvial fans, a common landform in the region, originate at the base of the mountains, and occasionally extend far into the valleys.

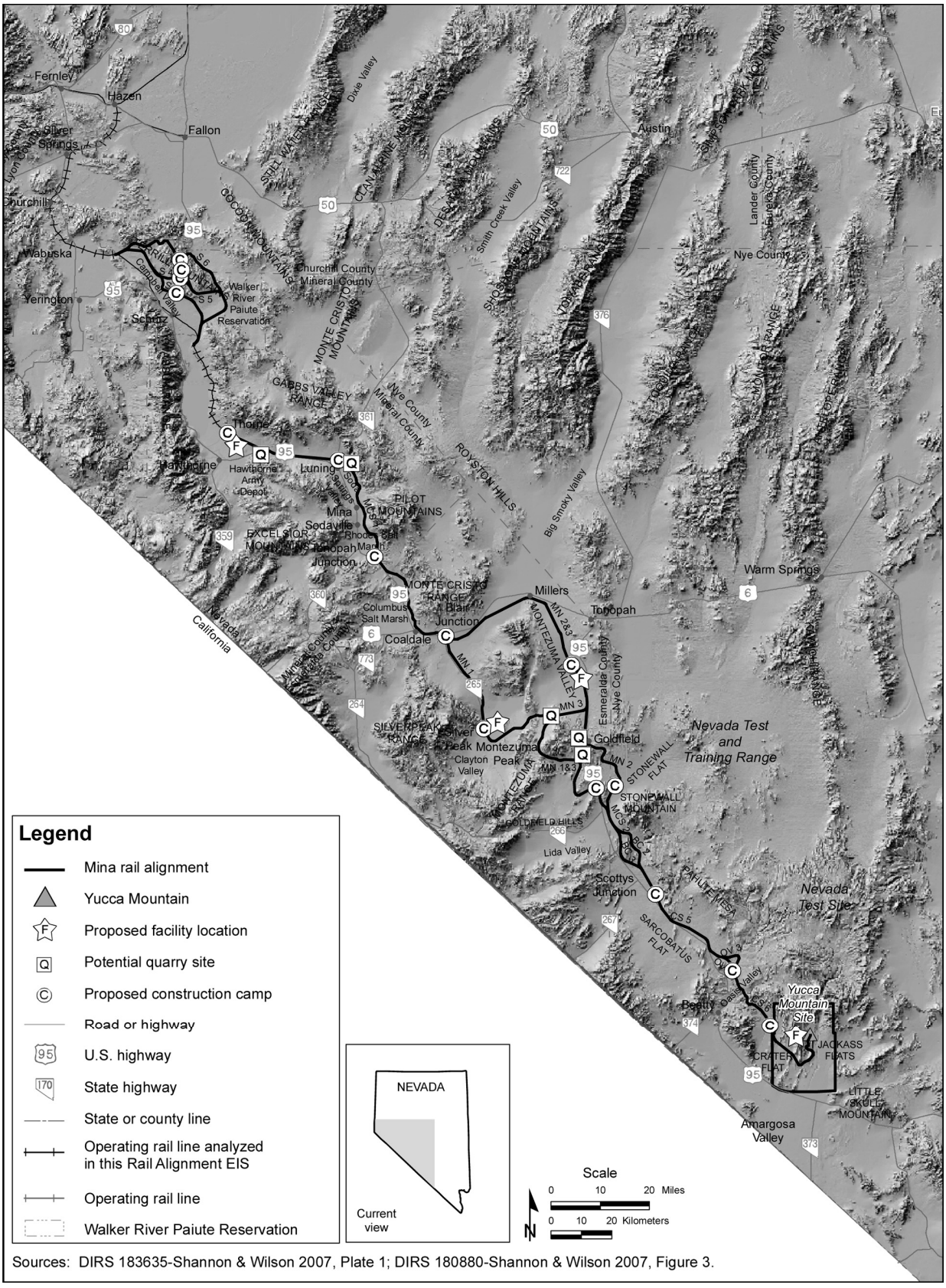


Figure 3-124. Physiographic setting along the Mina rail alignment.

Playas occur in the lowest parts of some valleys. After heavy rains or snowmelt, the lowlands can fill with water. Evaporation of this water over days or weeks leaves a variety of salts near the surface that limit the growth of vegetation. In some locations, where the surface water percolates at a sufficient depth, the water can enter deep saline aquifers. Valleys with playas are sometimes referred to as closed basins, because no surface water flows out of them.

Elevations along the Mina rail alignment range from approximately 980 meters (3,200 feet) above mean sea level at the base of Busted Butte on the west side of Jackass Flats to approximately 2,000 meters (6,500 feet) above mean sea level at an unnamed pass in the Montezuma Range (DIRS 182854-Shannon & Wilson 2006, Figure 3; DIRS 180880-Shannon & Wilson 2007, Figure 3).

3.3.1.2.2 Geology

This section summarizes regional geology along the Mina rail alignment. The geotechnical reports to support the preliminary design effort (DIRS 183635-Shannon & Wilson 2007, all; DIRS 180880-Shannon & Wilson 2007, all) provide a more detailed discussion of regional geology.

The Mina rail alignment would cross a region of complex stratigraphic and structural elements that includes major north-south trending basins and ranges and broad volcanic uplands. Table 3-79 provides a generalized stratigraphic description and lists rock sequences according to the geologic age during which they were deposited, and their locations from north to south along the Mina rail alignment. Table 3-79 also defines the geologic periods discussed in the geology sections of this Rail Alignment EIS.

North of the Montezuma Range, exposures consist of ***sedimentary rocks*** (such as carbonate) and ***volcanic rocks*** of Paleozoic age, as well as Tertiary volcanic flows and ash fall deposits. South of the Montezuma Range, only the Tertiary volcanic rocks are visible at the surface.

Soils in the valleys were primarily formed from late Tertiary and Quaternary and some Paleozoic debris eroded from neighboring mountains, wind-blown sand and silt, fine-grained lake deposits, evaporite deposits, and marsh and playa sediments. In some areas, alluvial fans are thin and overlie bedrock surfaces. Elsewhere, basin-fill sediments are more than 1,200 meters (4,000 feet) thick (DIRS 183635-Shannon & Wilson 2007, p. 14).

The oldest ***outcrops*** in the region are Precambrian Era ***metamorphic rocks***, which are exposed in hills west of Montezuma alternative segment 1 and west of common segment 6. Other than these exposures, Precambrian bedrock is covered by younger rocks.

Metamorphic rocks are rocks in which the original mineralogy, texture, or composition has changed due to the effects of pressure, temperature, or the gain or loss of chemical components.

Sedimentary rocks are rocks formed by the accumulation of sediment in water or land. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks that are found in the Great Basin. They are differentiated by chemistry, deposition, and grain size.

Volcanic rocks are rocks that have been ejected at or near the earth's surface. Tuffs, lava flows, volcanic breccias, basalt, andesite, and rhyolite are types of volcanic rocks that are found in the Great Basin. They are differentiated by chemistry and texture.

During the late Paleozoic Era, the area was periodically covered by shallow seas to the east that generally deepened westward. Thick layers of limestone, shale, sandstone and some volcanic rocks, now exposed widely in the mountains along Mina common segment 1, are the remains of these Paleozoic seas (DIRS 183635-Shannon & Wilson 2007, p. 13).

Table 3-79. General stratigraphy – Mina rail alignment (page 1 of 2).

Geologic period[a]	Northern portion of the Mina rail alignment[b,c]	Northern portion of Mina common segment 1[b,d]	Southern portion of Mina common segment 1[b,e]	Montezuma alternative segments 1, 2, and 3 [b,f]	Southern portion of the Mina rail alignment (southwest Nevada volcanic field)[g]
Cenozoic Era[h] (less than 65 Ma)-Quaternary Period (less than 1.6 Ma)	Stream channel and lake alluvium; wind-blown, playa, and basin-fill deposits.	Stream channel, lake, floodplain and fan alluvium; wind-blown, playa and basin-fill deposits.	Stream channel, lake, floodplain and fan alluvium; wind-blown and basin-fill deposits.	Stream channel and fan alluvium; dune, playa and landslide deposits; basalt flows and cinder cones.	Stream channel and floodplain alluvium; wind-blown, playa, and landslide deposits; fan alluvium; basin-fill deposits. Basalt flows.
Cenozoic Era (less than 65 Ma)-Tertiary Period (65 to 1.6 Ma)	Late Tertiary rocks include alluvial fan and landslide deposits; gravel; basalt and andesite lava flows; sedimentary and volcanic rocks; sedimentary breccia; conglomerate; and sandstone. No mid-Tertiary rocks. Early Tertiary rocks include dacite, rhyodacite, tuffs, and rhyolite dikes.	Late Tertiary rocks include alluvial, fan, landslide and gravel deposits, conglomerate, lava flows, dikes, fine-grained lake deposits, stream alluvium, sandstone, cinder cones, claystone. Mid-Tertiary rocks include lava flows, interbedded with tuffs, and other volcanic rocks. Early Tertiary rocks include tuff, sandstone, conglomerate, siltstone, shale and conglomerate and volcanic rocks.	Late Tertiary rocks include basalt lava flows, cinder cones, sandstone and conglomerate, tuff, andesite, breccia. Mid-Tertiary rocks include dacite and andesite to rhyodacite, tuff, tuff breccia, lava flows, and intrusive volcanic rocks. No early Tertiary rocks area exposed along this portion of the alignment.	Late Tertiary rocks include conglomerate and sandstone, basalt siltstone, claystone, tuff, volcanic and lava flows. Mid-Tertiary rocks include lava flows, and dykes, andesite breccia, silicic dykes, tuff, volcaniclastic, sandstone and shale. Early Tertiary rocks include sandstone and siltstone, conglomerate, sandstone and basalt flows, rhyolite, and ash fall tuff.	Silicic ash-flow tuffs; minor basalts. Predominantly volcanic rocks of the southwestern Nevada volcanic field.
Mesozoic Era (240 to 65 Ma)	Late Mesozoic rocks include granite, granodiorite and quartz monzonite, diorite, tonalite gabbro, hornfels, schist and marble. Early Mesozoic rocks include andesite lava flows, tuff, metamorphosed volcanoclastic rocks.	Granite, quartz monzonite, granodiorite, diorite, tonalite and serpentine, volcanic rocks, ***clastic***, volcaniclastic and carbonate sedimentary rocks. Metamorphosed marine and submarine sedimentary rocks, lava flows and flow breccia, tuff, hornfels, greywacke, argillite and limestone (such as marine volcanic and sedimentary rocks).	Late Mesozoic (Cretaceous) age rocks include quartz monzonite, granodiorite, and granite. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.	Late Mesozoic (Cretaceous) age rocks include granite, quartz monzonite, granodiorite, mafic and felsic dikes. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.	Granitic rocks of late Mesozoic (Cretaceous) age occur. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.

Table 3-79. General stratigraphy – Mina rail alignment (page 2 of 2).

Geologic period[a]	Northern portion of the Mina rail alignment[b,c]	Northern portion of Mina common segment 1[b,d]	Southern portion of Mina common segment 1[b,e]	Montezuma alternative segments 1, 2, and 3 [b,f]	Southern portion of the Mina rail alignment (southwest Nevada volcanic field)[g]
Paleozoic Era (570 to 240 Ma)	Rocks of this age are not exposed along this portion of the alignment.	Submarine lava flows, volcanic clast sedimentary rock, and conglomerate. Limestone, dolomite chert, chert-clast sandstone, and chert pebble conglomerate. Sandstone, fine-grained clastic rocks, quartzite, hornfels, siltstone, and shale. Early Paleozoic (Ordovician and Cambrian) rocks are shale, siltstone, claystone, limestone, marble, and metamorphosed sedimentary rocks.	Dolomite chert, chert-clast sandstone and chert pebble conglomerate. Fine-grained clastic rocks, conglomerate, limestone, quartzite, and partially altered mafic volcanic rocks.	Rocks of Middle and Late Paleozoic age are not exposed along this portion of the alignment. Early Paleozoic (Ordovician and Cambrian) rocks are shale, siltstone, claystone, limestone, marble, and metamorphosed sedimentary rocks.	Alternating marine and terrestrial sediments comprised mostly of shale, quartzite, limestone, and dolomite.
Precambrian Era (greater than 570 Ma)	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Claystone, siltstone, fine-grained sandstone, sandy limestone, dolomite, and slightly metamorphosed sedimentary rocks.	Conglomerate, quartzite, sandstone, shale, dolomite, limestone, chert, and diabase overlie old ***igneous*** and metamorphic rocks that form the crystalline "basement."

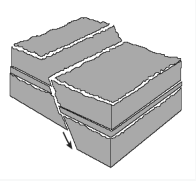
a. Ma = approximate years ago in millions.
b. Source: DIRS 180880-Shannon & Wilson 2007, Table 2 and Table 3.
c. Includes Wassuk Range, Walker River Basin, and Whiskey Flat.
d. Includes Candelaria and Goldfield Hills, Excelsior Mountains, Columbus and Rhodes Salt Marshes, Soda Spring Valley, Pilot Mountain, Gabbs Valley, and Gibbs Range.
e. Includes Monte Cristo Range.
f. Includes Montezuma Range, Clayton Ridge, Paymaster Ridge, Palmetto Mountains, Silver Peak Mountains, Mineral Ridge, Weepah Hills, Big Smoky Valley, Goldfield Hills, Malpais Mesa, Mt. Jackson Ridge, Montezuma and Lida Valleys, and Lone Mountain.
g. Includes Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat. Source: DIRS 182854-Shannon & Wilson 2006, Tables 2 and 3.
h. The Cenozoic Era consists of both the Quarternary and the Tertiary periods.

In Mineral County, off-shore sedimentation continued throughout the Mesozoic era, before ending with new tectonic movement (DIRS 183635-Shannon & Wilson 2007, p. 13).

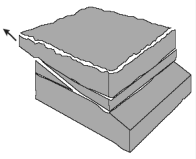
Major east-west compression occurred periodically in the Great Basin between about 350 million and 65 million years ago (DIRS 169734-BSC 2004, p. 2-16). This compression moved large sheets of old rock great distances upward and eastward over young rocks along ***thrust faults*** to produce mountains. Most of the thrust ***fault*** traces have eroded away; however, there is evidence of thrust motion in the Garfield Hills area, where Triassic rocks overlie Jurassic rocks (DIRS 183635-Shannon & Wilson 2007, p. 16). Range-bounding ***normal faults***, which have developed in response to ***crustal extension*** over approximately the last 20 million years, are conspicuous features in this part of Nevada and are especially visible in parts of Nye County. These faults have surface traces that form distinctive segments 5 to 30 kilometers (3.1 to 19 miles) long (DIRS 174214-Kleinhampl and Ziony 1985, p. 144). Although generally coincident with the range fronts, in places these normal faults, and shorter ***splay faults*** radiating outward from these normal faults, extend into adjacent valleys where they are buried by recent alluvial deposits. Both the exposed and buried parts of active faults could be capable of rupturing the surface.

Faulting is movement of the earth's crust that produces relative displacement of adjacent rock masses along a fracture. Generally, the fracture is referred to as a fault.

Splay faults are minor faults that branch off of a primary fault, or interconnect to form a fault zone.



A normal fault is a fault where the block above an inclined fault has moved down relative to the other block.



A **thrust fault** is a fault that occurs when squeezing forces push the block above an inclined fault up in relation to the other block.

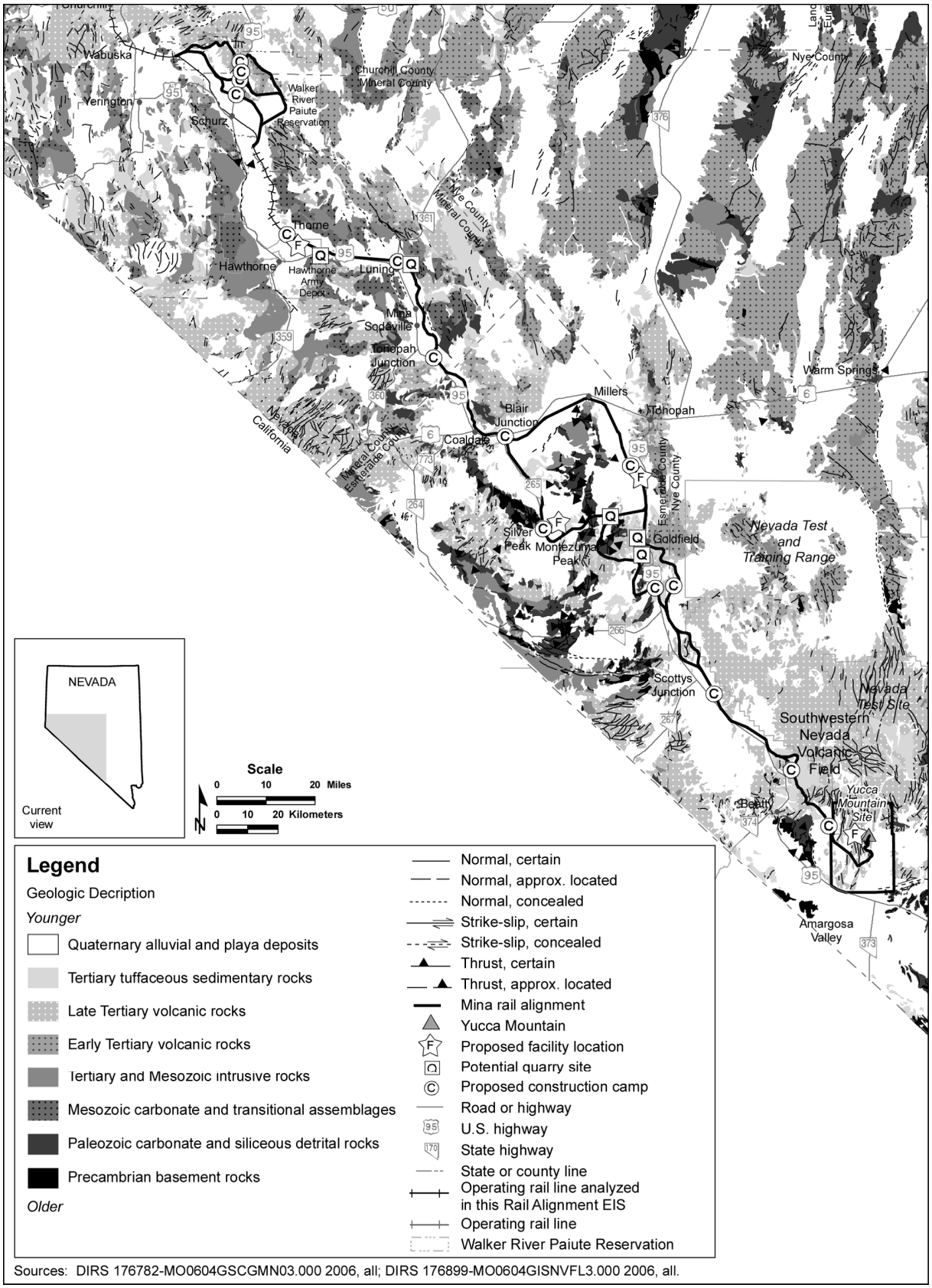
Source: DIRS 155970-DOE 2002, Figure 3-9.

Crustal extension in the region, which began about 20 million years ago, is still occurring (DIRS 183639-Shannon & Wilson 2007, p. 13). By about 11.5 million years ago, present-day mountains and valleys were well developed. Evidence for recent, continuing crustal extension is based on Holocene-age (approximately the last 10,000 years) faults, recurring ***earthquakes***, and geothermal features. The Holocene-age faults are visible in many valleys in Mineral, Esmeralda, and Nye Counties that the proposed rail line would cross (Figure 3-125).

Evidence of crustal extension is seen in the Walker-Lane Structural Belt, a 96-kilometer (60-mile)-wide deformation zone that parallels the Nevada-California border from Las Vegas to northern California. The belt includes generally northwest-trending faults that were active within the last 20 million years (DIRS 183635-Shannon & Wilson 2007, p. 17). The earthquakes along the western section of the Great Basin are primarily connected to ruptures along surface or buried faults in the Walker-Lane Belt (DIRS 183635-Shannon & Wilson 2007, pp. 16 and 17). Section 3.3.1.2.2.1 provides more information on ***seismic*** activity along the Mina alignment.

The southwestern Nevada volcanic field is a volcanic plateau that developed between 16 and 7 million years ago, with the greatest eruptions occurring between 14 and 11 million years ago (DIRS 183639-Shannon & Wilson 2007, p. 11). The volcanic field encompasses common segment 5, the Oasis Valley alternative segments, and common segment 6 (Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat).

The field has a complex history of volcanism and deformation (DIRS 169734-BSC 2004, pp. 2-4 through 2-15). Eruption of 17 ash-flow ***tuff*** sequences and lava flows occurred from at least seven large, overlapping ***caldera*** complexes to form the southwestern Nevada volcanic field.



Sources: DIRS 176782-MO0604GSCGMN03.000 2006, all; DIRS 176899-MO0604GISNVFL3.000 2006, all.

Figure 3-125. Geologic setting along the Mina rail alignment.

The youngest caldera-forming events associated with this feature occurred between 7.5 and 7.6 million years ago with eruptions southeast of Mina common segment 2 (DIRS 183635-Shannon & Wilson 2007, p. 13). The mid-Tertiary eruptions deposited ash-fall and volcanic-ash flows with minor lava flows and reworked materials. Only Tertiary and younger rocks are exposed in the southwestern Nevada volcanic field area.

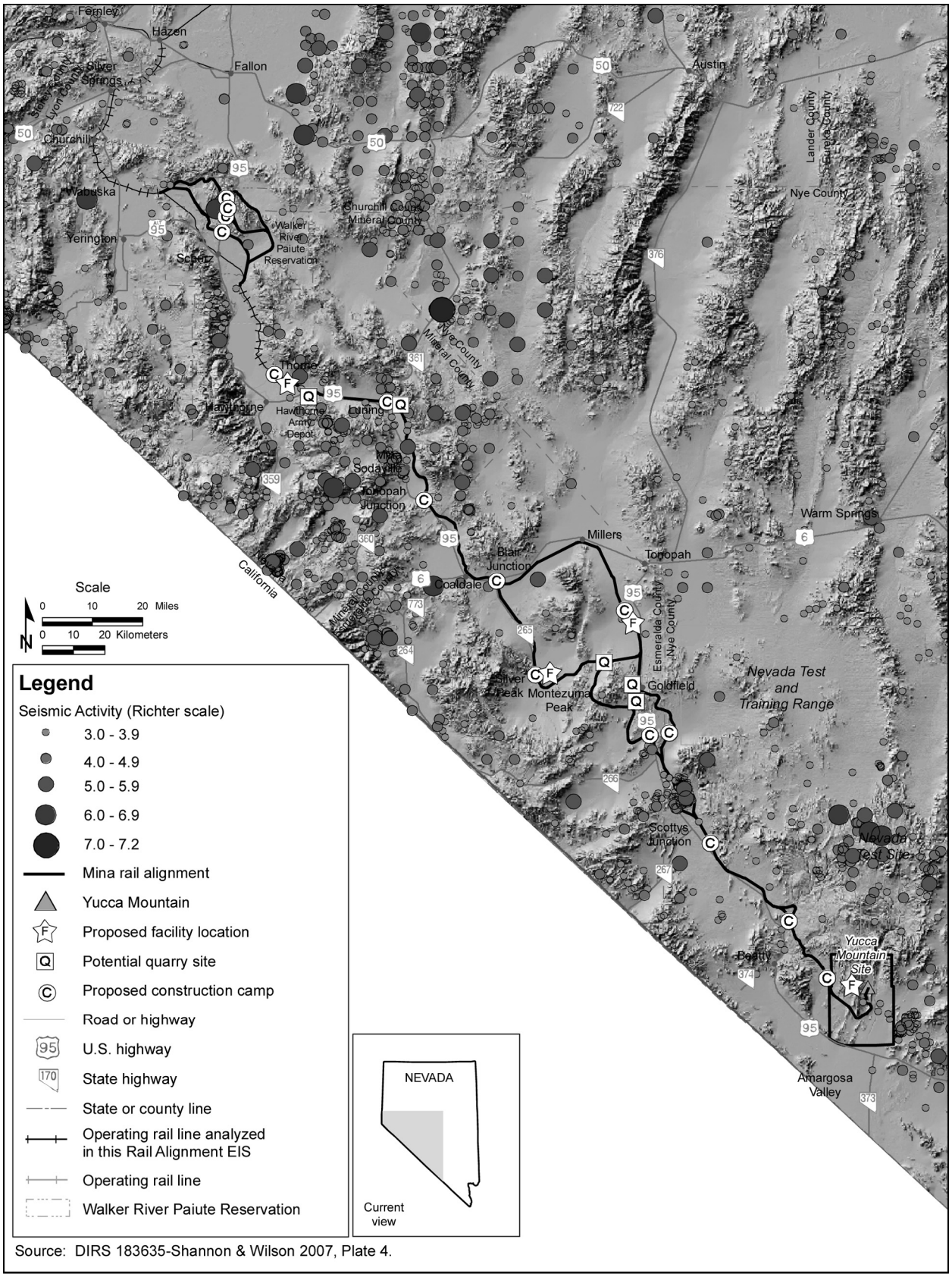
There are cinder cones (a type of volcano formed by ejected cinders) south of Blair Junction in Big Smoky Valley, the northwest corner of Clayton Valley, and Oasis Valley. The ***basalt*** flows and associated material ejected from volcanoes are dated approximately between 1.6 million years and 10,000 years old (DIRS 183635-Shannon & Wilson 2007, p. 29; DIRS 183639-Shannon & Wilson 2007, pp. 25 and 26).

3.3.1.2.2.1 Faulting and Seismic Activity. Historically, there have been numerous earthquakes in the Great Basin region as a result of the ongoing crustal extension (see Figure 3-126). Consistent with geologic evidence, the historical record of Holocene-age ***seismicity*** (occurring within the last 10,000 years) suggests that seismic activity was concentrated in the western part of the Great Basin (DIRS 183635-Shannon & Wilson 2007, p. 16 and Plate 4). Modern earthquakes in the area predominantly occur at depths of 2 to 12 kilometers (1.2 to 7.4 miles) below Earth's surface (DIRS 169734-BSC 2004, p. 4-35).

The western Great Basin contains many Quaternary fault traces; however, there are few instances of surface rupture within the last 10,000 years (DIRS 183635-Shannon & Wilson 2007, p. 16). These faults are characterized by discontinuous scarps (vertical displacement along a fault), from surface displacement. Studies of Holocene faults have calculated slip rates of 0.01 to 0.1 millimeter (0.000039 to 0.0039 inch) per year, with a surface-rupturing recurrence of approximately 100 years (DIRS 176905-Workman et al. 2002, p. 18). Studies of fractures other than ***block-bounding faults*** around Yucca Mountain determined that fault displacements of about 0.1 centimeter (0.039 inch) would have an exceedance ***probability*** of once every 100,000 years (DIRS 169734-BSC 2004, p. 4-64).

Figure 3-126 shows the number and locations of earthquakes of magnitude 3.0 and greater on the Richter scale based on available historical and recorded data from 1852 to 2004. Most of the earthquakes around the Mina rail alignment fall within a magnitude range of 3.0 to 3.9, the range that most people start to feel ground shaking (DIRS 180969-USGS 2006, all). As magnitude increases, the potential for damage from ground shaking also increases. The highest concentration of earthquakes, large and small, along the Mina rail alignment occur in the northern portion of Mina common segment 1, centered around Garfield Hills and Soda Spring Valley.

There have been many seismic events with a magnitude 5.0 or larger on the Richter scale within 30 kilometers (19 miles) of the proposed rail alignment, several occurring on the Nevada Test Site north of Yucca Mountain. Most seismic events on the Nevada Test Site are associated with historical underground testing, not natural ***faulting***. Seismic activity from man-made tests has not activated local faults (DIRS 169734-BSC 2004, pp. 4-33 and 4-35). There is another cluster of earthquakes around the northern portion of the Mina rail alignment, in the mountains around Soda Spring Valley. This seismic activity is believed to be connected to stretching along the Walker Lane Structural Belt (DIRS 183635-Shannon & Wilson 2007, pp. 16 and 17). The closest major earthquake to the rail alignment was a magnitude 6.3 magnitude event in 1959 near Schurz. In 1932, there was a magnitude 7.2 earthquake near Cedar Mountain that caused cracking in some structures. A 1992 earthquake near Little Skull Mountain is the largest recorded earthquake in the vicinity of Yucca Mountain. The magnitude 5.6 event was apparently triggered by a magnitude 7.3 earthquake that occurred 20 hours earlier at Landers, California, 300 kilometers (190 miles) southwest of Yucca Mountain (DIRS 169734-BSC 2004, pp. 4-38 and 4-39). Since 1978, DOE has monitored seismic activity in the area around Yucca Mountain to pinpoint seismic events (DIRS 155970-DOE 2002, p. 3-32). In the area around the Mina rail alignment, earthquakes with a magnitude of 6.1 to 6.4 are predicted to have a return period of 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14).



Source: DIRS 183635-Shannon & Wilson 2007, Plate 4.

Figure 3-126. Seismic activity in Nevada along the Mina rail alignment from 1852 to 2004.

Through the National Earthquake Hazard Reduction Program, national and regional shaking-hazard maps are used to determine the probability of seismic-related damage based on regional earthquake occurrence rates and how far the shaking travels horizontally (DIRS 174194-USGS 2005, all). These maps are used to meet modern seismic design provisions for the construction of buildings, bridges, highways, and utilities. Shaking-hazard maps, also known as peak acceleration maps, show the levels of horizontal shaking that have a certain probability of being exceeded in a 50-year period (see Figure 3-127). When an earthquake occurs, the forces caused by the shaking can be measured as a percentage of the constant known as *g,* which is the acceleration of a falling object due to gravity. The resulting map uses contour lines to show the amount of shaking a location would experience during any area earthquake, regardless of its distance to the epicenter.

The predicted peak horizontal accelerations tend to decrease from northwest to southeast along the Mina rail alignment. The northern portion of the Mina rail alignment shows a 2-percent probability of exceeding a peak horizontal acceleration of 50-percent *g* within a 50-year period (Figure 3-127) and a 10-percent probability of exceeding a peak horizontal acceleration of 25-percent *g* within a 50-year period (DIRS 174296-Shannon & Wilson 2005, Figure 3). In other words, the Mina rail alignment would experience shaking of 50-percent *g* or more from a seismic event with a return period of approximately 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14). Peak horizontal acceleration of 10-percent *g* is considered to be capable of minor structural damage in normal buildings, while 50-percent *g* could cause damage to most structures.

3.3.1.2.2.2 Mineral and Energy Resources. For more than 100 years, parts of the western Great Basin have produced substantial amounts of base and precious metals, particularly gold and silver (DIRS 183637-Shannon & Wilson 2007, pp. 5 and 6). Parts of the Mina rail alignment, especially in the vicinity of the Goldfield Mining District, have been intensely mined and have extensive surface and underground mine workings. Energy resources reported along and near the rail alignment include low-temperature geothermal water. Section 3.3.2, Land Use and Ownership, describes ***mining districts*** and associated land claims along the Mina rail alignment in more detail.

3.3.1.2.2.3 Potential Sources of Construction Materials. As described in Chapter 2, there would be local sources for some construction materials. The estimated quantity of ***ballast*** required for construction of a rail line along the Mina rail alignment would range from 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). DOE has identified five potential ballast quarry locations along the Mina rail alignment with sufficient topographic and geologic characteristics to accommodate excavation and preparation facilities. Figures 2-28 through 2-32 show the potential quarry sites along Mina common segment 1 and Montezuma alternative segments 1, 2, and 3. The topography and geology of potential ballast quarry sites are described in more detail in the discussion of the alternative segment or common segment with which they are associated.

The amount of material excavated from cuts would not equal the fill requirements to construct the rail alignment. Therefore, borrow pits would need to be excavated to supplement the difference in subballast. There is also a high likelihood the Department would find suitable sands and gravels on the alluvial fans along the rail alignment for this use. Section 3.3.11, Utilities, Energy, and Materials, discusses the regional supply chains for other construction materials.

3.3.1.2.3 Soils

DOE used soil survey databases from the U.S. Department of Agriculture, Natural Resources Conservation Service (DIRS 184079-Natural Resources Conservation Service 2007, all), to identify soil types and characteristics along the Mina rail alignment. Approximately 95 percent of the project area has been surveyed. However, soil surveys around the Nevada Test and Training Range have not been completed.

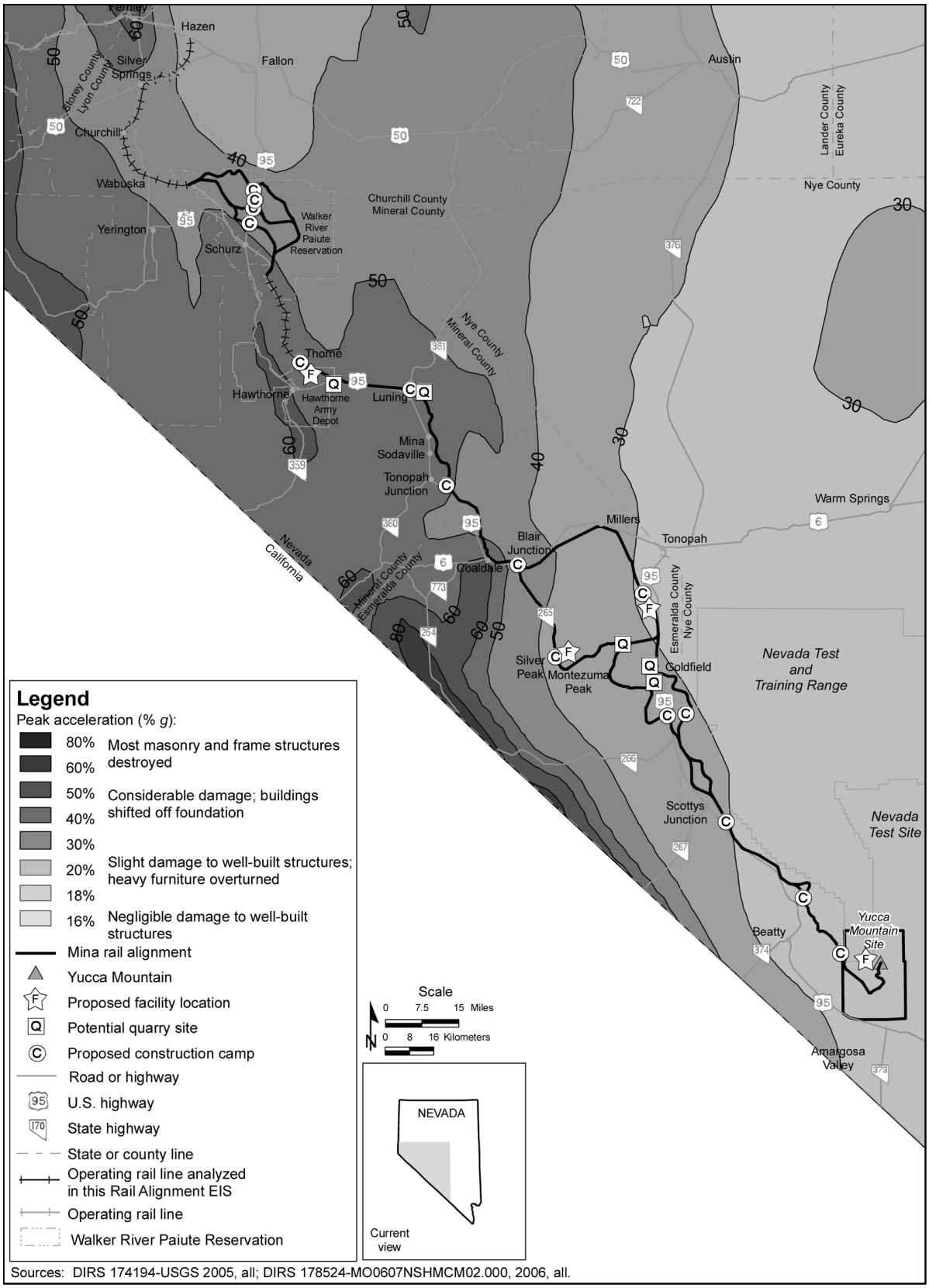


Figure 3-127. Seismic hazards along the Mina rail alignment: peak acceleration (percent *g*) with 2-percent probability of exceedance in 50 years.

In areas where soils data are not available, DOE does not consider the unavailable data critical to the design and construction of a railroad along the Mina rail alignment because soils are expected to be similar to those already surveyed. In addition, as part of the design, DOE would place geotechnical borings along the entire rail alignment to obtain site-specific soils data.

This Rail Alignment EIS identifies the specific soil characteristics relevant to proposed railroad construction and operations. From a potential impact perspective, soil designated as supporting ***prime farmland*** is considered one of the relevant characteristics. The Natural Resources Conservation Service (DIRS 181427-NRCS 2007, Part 622.04(a)) defines prime farmland as:

> Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or ***alkalinity***, an acceptable content of salt and sodium, and few or no rocks. Its soils are ***permeable*** to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.

The prime farmland soil label is applied to the soil types and associations that the National Resources Conservation Service identifies as satisfying this definition. Less than 0.1 percent, or about 0.14 square kilometer (35 acres), of the Mina rail alignment construction right-of-way would contain soils classified as prime farmland (see Figure 3-128). All of the prime farmland soils that the Mina rail alignment would cross are found on the Walker River Paiute Reservation, which contains 5.5 square kilometers (1,400 acres) of prime farmland soils. Lyon, Churchill, Mineral, and Nye Counties contain 299 square kilometers (74,000 acres), 407 square kilometers (100,000 acres), 44 square kilometers (11,000 acres), 610 square kilometers (150,000 acres), respectively, of soils classified as prime farmland (DIRS 184079-Natural Resources Conservation Service 2007, all). Esmeralda County has none. The amount of prime farmland soils within the Mina rail alignment construction right-of-way would consist of 2.6 percent of the total prime farmland soils on the Walker River Paiute Reservation but less than 0.01 percent of the total prime farmland soils on the Walker River Paiute Reservation and in Lyon, Churchill, Mineral, and Nye Counties. DOE has also contacted the Nevada Natural Resource Conservation Service office to collaborate on the identification of prime, unique statewide, or locally important farmland along the alignment. This correspondence is further described in Section 4.3.1.2.1.3, and in the individual segment discussions in Section 4.3.1.2.2.

Table 3-80 lists the prime farmland and quantity of soils with other characteristics along the Mina rail alignment. The table lists the percentage of the area within the nominal width of the construction right-of-way that contains soils with a particular characteristic. In some locations along the rail alignment, DOE would occupy and disturb less of the construction right-of-way to avoid sensitive environmental resources and private property. Because different combinations of alternative segments and common segments would be different lengths and have different disturbed areas, DOE judged the impacts from soil erosion based on the acreage of specific soil types that would be affected by construction-related disturbance. Section 4.3.1.2.1.3 provides a more detailed discussion of how railroad construction and operations could affect topsoil.

Other soil characteristics that are particularly relevant to proposed railroad construction and operations are classified in Table 3-80 as ***erodes easily*** and ***blowing soil***. Soil with either of these characteristics can be quite susceptible to erosion. As seen in Table 3-80, these soil types are found in similar amounts within each group of alternative segments.

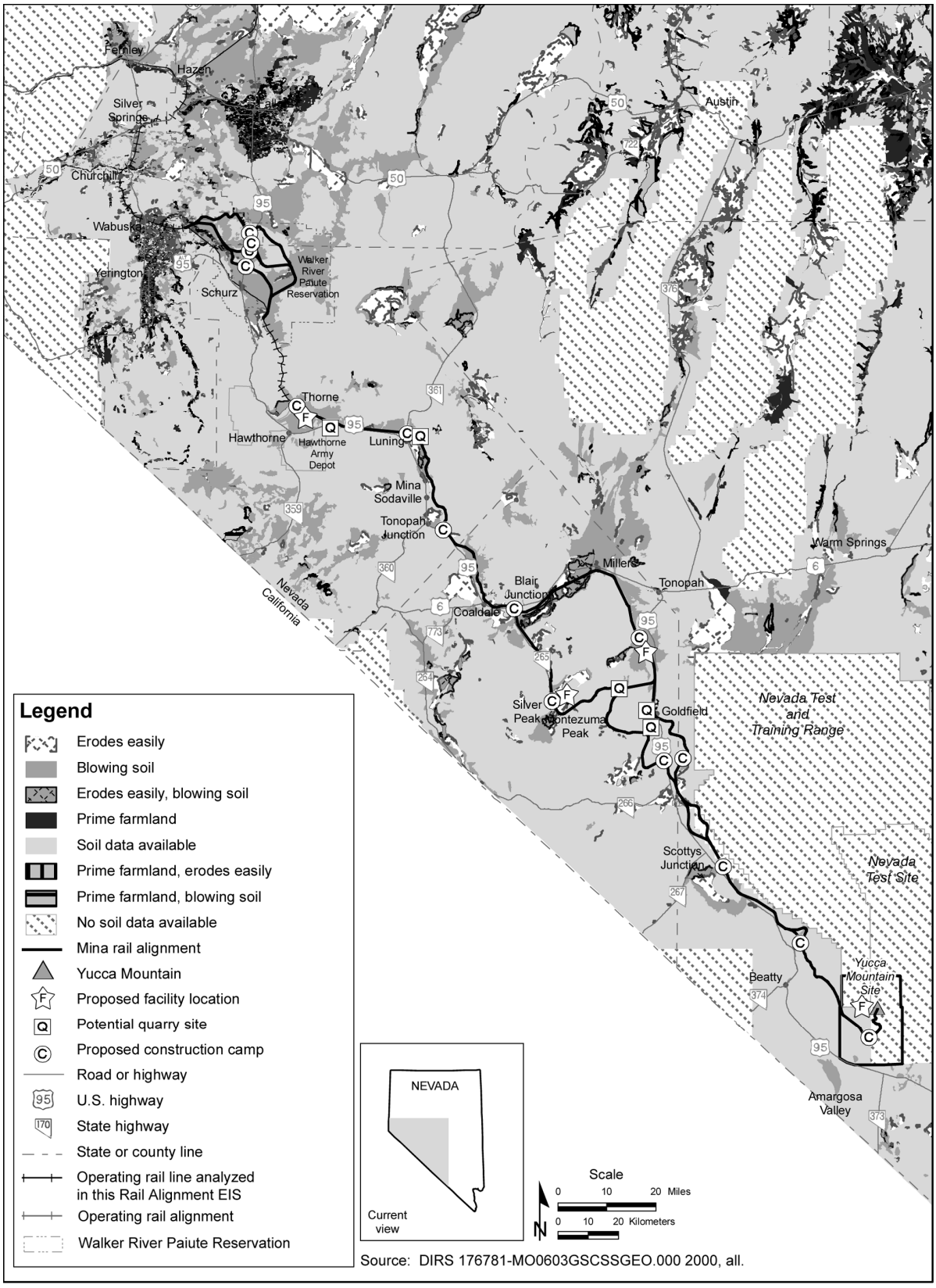


Figure 3-128. Soils with prime farmland, erodes easily, and blowing soil characteristics along the Mina rail alignment.

Table 3-80. Percent of soil characteristics within the Mina rail alignment construction right-of-way.[a]

Rail line segment	Percent prime farmland	Percent blowing soil	Percent erodes easily	Percent soil survey coverage[b]
Union Pacific Railroad Hazen Branchline[c]	NA	NA	NA	NA
Department of Defense Branchline North[c]	NA	NA	NA	NA
Schurz alternative segment 1	d	83	4.7	100
Schurz alternative segment 4	d	69	4.8	100
Schurz alternative segment 5	d	63	2.9	100
Schurz alternative segment 6	d	51	2.9	100
Department of Defense Branchline South[f]	e	39	e	100
Mina common segment 1	e	39	7.9	100
Montezuma alternative segment 1	e	5.2	15	100
Montezuma alternative segment 2	e	33	13	100
Montezuma alternative segment 3	e	26	10	100
Mina common segment 2	e	e	100	100
Bonnie Claire alternative segment 2	e	e	27	18
Bonnie Claire alternative segment 3	e	e	25	77
Mina common segment 5	e	2.6	e	74
Oasis Valley alternative segment 1	e	13	e	100
Oasis Valley alternative segment 3		4.8	e	100
Mina common segment 6	e	e	e	74

a. Source: DIRS 184079-Natural Resources Conservation Service 2007, all.
b. There are data gaps for Nye County around the Nevada Test and Training Range because those soil surveys have not been completed.
c. Soil survey is not described because there would be no surface disturbance along this portion of the rail alignment. NA = not applicable.
d. Amount is less than 1 percent.
e. Characteristic not present. Soil percentages do not add up to 100 percent.
f. Soil characteristics are identified because DOE would establish a construction camp and build a siding along this branchline.

The erodes easily characteristic is a measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, tend to erode easily when disturbed. Approximately 19 percent of the entire Mina rail alignment has soils with this characteristic (DIRS 184079-Natural Resources Conservation Service 2007, all).

The blowing soil characteristic is based on the soil survey classification of susceptibility of a given soil to wind erosion. This classification method uses eight groupings. Soils assigned to Group 1 are the most susceptible to wind erosion and those assigned to Group 8 are the least susceptible. Soils listed in Table 3-80 with the blowing soil characteristic are those assigned to erodibility Group 1 or 2 (DIRS 181427-NRCS 2007, Exhibit 618-16). The blowing soil characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion. Depending on the combination of alternative segments and common segments, between 23 and 26 percent of the entire Mina rail alignment would have soils with the blowing soil characteristic (DIRS 184079-Natural Resources Conservation Service 2007, all). Figure 3-128 identifies the locations of prime farmland, erodes easily, and blowing soils.

3.3.1.3 Setting and Characteristics along Alternative Segments and Common Segments

3.3.1.3.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

There would be no new construction along the Union Pacific Railroad Hazen Branchline. Therefore, DOE has not characterized the physical setting in this area.

3.3.1.3.2 Department of Defense Branchline North (Wabuska to the Boundary of the Walker River Paiute Reservation)

Figure 3-129 shows this existing rail line. DOE would build a passing ***siding*** adjacent to the existing rail line on previously disturbed land within the existing right-of-way. Therefore, the Department has not characterized the physical setting in this area.

3.3.1.3.3 Schurz Alternative Segments

3.3.1.3.3.1 Physiography. The Schurz alternative segments would be in the Walker River Basin, northeast of the Wassuk Range.

There is an existing rail line (in this Rail Alignment EIS, called the Department of Defense Branchline through Schurz), which connects Department of Defense Branchlines North and South (see Figure 3-129). The branchline travels along the southern edge of Campbell Valley, along the eastern side of the Wassuk Range, through the town of Schurz on the Walker River Paiute Reservation, and terminates at Hawthorne.

Each of the Schurz alternative segments would start at the north end of Campbell Valley and end near Gillis Canyon (see Figure 3-129). In flat locations, the alternative segments would travel along a similar path, and divert around hilly terrain.

Schurz alternative segment 1 would run through Sunshine Flat and travel east of the Weber Reservoir through the Walker River Paiute Reservation. Schurz alternative segment 4 would also cross Sunshine Flat, traveling north of the Calico Hills. Schurz alternative segment 4 would then curve along the southern edge of the Terrill Mountains and travel along an unnamed valley. Schurz alternative segment 5 would travel along the southern edge of the Desert Mountains (elevation 2,040 meters [6,700 feet] above mean sea level), then southeast through Long Valley (elevation 1,300 meters [4,300 feet] above mean sea level), between the Calico Hills and Terrill Mountains, and through the unnamed valley at the southern edge of the Walker River Paiute Reservation. Schurz alternative segment 6 would also travel along the southern edge of the Desert Mountains, and southeast through Long Valley, then curve northeast around the Terrill Mountains, west of the Rawhide Flats, and then down through the unnamed valley before terminating at Gillis Canyon.

3.3.1.3.3.2 Geology. All of the Schurz alternative segments would cross a variety of recent alluvial fans, wind-blown and river deposits, playas, Tertiary sedimentary rocks, basalt, ash-fall deposits, and Mesozoic granite bedrock. Sections of the bedrock in this area have been altered with intrusive volcanic veins, resulting in variable concentrations of commercial minerals. Metallic and nonmetallic minerals of variable quantity and quality have been identified in the surrounding mountains. Surveys and drill cores have identified an iron-rich ore called the Hottentot prospect within Calico Hills (DIRS 183637-Shannon & Wilson 2007, pp. 28 and 29). To construct any of the Schurz alternative segments, DOE would use ***alluvium*** within the nominal construction right-of-way as fill materials, but otherwise would not excavate construction materials.

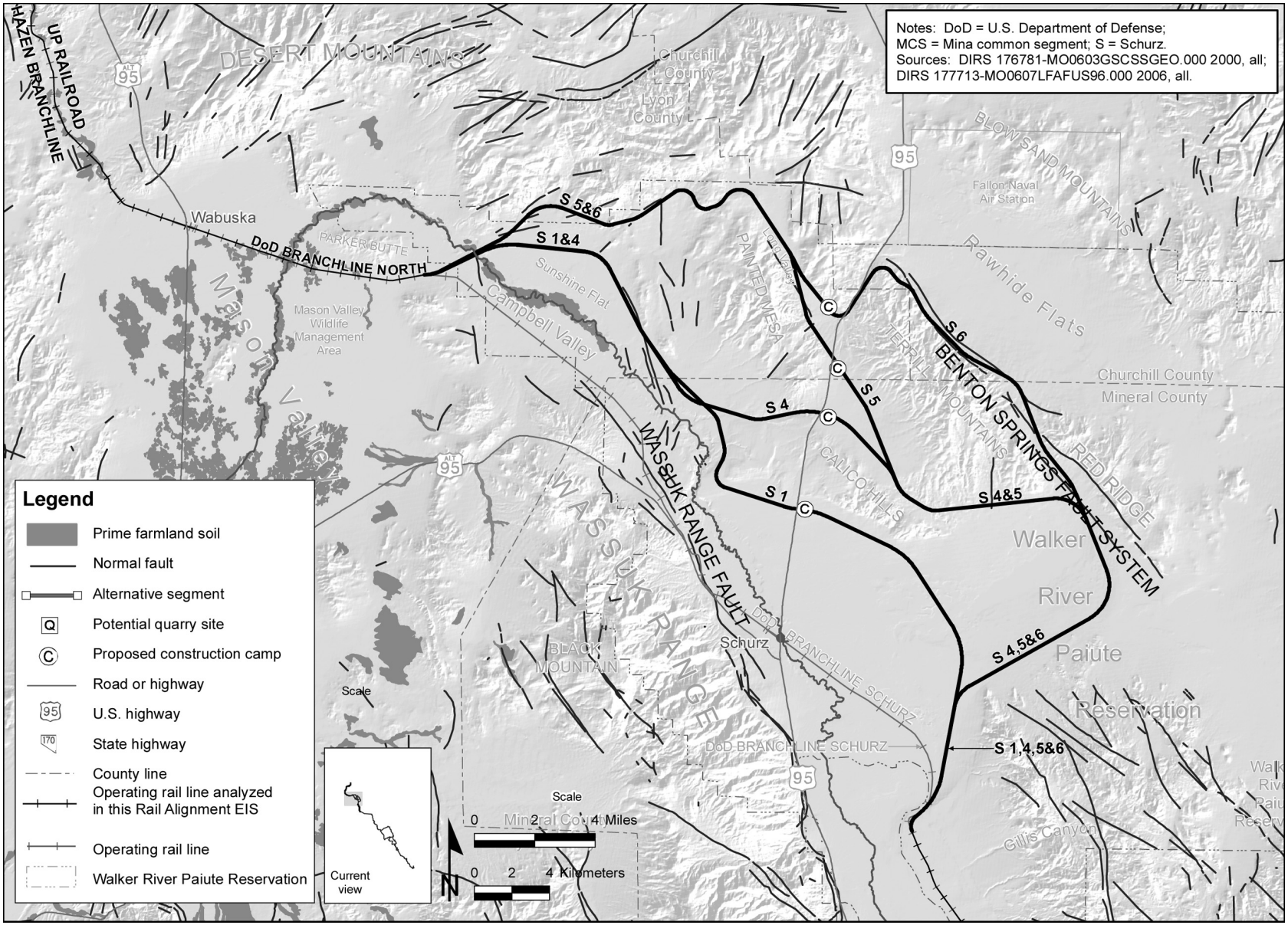


Figure 3-129. Physiographic features of common segments and alternative segments within map area 1.

There are both metallic minerals and nonmetallic minerals of variable quality and quantity in the surrounding mountains (DIRS 183637-Shannon & Wilson 2007, pp. 22, 23, 31, and 32). Geothermal resources include warm springs and steam wells that are found approximately 14 kilometers (8.5 miles) west of the beginning of the Schurz alternative segments. A geothermal power plant and biodiesel plant use energy heat from the steam wells in Wabuska. Section 3.3.2, Land Use and Ownership, provides additional information about the mining districts around the Schurz alternative segments.

All four Schurz alternative segments would cross a small normal fault, and Schurz alternative segments 1 and 4 would cross another linear fault, both of which are part of the Wassuk Range Fault System. This fault system is a series of north-trending faults along the eastern edge of the Wassuk Range. The Walker River Basin was formed during the Quaternary as the western edge of the valley downslipped along the fault system. Schurz alternative segment 6 would cross northern-tracing faults along the eastern edge of the Terrill Mountains. These faults could be correlated with the Benton Springs Fault system to the southeast (DIRS 181849-Sawyer 1999, all). There has been one magnitude 6.3 earthquake, one magnitude 5.0 earthquake, and three magnitude 4.0 earthquakes in the vicinity of the Schurz alternative segments (see Figure 3-127). The magnitude 6.3 earthquake occurred in 1959, approximately 2.3 miles to the east of Schurz alternative segment 1 (DIRS 183635-Shannon & Wilson 2007, p. 17).

3.3.1.3.3.3 Soils. Soils along the Schurz alternative segments occur on ***fan piedmonts***, ***fan remnants***, ***fan skirts***, ***sand sheets***, wind-blown sand, dunes, river valleys, lake plains, and closed valley sediments. They are derived from mixed alluvium, sand sheets, wind-blown and lake deposits, and reworked sedimentary deposits.

The Schurz alternative segments each contain more than 50 percent blowing soils. Schurz alternative segment 1 contains the most blowing soils (83 percent of the alternative segment). Schurz alternative segment 6 contains the least blowing soils (51 percent of the alternative segment). All of the Schurz alternative segments have lower quantities of erodes easily soils, ranging from Schurz alternative segments 5 and 6 at 2.9 percent each, to Schurz alternative segment 4 at 4.8 percent. Each of the Schurz alternative segments contains less than 1 percent prime farmland soils (see Table 3-80).

Fan piedmonts, fan remnants, and **fan** skirts refer to locations within a large alluvial fan. Fan piedmonts refer to the area along the base of a mountain slope. Fan remnants refer to parts of an older alluvial fan that remain after erosion has removed most of the fan. Fan skirts refer to the area along the base of the alluvial fan in a valley.

Sand sheets are large, irregularly shaped, commonly thin, surficial mantles of windblown sand that lack the discernible slip faces that are common on dunes.

3.3.1.3.4 Department of Defense Branchline South (Boundary of the Walker River Paiute Reservation to Thorne)

One construction camp (number 17) would be located at the south end of Department of Defense Branchline South where it would connect with Mina common segment 1. The construction camp would be on the Hawthorne Army Depot and would not require additional road construction. Approximately 39 percent of the soils in the proposed construction camp footprint are considered blowing soils. DOE would also build a siding within the construction right-of-way. Aside from the camp and the siding, there would be no surface disturbance along this portion of the Mina rail alignment. Therefore, DOE has not characterized the physical setting in this area.

3.3.1.3.5 Mina Common Segment 1 (Gillis Canyon Area to Blair Junction)

3.3.1.3.5.1 Physiography. Mina common segment 1 would travel south of the Gillis Range through Soda Spring Valley, with the Gabbs Valley Range to the north and east and Garfield Hills to the west (see Figure 3-130). The common segment would pass to the east of Rhodes Salt Marsh between the

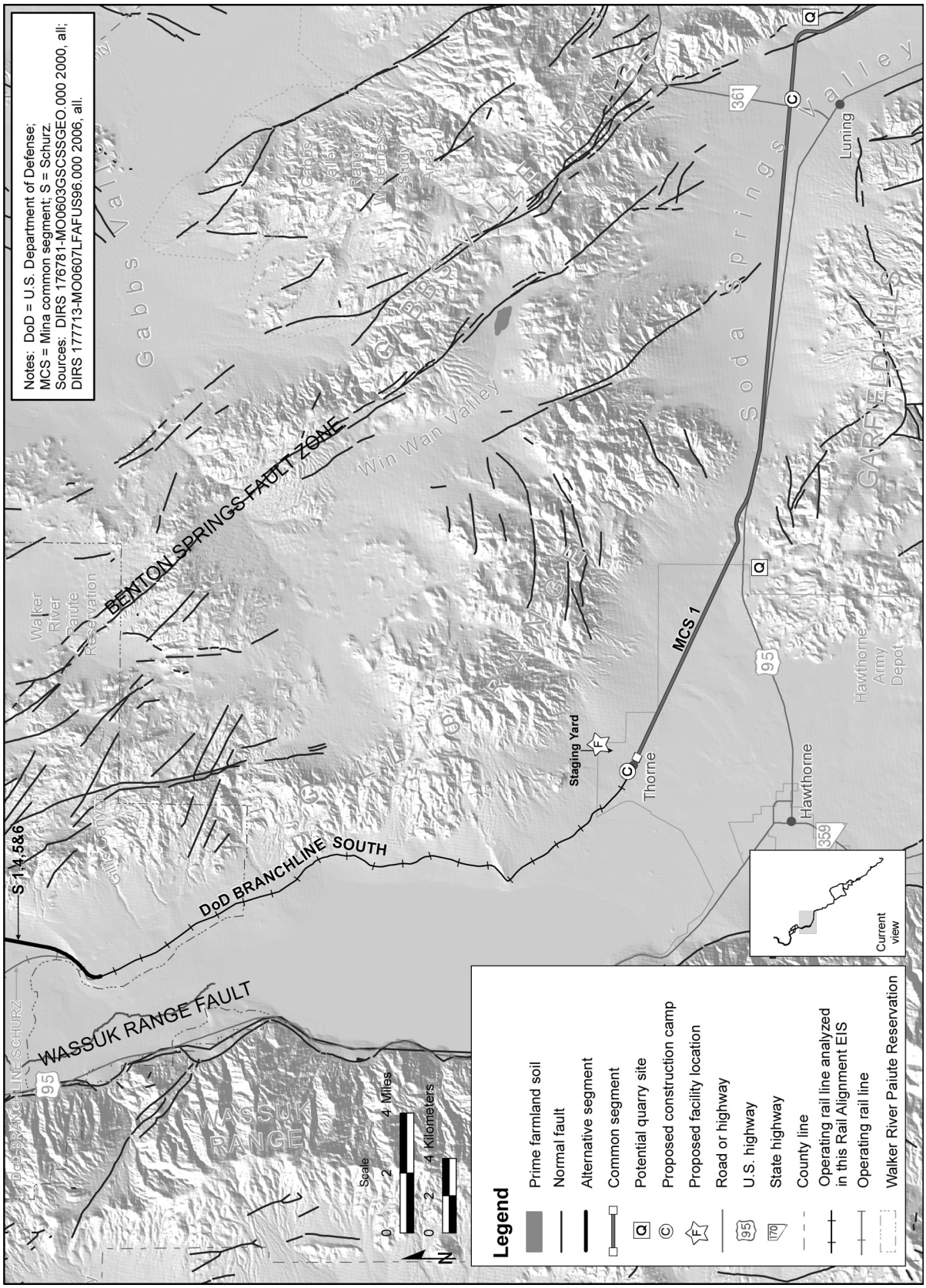


Figure 3-130 Physiographic features of common segments and alternative segments within map area 2.

Excelsior Mountains and Pilot Mountains, and then to the east of Columbus Salt Marsh between Candelaria Hills and the Monte Cristo Range (see Figure 3-131). Elevations along this common segment generally range from 1,300 meters (4,300 feet) above mean sea level at Rhodes Salt Marsh to 1,500 meters (4,900 feet) above mean sea level at the lower valley floors of the Monte Cristo Range. The location of the common segment would avoid existing sand dunes in the Soda Spring Valley and playa deposits in the Rhodes and Columbus Salt Marshes.

3.3.1.3.5.2 Geology. Mina common segment 1 would primarily cross sedimentary material including alluvial fan, wind-blown, basin-fill, lake deposits, and playas in addition to old basalt flows, sedimentary rocks, and locally altered sedimentary and volcanic bedrock.

Most of the hills surrounding Mina common segment 1 are part of local mining districts, due to the many types of minerals found in the bedrock within the mountain ranges. Historically, gold, silver, lead, copper, iron, uranium, thorium, manganese, turquoise, calcium carbonate, and halite have been mined or documented in the surrounding mountains (DIRS 183637-Shannon & Wilson 2007, pp. 38, 40, 41, 44, 60, 64, and 79). The rail line would travel along the valleys, avoiding the calcium carbonate and salt deposits around the playas. It would not cross or approach energy or geothermal resources.

DOE has identified two potential quarry sites along Mina common segment 1. The Garfield Hills quarry would mine basalt at the beginning of Mina common segment 1 in the northern edge of the Garfield Hills. The Gabbs Range quarry would be on the northeastern edge of the Soda Spring Valley where the rail line would turn south. The quarry would mine granite from a foothill at the base of the Gabbs Valley Range.

There are several northwest-trending Quaternary faults in the mountains north of Mina common segment 1. The Gabbs Valley Range, Pilot Mountains, and Soda Spring Valley are all bounded by the Benton Spring Fault. In 1932, there was a magnitude 7.2 earthquake to the northeast of Mina common segment 1 at Cedar Mountain. There have been numerous other earthquakes greater than magnitude 3.0 in the northeastern corner of Soda Spring Valley; however, the number and magnitude of earthquakes decreases farther south around the Monte Cristo Range.

3.3.1.3.5.3 Soils. Soils along Mina common segment 1 consist primarily of alluvial fan deposits comprising sorted sand and gravel, and occasionally overlie shallow bedrock made up of recent volcanic material. Deposits of calcium carbonate in the form of calcrete are also occasionally found within the soils. The common segment would avoid playa deposits in the area of Rhodes Salt Marsh and Columbus Salt Marsh. Approximately 39 percent of Mina common segment 1 is made up of blowing soils and 7.9 percent of the soils have the erodes easily characteristic. There are no prime farmland soils along Mina common segment 1.

3.3.1.3.6 Montezuma Alternative Segments

3.3.1.3.6.1 Physiography. Montezuma alternative segment 1 would travel southeast from Blair Junction, through Clayton Valley, and within a pass between Paymaster Ridge and Clayton Ridge (Figures 3-132 and 3-133). The alternative segment would then turn south through an unnamed valley, then cross the Montezuma Range in an unnamed pass and switchback between the Goldfield and Cuprite Hills. Elevations along Montezuma alternative segment 1 would range from 1,300 meters (4,300 feet) at Clayton Valley to 1,980 meters (6,500 feet) above mean sea level at the south end of the Montezuma Range.

Montezuma alternative segment 2 would travel from Blair Junction northeast through Big Smoky Valley, around Lone Mountain, southeast through Montezuma Valley, and would weave through the Goldfield Hills, with elevations ranging from 1,500 meters (4,900 feet) at Montezuma Valley to 1,950 meters (6,400 feet) above mean sea level at Goldfield Hills.

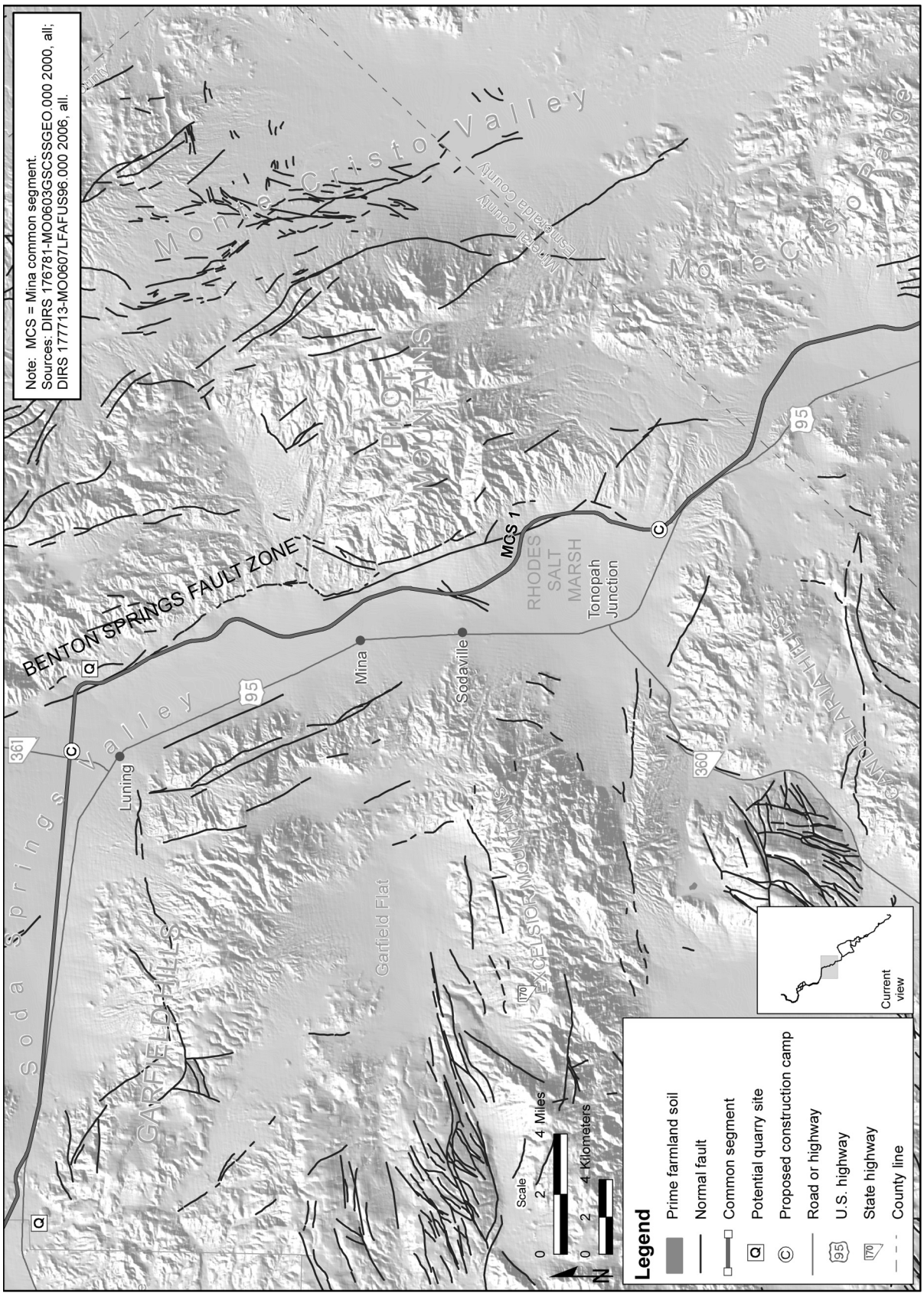


Figure 3-131. Physiographic features of common segments and alternative segments within map area 3.

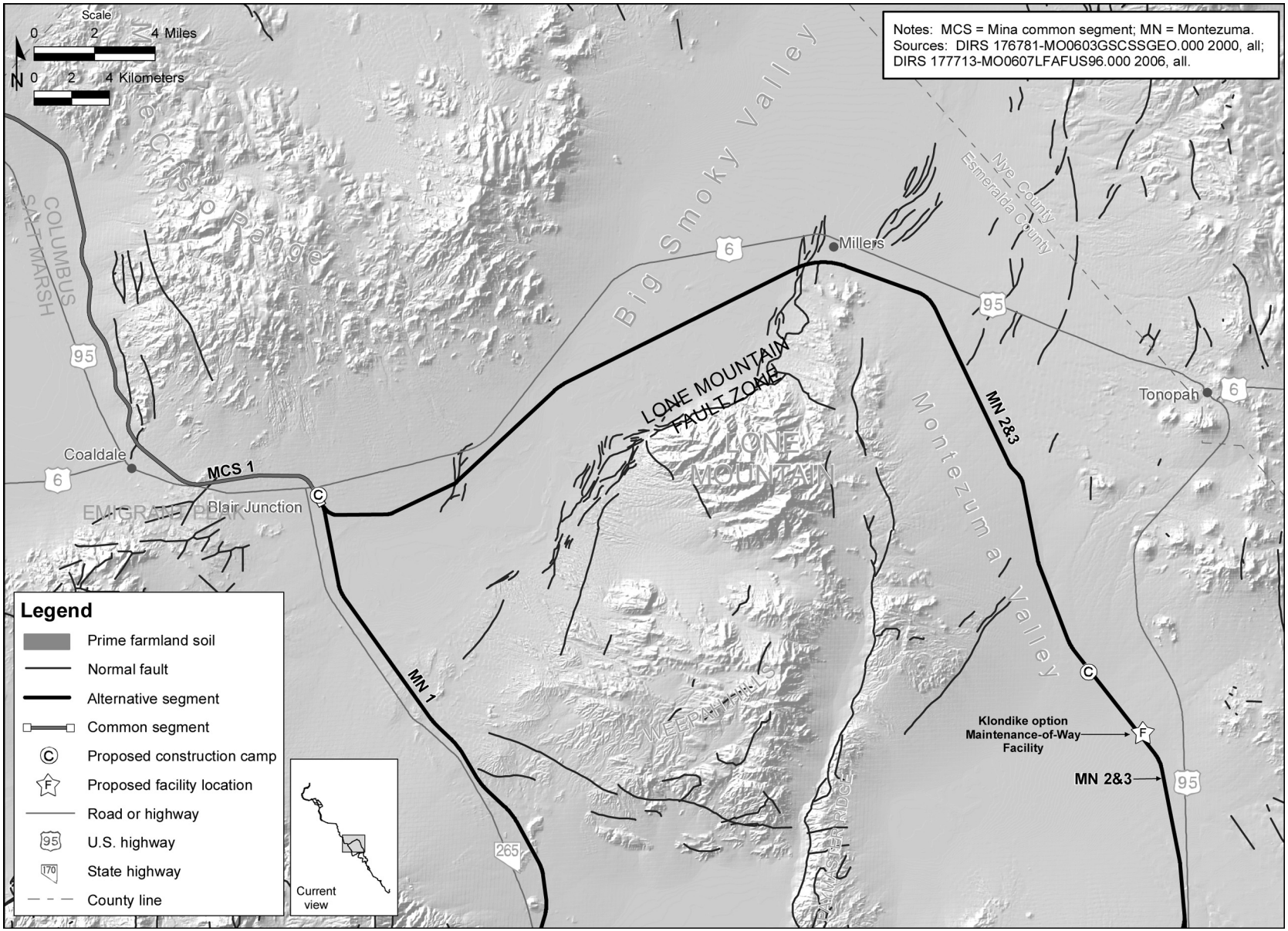


Figure 3-132. Physiographic features of common segments and alternative segments within map area 4.

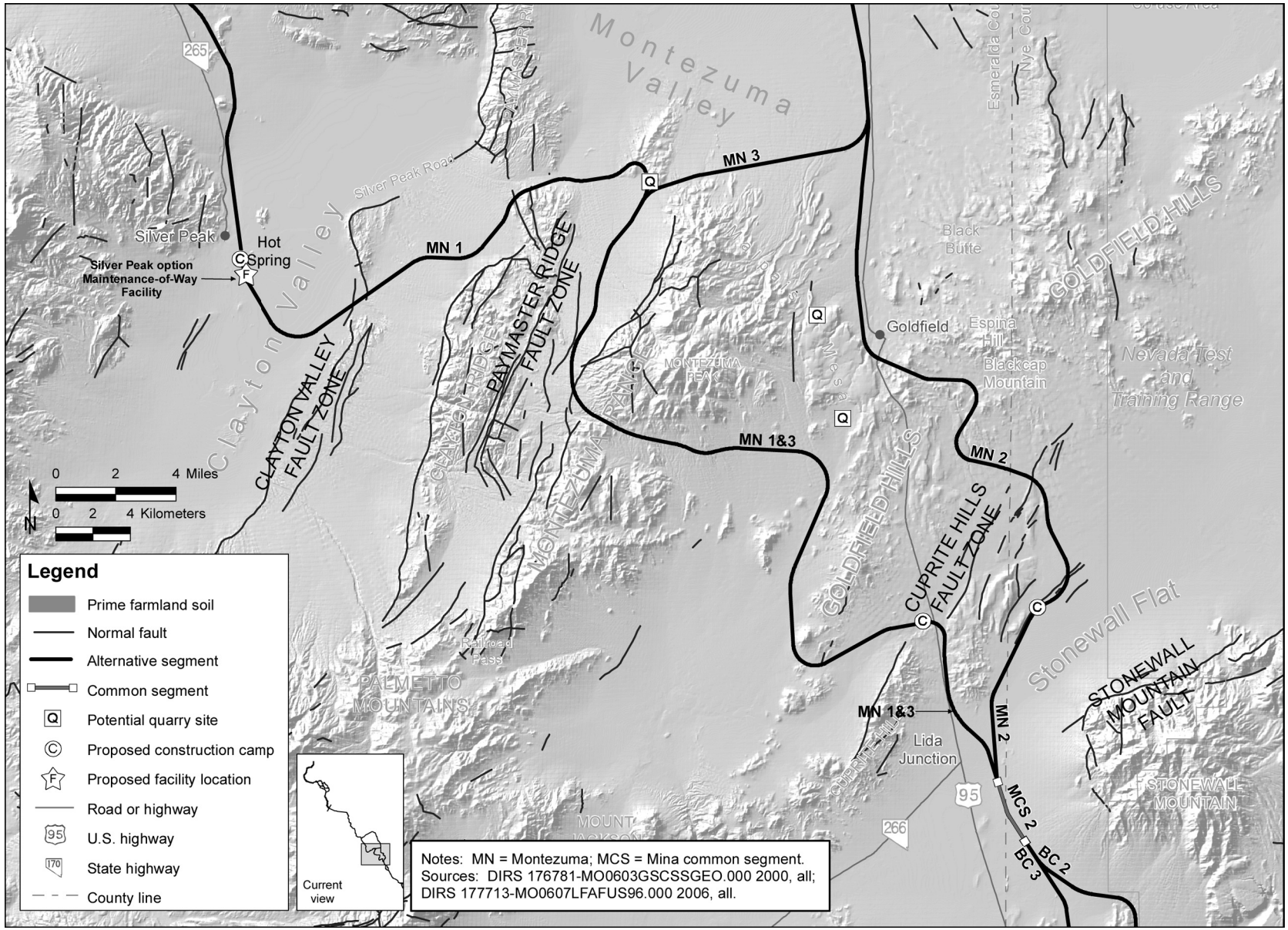


Figure 3-133. Physiographic features of common segments and alternative segments within map area 5.

Montezuma alternative segment 3 would travel from Blair Junction northeast through Big Smoky Valley, around Lone Mountain, southeast through Montezuma Valley, and then cross west near the north end of Montezuma Range. Montezuma alternative segment 3 would continue south through an unnamed valley and cross the Montezuma Range in an unnamed pass and switchback between the Goldfield and Cuprite Hills. The elevation ranges along Montezuma alternative segment 3 would be the same as Montezuma alternative segment 2, with the low point in Montezuma Valley and the high point at Goldfield Hills.

3.3.1.3.6.2 Geology. All of the Montezuma alternative segments would cross a combination of recent alluvial and playa deposits overlying Quaternary volcanic rocks, Mesozoic granite, and Cambrian limestone bedrock. A variety of metallic minerals (silver, gold, and copper; iron and hematite) have been mined in Lone Mountain, Silver Peak, Montezuma Range, and the Cuprite and Goldfield Hills. All of the Montezuma alternative segments would travel through valleys near a range that contains either active or historic mining operations. Montezuma alternative segments 1 and 3 would also cross the Montezuma Range, and Montezuma alternative segment 2 would cross through the Goldfield Hills, where gold, silver, and zeolilte have been mined since 1900.

In addition to the metallic minerals identified within the mountains surrounding the Montezuma alternative segments, there are nonmetallic minerals in the valleys. Montezuma alternative segment 1 would cross Clayton Valley and approach the town of Silver Peak. Minerals such as alum, native sulfur, and kaolinite have been found in Clayton Valley, and a large-scale brine facility in Silver Peak extracts lithium from salt-rich aquifer water. There are warm springs in the Silver Peak area; however, at present, they are not used as an energy resource. In the Cuprite Hills, at the end of the Montezuma alternative segments, there is a large geothermal system with multiple warm heat-flow wells, also not currently used as geothermal resources (DIRS 183637-Shannon & Wilson 2007, Plate 3). Section 3.3.2, Land Use and Ownership, describes the history and extent of the regional mining districts in more detail.

DOE has identified several potential quarry sites along the Montezuma alternative segments. The North Clayton Quarry would be along the northern tip of the Montezuma Range, and would serve either Montezuma alternative segment 1 or 3. The quarry would mine granite from the bottom of the ridge, moving up as additional rock is quarried. The Malpais Mesa Quarry would be on the northwestern edge of the Goldfield Hills and would be accessed by Montezuma alternative segment 1 or 3. This quarry would mine basalt from the bowl-shaped cliff. Potential quarry ES-7, on the northern edge of Malpais Mesa, would serve Montezuma alternative segment 2.

The mountain ranges in this area are typically bounded on one side by linear, north-trending faults. Montezuma alternative segment 1 would cross the Clayton Valley Fault Zone, Paymaster Ridge Fault Zone, Montezuma Range Fault Zone, and Cuprite Hills Fault Zone. These faults are primarily late Quaternary in age. Montezuma alternative segment 2 would cross the Cuprite Hills Fault Zone along the northern edge of the Goldfield Hills. Montezuma alternative segments 2 and 3 would cross the Lone Mountain Fault Zone along the northern edge of the Lone Mountain foothills. Some of the faults associated with this fault zone were active within the last 15,000 years (DIRS 181852-Sawyer and Anderson 1999, all). Seismic activity in the area around the Montezuma alternative segments is limited to a magnitude 5.0 earthquake west of Lone Mountain, and several magnitude 3.0 earthquakes in the immediate vicinity of Lone Mountain and along the Cuprite Hills (see Figure 3-126).

3.3.1.3.6.3 Soils. Soils along the Montezuma alternative segments vary based on their location and the source bedrock. The alternative segments would cross soils consisting of alluvial deposits on fan skirts, fan remnants, and fan piedmonts; sand sheets and basins; and alluvial flats. The soils are derived from mixed alluvium, wind-blown sand, and volcanic sedimentary (limestone) rocks.

In some locations along Montezuma alternative segments 1 and 3, thin soils derived from volcanic, sedimentary, or limestone material overlie the mountain bedrock. Along all of the alternative segments, the soils are considered well drained to excessively drained.

There are no prime farmland soils in Esmeralda County, the location of most of the length of the Montezuma alternative segments. Other soil characteristics are variable, depending on their position in the valley (see Table 3-80). Montezuma alternative segment 2 would contain the most blowing soils (33 percent), while Montezuma alternative segment 1 would contain only 5.2 percent. However, Montezuma alternative segment 1 would contain the most erodes easily soils (15 percent), and Montezuma alternative segment 3 would contain the least (10 percent).

3.3.1.3.7 Mina Common Segment 2 (Stonewall Flat Area)

3.3.1.3.7.1 Physiography. Mina common segment 2 would cross Lida Valley, a depression with numerous alkali flats (see Figure 3-133), at an elevation of approximately 1,430 meters (4,700 feet) above mean sea level. Stonewall Mountain is a prominent feature that would border the common segment on the east.

3.3.1.3.7.2 Geology. Through the Stonewall Flat area, Mina common segment 2 would mostly cross fan and stream-channel alluvium filling a ***graben*** (a depression between normal faults) formed by the northerly-trending Stonewall Mountain Fault.

There has been some seismic activity around the Cuprite Hills and at Stonewall Mountain within the past 150 years (see Figure 3-126).

There are metallic minerals, including copper, silver, and gold along this common segment. The deposits occur in sedimentary and volcanic rocks that have been altered by hot fluids. Quartz veins are also mined for silica. Drilling in the Cuprite Hills suggests the existence of a large geothermal system in the area, with multiple warm heat-flow wells drilled in the Cuprite Hills; however, at present, these are not used as geothermal resources (DIRS 183637-Shannon & Wilson 2007, Plate 3). Except for alluvium, the common segment would not cross rocks suitable for construction.

3.3.1.3.7.3 Soils. Soils along Mina common segment 2 are derived from alluvium and occur on fan piedmonts and fan skirts (DIRS 184079-Natural Resources Conservation Service 2007, all). All of the soils are considered to be easily erodible. There are no blowing soils or prime farmland soils along the segment.

3.3.1.3.8 Bonnie Claire Alternative Segments

3.3.1.3.8.1 Physiography. The physiography of the Bonnie Claire area is characterized by the southern boundary of Lida Valley and the northern portion of Sarcobatus Flat, which are depressions with numerous alkali flats. Pahute Mesa is to the east of the alternative segments; Stonewall Mountain is to the northeast (see Figure 3-134). Bonnie Claire alternative segment 2 would pass to the east of an unnamed 1,500-meter (4,900-foot)-high bedrock knoll that separates Sarcobatus Flat and Lida Valley; Bonnie Claire alternative segment 3 would pass this knoll to the west (DIRS 182854-Shannon & Wilson 2006, Figure 3). Elevations in this area range from about 1,250 to 1,400 meters (4,100 to 4,600 feet) above mean sea level.

3.3.1.3.8.2 Geology. The Bonnie Claire alternative segments would cross the eastern portion of the southwestern Nevada volcanic field. Bonnie Claire alternative segment 3 would cross a mixture of young volcanic rocks and ash-flow sedimentary rocks, while Bonnie Claire alternative segment 2 would primarily cross alluvium on the western edge of Sarcobatus Flat (DIRS 182854-Shannon & Wilson 2006, Table 5).

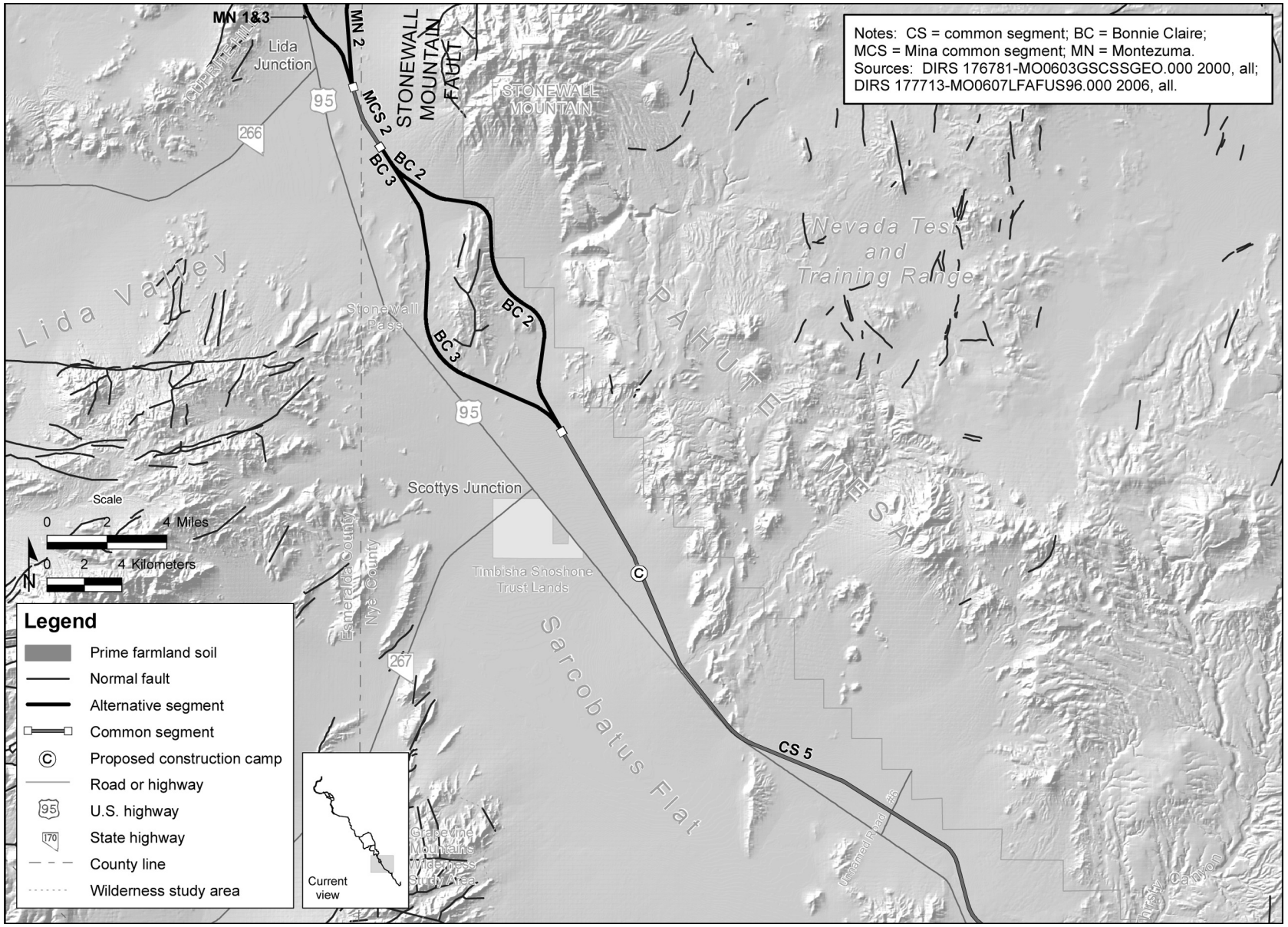


Figure 3-134. Physiographic features of common segments and alternative segments within map area 6.

The two alternative segments would bypass a sequence of interconnected unnamed faults. These faults are not well studied, although recent seismic activity has been recorded in the area. In 1999, there was a magnitude 5.3 earthquake in the area between the Bonnie Claire alternative segments. As seen in Figure 3-126, many aftershocks were recorded in the area, most between magnitudes 2.0 and 3.5. Since then, earthquakes immediately around the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 183639-Shannon & Wilson 2007, Plate 4).

Metallic minerals such as gold and copper have been found within the volcanic rocks around the Bonnie Claire alternative segments. The Wagner Mining District is in this area, and is discussed in more detail in Section 3.3.2, Land Use and Ownership.

There are no known energy or geothermal resources in the area surrounding the Bonnie Claire alternative segments, and other than gravel and alluvial materials present on the floor of Lida Valley, the Bonnie Claire alternative segments would not cross any known mineral deposits.

3.3.1.3.8.3 Soils. Soils along Bonnie Claire alternative segments 2 and 3 are derived from alluvium and ***colluvium***, and are found on hills, alluvial fan piedmonts, and fan skirts. Soils are mainly identified for Bonnie Claire alternative segment 3, because soil data are not available for the area around the Nevada Test and Training Range.

Soils with the erodes easily characteristic comprise 27 and 25 percent of the soils along Bonnie Claire alternative segments 2 and 3, respectively. Available data do not indicate any soils with the blowing soil or prime farmland characteristic.

3.3.1.3.9 Common Segment 5 (Sarcobatus Flat Area)

3.3.1.3.9.1 Physiography. The physiography of common segment 5 consists of most of Sarcobatus Flat. Pahute Mesa would be to the northeast (see Figure 3-134). Coba Mountain is a prominent feature in the area that extends from common segment 5 to the southwest (see Figure 3-135). Rail alignment elevations in the Sarcobatus Flat area would range from 1,200 to 1,250 meters (3,900 feet to 4,100 feet) above mean sea level.

3.3.1.3.9.2 Geology. Common segment 5 would cross Quaternary alluvium and mid-Tertiary ash-flow tuffs, minor lava flows, and reworked materials associated with the southwestern Nevada volcanic field. The common segment would not cross Quaternary faults (see Figures 3-134 and 3-135). Commercial minerals found within the area include gold and silver (DIRS 183644-Shannon & Wilson 2007, pp. 50 and 51). Additionally, an actively mined, relatively large gravel pit at the alluvial fan boundary between Pahute Mesa and Sarcobatus Flat would be within 0.8 kilometer (0.5 mile) of the rail alignment in this area.

Geothermal occurrences in Sarcobatus Valley include one warm spring and one hot well, which would be about 0.20 kilometer (0.12 mile) from the rail alignment.

3.3.1.3.9.3 Soils. Area soils are derived from alluvial deposits and are well drained. They occur on alluvial flats and fan piedmonts. Soils with the blowing soil characteristic comprise about 2.6 percent of the soils. There are no soils along common segment 5 with the erodes easily or prime farmland characteristics.

3.3.1.3.10 Oasis Valley Alternative Segments

3.3.1.3.10.1 Physiography. Oasis Valley alternative segments 1 and 3 would be in Oasis Valley, which is incised by the Amargosa River, an ***ephemeral stream***, and tributary washes (see Figure 3-135).

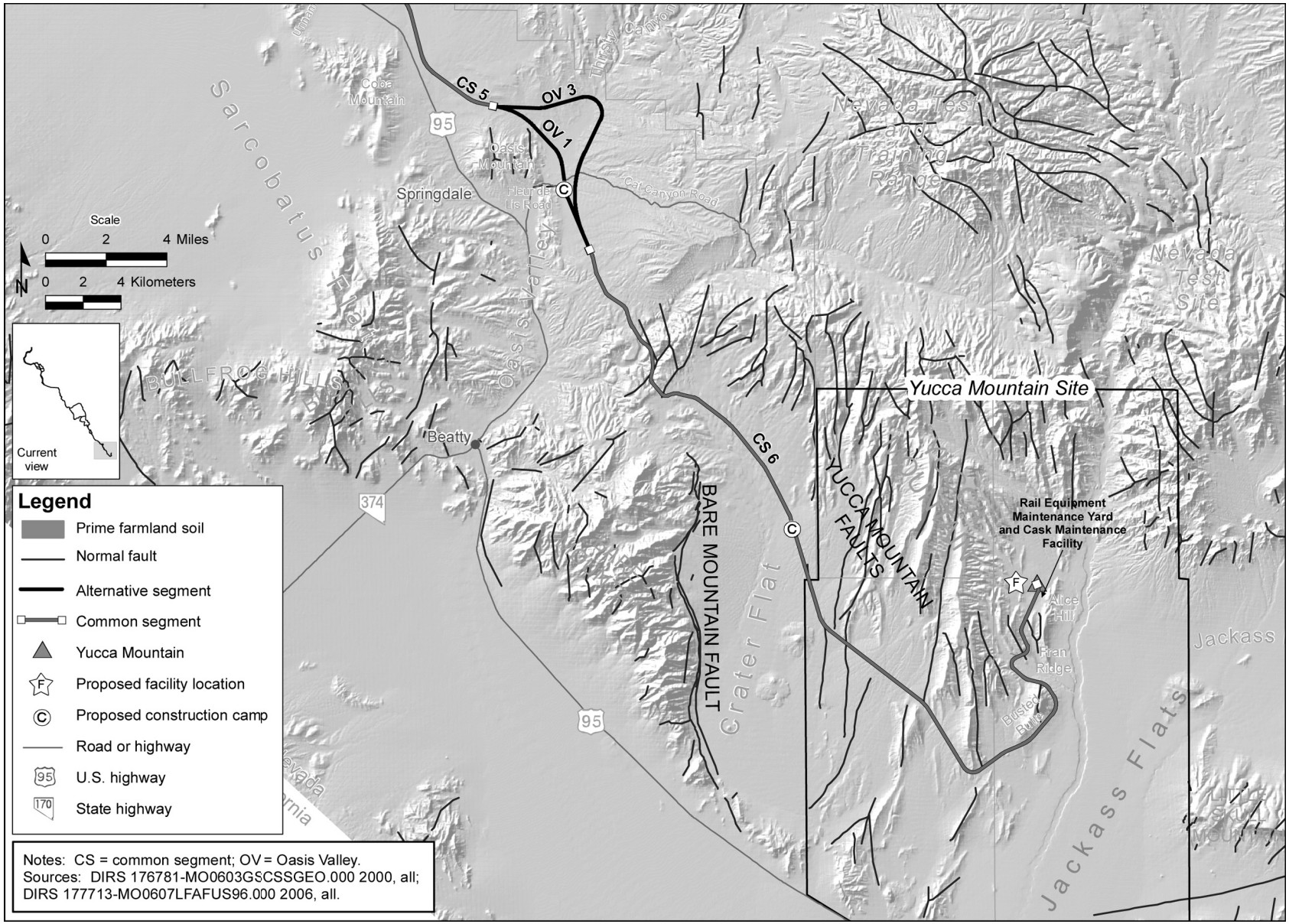


Figure 3-135. Physiographic features of common segments and alternative segments within map area 7.

Elevations range from about 1,200 to 1,300 meters (3,900 to 4,200 feet) above mean sea level. At the northwest end, the alternative segments would cross alluvial fans extending from Pahute Mesa on the north and Oasis Mountain (in Bullfrog Hills) on the south.

3.3.1.3.10.2 Geology. The two Oasis Valley alternative segments would cross sedimentary rocks overlain in part by recent sediment from alluvial fans and Amargosa River floodplain deposits. Small outcrops of young volcanic rocks from the southwestern Nevada volcanic field area are also exposed. The rail alignment would not cross Quaternary faults, commercial mineral operations, geothermal resources or materials suitable for construction purposes.

3.3.1.3.10.3 Soils. Soils along Oasis Valley alternative segments 1 and 3 are derived from alluvium and are well drained to somewhat excessively drained. Soils occur on fan skirts and fan piedmonts. Oasis Valley 1 contains approximately 13 percent soils with the blowing soil characteristic, while Oasis Valley 3 contains approximately 5.3 percent of blowing soils. There are no prime farmland or erodes easily soils along either of the Oasis Valley alternative segments.

3.3.1.3.11 Common Segment 6 (Yucca Mountain Approach)

3.3.1.3.11.1 Physiography. The physiography of common segment 6 is characterized by Beatty Wash, Crater Flat, and several ridges and valleys that make up Yucca Mountain, Busted Butte, and Jackass Flats (see Figure 3-135). The common segment would go around the east side of Busted Butte, with Fortymile Wash and most of Jackass Flats to the east. North of Busted Butte, it would cross a series of washes and valleys flanked by multiple ridges, where it would terminate near Yucca Mountain. Rail alignment elevations would range from about 1,300 meters (4,300 feet) at Tram Ridge to 1,000 meters (3,300 feet) above mean sea level at the base of Busted Butte (DIRS 182854-Shannon & Wilson 2007, Figure 3, Sheets 70 and 71).

3.3.1.3.11.2 Geology. This area is in the southern edge of the southwestern Nevada volcanic field. Common segment 6 would cross a variety of alluvial deposits and sedimentary rocks, and young volcanic rocks. Faults in the area increase in number closer to the Yucca Mountain uplands. The fault traces generally trend to the north, including the Bare Mountain Fault and the eastern and western Yucca Mountain fault groups. Displacements along faults are characterized in terms of the amount of movement per seismic event. For the set of block-bounding faults of primary significance to the ***Yucca Mountain Site***, these surface values range from 0 to 1.7 meters (0 to 5.6 feet) per event (DIRS 155970-DOE 2002, Table 3-8).

DOE has monitored seismic activity at the Nevada Test Site since 1978. The largest recorded earthquake within 50 kilometers (30 miles) of Yucca Mountain was the Little Skull Mountain earthquake in 1992 (DIRS 169734-BSC 2004, p. 4-34 and Figure 4-19), which had a magnitude of 5.6 (DIRS 169734-BSC 2004, p. 4-38). DOE buildings at the Nevada Test Site were damaged and there was also damage in Beatty, Amargosa Valley, and Mercury, Nevada. DOE would continue to monitor the seismic activity around Yucca Mountain with an array of monitoring stations spread throughout the area.

The bedrock around common segment 6 contains metallic minerals such as gold and silver, and nonmetallic deposits, including fluorspar and silica (DIRS 183644-Shannon & Wilson 2007, pp. 40 and 41). There are also several hot springs around the Beatty Wash area, some of which are used by a hotel (DIRS 183644-Shannon & Wilson 2007, Plate 1).

3.3.1.3.11.3 Soils. Soils along common segment 6 occur on fan piedmonts, skirts, and fan remnants. The soils derived from Tertiary volcanic rocks and Quaternary alluvium are well drained to somewhat excessively drained. Soils on alluvial flats are derived from lake deposits and are well drained. None of the soils along common segment 6 contain prime farmland, blowing soil, or soils with the erodes easily characteristic.

3.3.2 LAND USE AND OWNERSHIP

This section describes the affected environment for land use and ownership along and adjacent to the Mina rail alignment. At the recommendation of the U.S. Bureau of Land Management (BLM; a cooperating agency in the preparation of the this Rail Alignment EIS), DOE organized this section by types of land uses rather than by rail alignment segments to enable the reader to quickly review topics of interest to them. The section provides an overview of land uses on private, American Indian, and public lands. The BLM, DOE, and the Department of Defense manage public land the Mina rail alignment would cross. The uses of public land discussed in detail in this section include grazing (within BLM-designated ***grazing allotments***), mineral and energy extraction, and recreation. This section also discusses land access and existing utility rights-of-way. Based on the construction right-of-way of the longest possible Mina rail alignment, the BLM manages 113.3 square kilometers (28,00 acres) of the land the rail line would cross, the Department of Defense manages 4.6 square kilometers (1,145 acres), the Walker River Paiute Tribe owns 5.3 square kilometers (1,315 acres), DOE manages 4.1 square kilometers (1,020 acres) and up to 0.45 square kilometer (71 acres) is privately owned.

Section 3.3.2.1 describes the region of influence for land use and ownership; Section 3.3.2.2 describes private land, including relevant land-use plans; Section 3.3.2.3 describes American Indian land; Section 3.3.2.4 describes public lands, BLM ***resource management plans***, and project-related land ***withdrawals***; and Section 3.3.2.5 describes the general environmental setting and land-use characteristics along the Mina rail alignment.

Other sections of this Rail Alignment EIS describe additional subjects related to land use. Section 3.3.1, Physical Setting, describes farmland and prime farmland; Section 3.3.7, Biological Resources, describes wild horse and burro ***herd management areas***; and Section 3.3.11, Utilities, Energy, and Materials, addresses utilities. Section 3.4 describes American Indian interests and concerns related to the Proposed Action.

3.3.2.1 Region of Influence

The region of influence for land use and ownership is the width of the rail line construction right-of-way, and includes all private land (including patented ***mining claims***), American Indian lands, and public land that would be fully or partially within the construction right-of-way. The land use and ownership region of influence also includes the locations of proposed railroad construction and operations support facilities outside the nominal width of the construction right-of-way.

Although the nominal width of the railroad ***operations right-of-way*** would be narrower than the nominal width of the construction right-of-way, DOE evaluated the construction right-of-way as the basis for identifying potential land-use impacts because:

- It provides a more conservative estimate of the amount of land that would be utilized than the operations right-of-way, providing an upper bound for analysis.
- The construction phase encompasses the most intensive land use in terms of noise, human activity, and disruptions to land access.
- The construction footprint would be the basis for the initial right-of-way applications submitted to the BLM for the project.

3.3.2.2 Private Land

Private lands in Mineral, Esmeralda, and Nye Counties are either clustered in towns and along highways, or are widely scattered. Private lands make up a very small portion of these counties. Figure 3-136 provides an overview of privately owned lands near the Mina rail alignment.

3.3.2.2.1 County Land-Use Plans

The Mina rail alignment would cross parts of Churchill, Lyon, Mineral, Esmeralda, and Nye Counties. County plans that could affect land use along the rail alignment include the *Churchill County Master Plan* (DIRS 180482-Churchill County Planning Department 2007, all), the *Esmeralda County Master Plan* (DIRS 176770-Duval et. al. 1976, all), and *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all).

3.3.2.2.1.1 Churchill County. In Churchill County, the northernmost section of the Mina rail alignment would be the existing Union Pacific Railroad Hazen Branchline. A portion of Schurz alternative segment 6 would cross land within Churchill County, although entirely within the Walker River Paiute Reservation. Therefore, there would be no construction activities that could affect land use and ownership within lands under the jurisdiction of Churchill County, and its master plan would not apply to the Mina rail alignment.

3.3.2.2.1.2 Lyon County. A portion of the Union Pacific Railroad Hazen Branchline, all of Department of Defense Branchline South, and 0.6 kilometer (0.4 mile) of the western portions of the Schurz alternative segments lie within Lyon County. Lyon County is in the process of updating its 1990 Comprehensive Master Plan and the process will last through 2008. However, the Mina rail alignment would travel on existing railroad, within the Walker River Paiute Reservation, or on BLM-administered land for its entire length through Lyon County. Because there would be no new railroad construction on land under Lyon County jurisdiction, the Lyon County master plan would not apply to the Mina rail alignment.

3.3.2.2.1.3 Mineral County. Mineral County covers more than 9,900 square kilometers (3,800 square miles), of which 81.3 percent is controlled and managed by the Federal Government. The Walker River Paiute Reservation is at the very northern end of Mineral County. In the Hawthorne area, the Department of Defense has large land holdings used for storage of conventional weapons. In Hawthorne, land uses are mixed, with primarily commercial and residential developments on the highway corridor. In Mina and Luning, the predominant land uses are small tourist commercial and residential (DIRS 180702-Mineral County Nuclear Projects Office 2005, p. 30). While there are zoning designations within Hawthorne, Walker Lake, Mina, and Luning (DIRS 180702-Mineral County Nuclear Projects Office 2005, pp. 26 to 29), there are no county master plans or town land-use plans in Mineral County that would apply to the Mina rail alignment.

3.3.2.2.1.4 Esmeralda County. The BLM manages more than 92 percent of the approximately 9,000 square kilometers (3,600 square miles) in Esmeralda County. Two percent of the land in Esmeralda County is National Forest land, and a small portion of the county falls within Death Valley National Park. Less than 5 percent of the land in the county is privately owned. The two most heavily populated areas in Esmeralda County at the issuance of the *Esmeralda County Master Plan* were Goldfield and Silver Peak (DIRS 176770-Duval et. al. 1976, p. 25). Goldfield is the county seat for Esmeralda County; there are no incorporated cities in the county. Under the *Esmeralda County Master Plan*, land use has been divided into three basic categories: multiple use, agriculture, and urban expansion. The multiple-use category is suggested for those areas where federal or state ownership is expected to remain. Grazing, mining and prospecting, and recreation activities are recommended under the multiple-use concept. The plan also

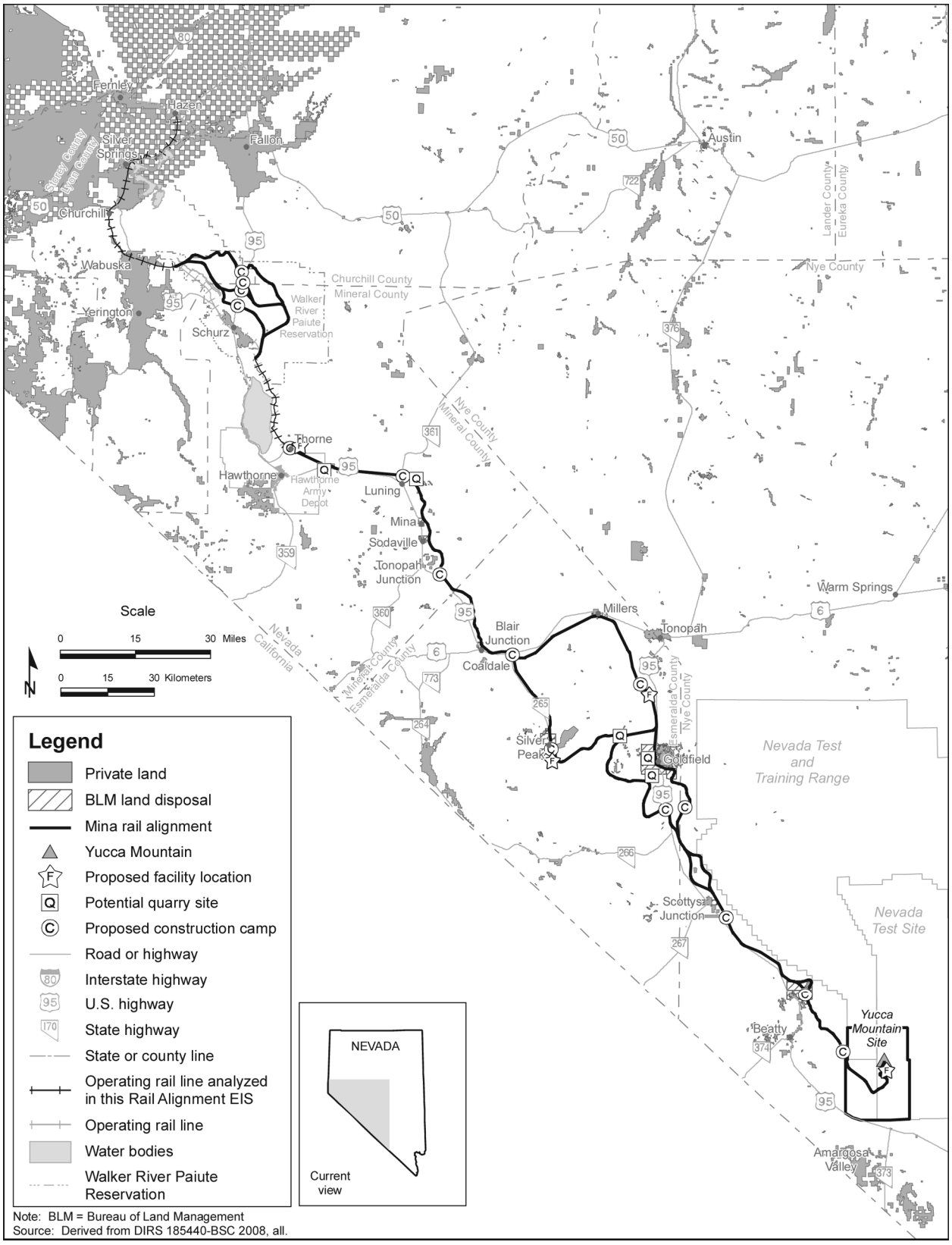


Figure 3-136. Private land along the Mina rail alignment.

recommends that residential and commercial development be concentrated in the existing communities of Goldfield and Silver Peak, where public facilities can be most economically concentrated (DIRS 176770-Duval et. al. 1976, p. 73).

3.3.2.2.1.5 Nye County. Nye County has an area of approximately 47,000 square kilometers (18,000 square miles) and is the largest county in Nevada. The Federal Government manages almost 93 percent of the county's land. Federally owned or managed lands in Nye County include the Nevada Test and Training Range, the Nevada Test Site, BLM-administered public land, a portion of Death Valley National Park, and portions of the Humboldt-Toiyabe National Forest. Private lands in Nye County are used for residential, commercial, and industrial purposes largely, but not exclusively, within the boundaries of unincorporated towns, and agricultural and mining uses both inside and outside these towns. The *Nye County Comprehensive Plan* guides growth and development, but is not equivalent to a zoning ordinance, nor does it regulate the use of land. However, the Nye County Board of Commissioners may choose to enact a zoning ordinance or other growth-management mechanisms to accomplish certain objectives of the plan. The plan also serves as a framework for local land-use plans and other growth-management mechanisms (DIRS 147994-McRae 1994, all).

3.3.2.2.2 Local Land-Use Planning

The initial design phase for the Mina rail alignment emphasized avoiding private land, which is generally concentrated near towns. While distinct town boundaries are not always available, DOE believes the rail alignment would not fall within Hawthorne, Luning, Mina, Sodaville, Tonopah Junction, Coaldale, Blair Junction, Millers, Silver Peak, Klondike, Ralston, Lida Junction, Scottys Junction, Springdale, or Beatty, which would be the towns or places closest to the rail alignment. A portion of Montezuma alternative segments 2 and 3 would pass through private lands to the south of Millers, but this very small town does not have zoning or land-use plans.

Montezuma alternative segment 2 would also pass through Goldfield. Goldfield, an unincorporated town, is the county seat for Esmeralda County. The Goldfield census county division encompasses an area of more than 3,900 square kilometers (1,500 square miles) (DIRS 176855-U.S. Census Bureau 2003, p. 5). During its most prominent mining period at the beginning of the 20th century, a number of passenger and freight railroad lines served Goldfield. The Goldfield Historic District, listed on the *National Register of Historic Places* in 1982 and entered onto the *Nevada State Register of Historic Places* on December 7, 2005, is in Goldfield and roughly bounded by Fifth Street, Miner Avenue, Spring Street, Elliot Street, and Crystal Avenue (DIRS 176854-National Register of Historic Places 1982, all). Although there is no zoning plan for Goldfield, the historic nature of its buildings and features are generally protected by the designation of its historic district. The Goldfield Historic District would be about 0.7 kilometer (0.4 mile) northwest of the Montezuma alternative segment 2 construction right-of-way.

3.3.2.2.3 Private Parcels

Table 3-81 lists the number of privately owned parcels of land that are within the construction right-of-way of each Mina rail alignment segment. Figures 3-137 through 3-143 show privately owned land along the Mina rail alignment segments.

3.3.2.3 American Indian Land

3.3.2.3.1 Walker River Paiute Reservation

The Mina rail alignment would pass through the Walker River Paiute Reservation. The Reservation is 68 kilometers (42 miles) south of Fallon and 37 kilometers (23 miles) east of Yerington (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1). The Reservation consists of 1,308 square kilometers (323,200

Table 3-81. Private land that would be within or intersect the Mina rail alignment construction right-of-way.

Rail line segment[a]	Number of parcels	Area of parcels (acres)[b]
Mina common segment 1	1	53
Montezuma alternative segment 2	34 plus at least 2 patented mining claims	145
Montezuma alternative segment 3	1	24
Oasis Valley alternative segment 1	2	0.9

a. No other segments would intersect private land.
b. To convert acres to square kilometers, multiply by 0.0040469.

acres) of land across Churchill, Lyon, and Mineral Counties (DIRS 182302-Miller Ecological Consultants 2005, p. 3-50). The Reservation does not have a land use plan.

The Reservation was established on November 29, 1859, by letter from the Indian Affairs Commissioner to the General Land Office requesting that land from sale or settlement for Indian use in the northeastern part of the Walker River Valley, including the Walker River Paiute Reservation, be established. The constitution of the Walker River Paiute Tribe was finalized on March 26, 1937 (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1).

At present, 8.5 square kilometers (2,100 acres) of Reservation land is used for agriculture (primarily alfalfa and grass hay) (DIRS 182302-Miller Ecological Consultants 2005, p. 3-50). More than 50 percent of the Reservation is rangeland. Small ranching businesses manage livestock, primarily cattle (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 2). The town of Schurz, the only town on the Reservation, consists of private property with residential and business uses. The Department of Defense operates a branchline across the Reservation, through Schurz. The Weber Dam and Reservoir are also on Reservation land.

The Walker River Paiute Tribe divides land into 0.08-square kilometer (20-acre) allotments (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1). Many of the allotments have multiple owners through inheritance (182302-Miller Ecological Consultants 2005, p. 3-49). There is no adopted land-use plan for the Reservation, although the Tribal Council in effect controls land-use decisions (DIRS 182302-Miller Ecological Consultants 2005, p. 3-49).

Table 3-82 summarizes the distances and areas of existing and proposed rail line segments within the Walker River Paiute Reservation.

3.3.2.3.2 Timbisha Shoshone Trust Lands

The Timbisha Homeland Act transferred into trust 31.4 square kilometers (7,754 acres) of land for the Timbisha Shoshone Tribe. The land is not contiguous; it is made up of five separate parcels in California and Nevada. The parcel near Scottys Junction covers approximately 11.3 square kilometers (2,800 acres).

During the public scoping period for this Rail Alignment EIS, the Timbisha Shoshone Tribe requested that DOE alter the rail alignment to avoid their land (DIRS 174558-Sweeney 2004, all). The segment nearest the Timbisha Shoshone Trust Lands near Scottys Junction, common segment 5, would be more than 3 kilometers (2 miles) east.

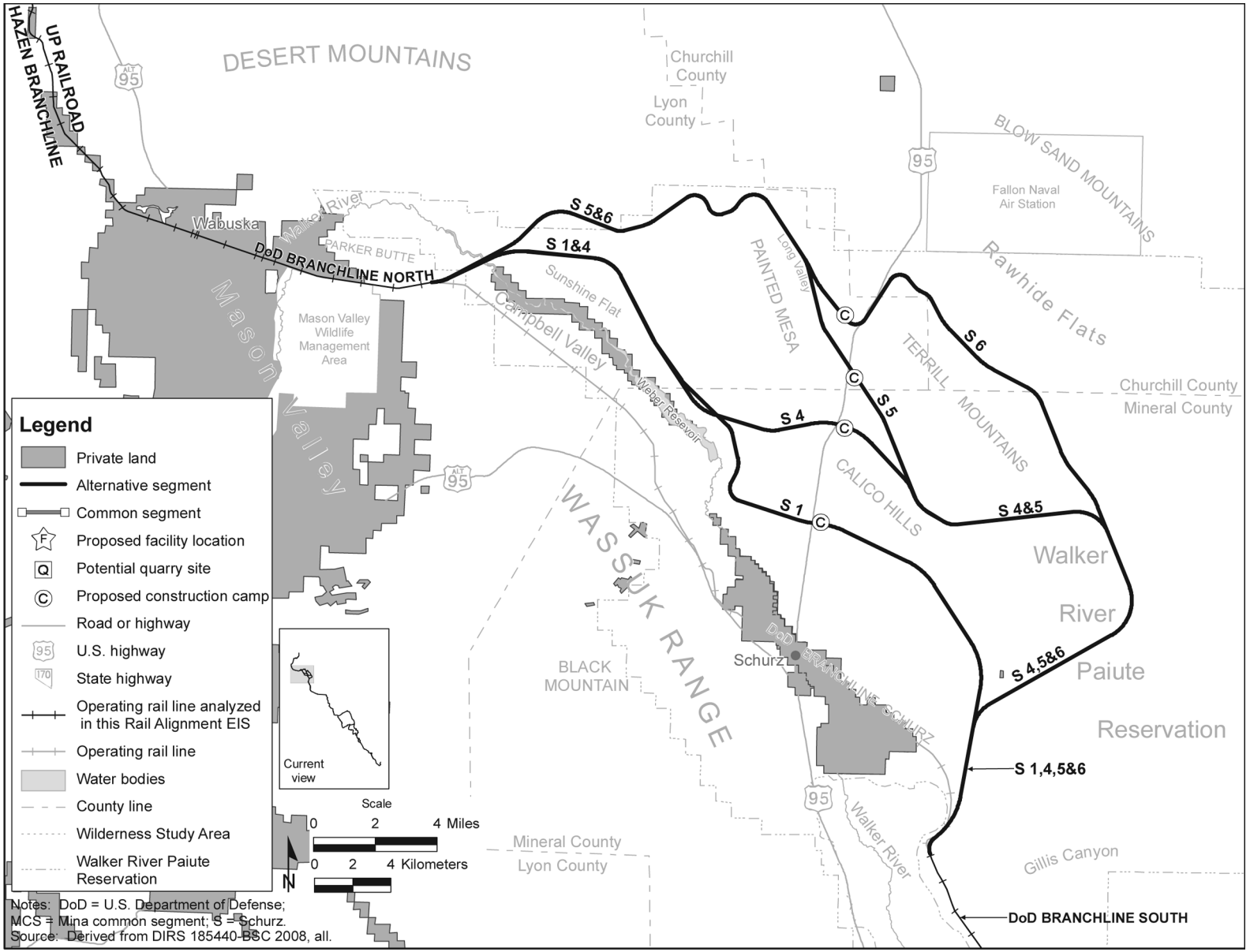


Figure 3-137. Private land within map area 1.

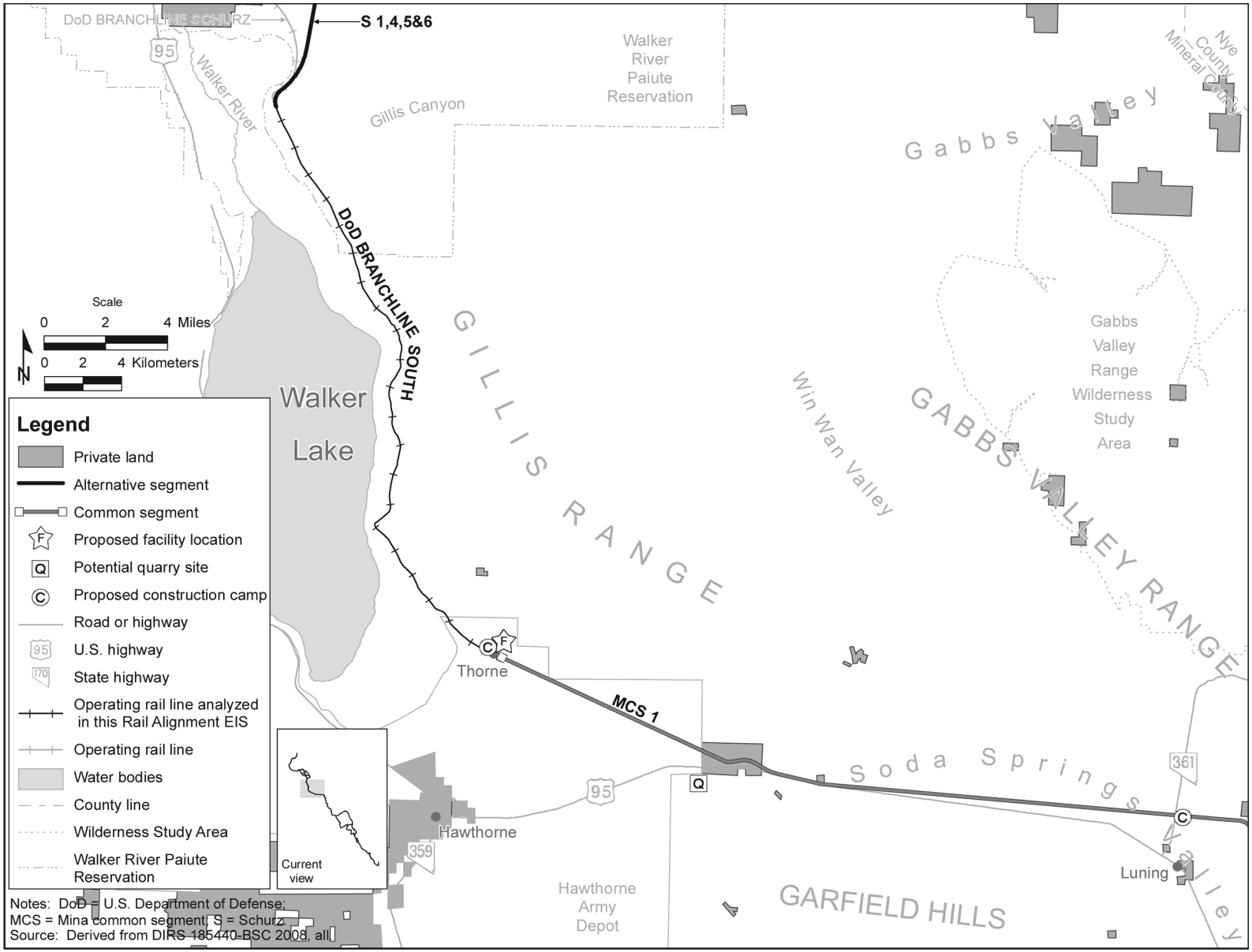


Figure 3-138. Private land within map area 2.

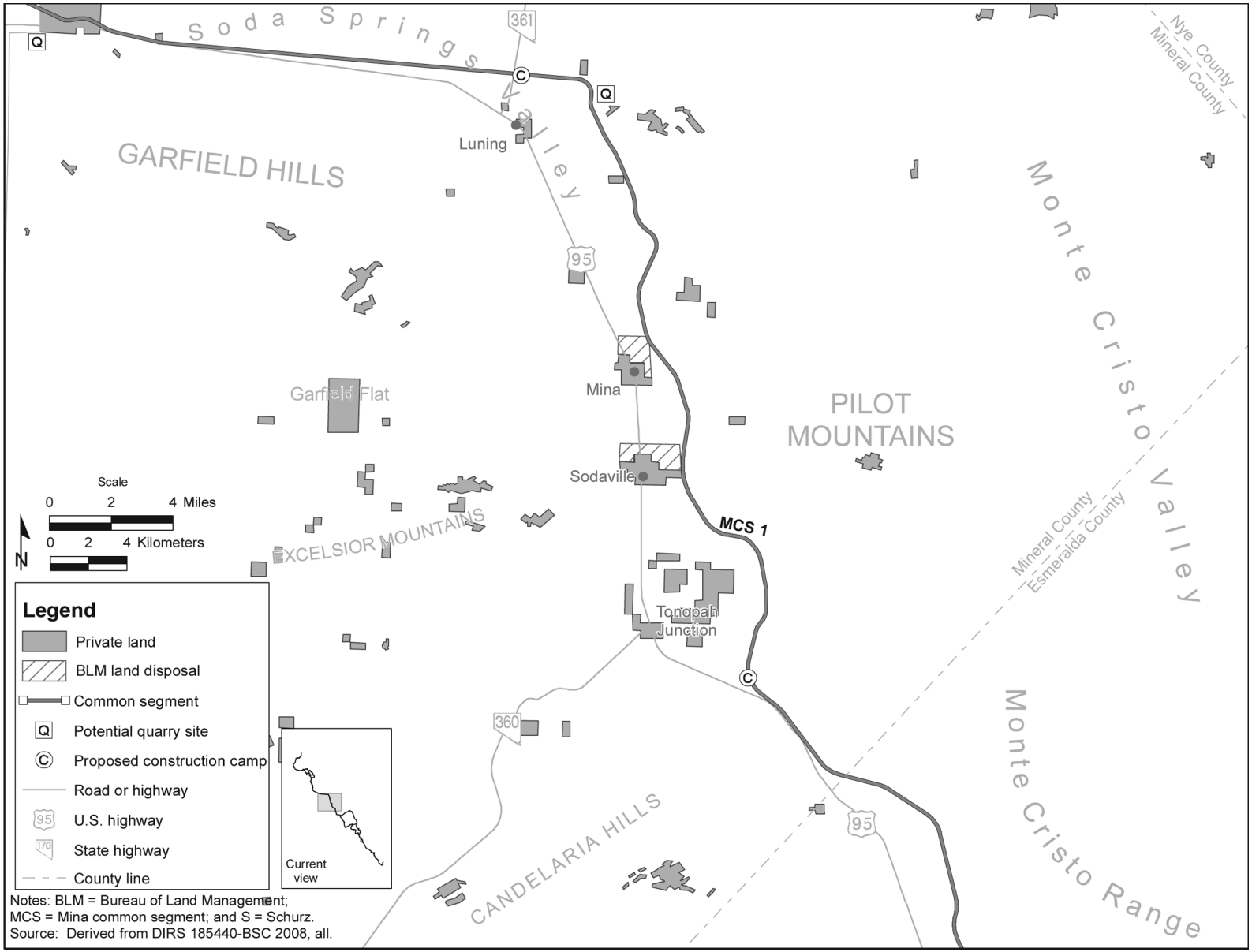


Figure 3-139. Private land within map area 3.

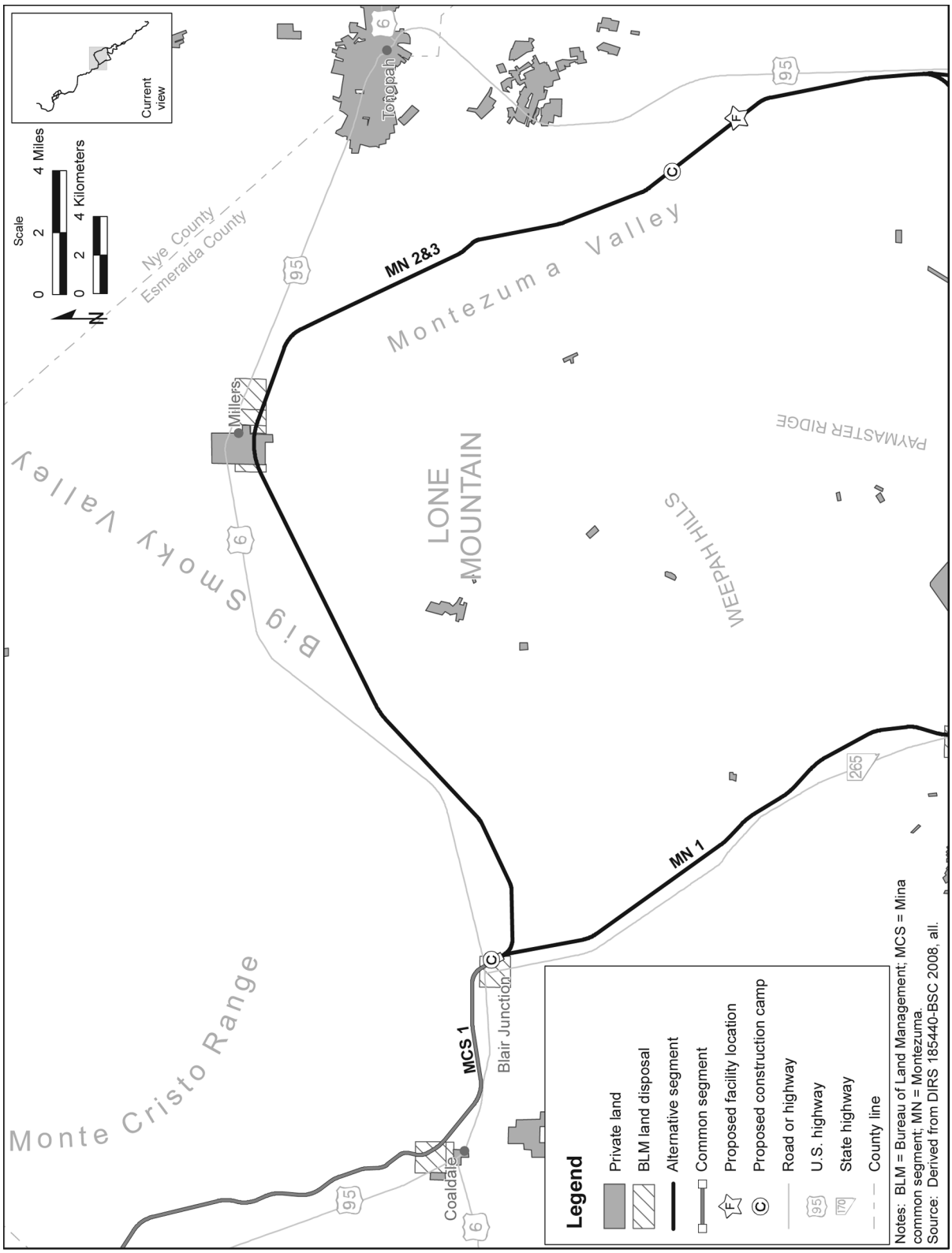


Figure 3-140. Private land within map area 4.

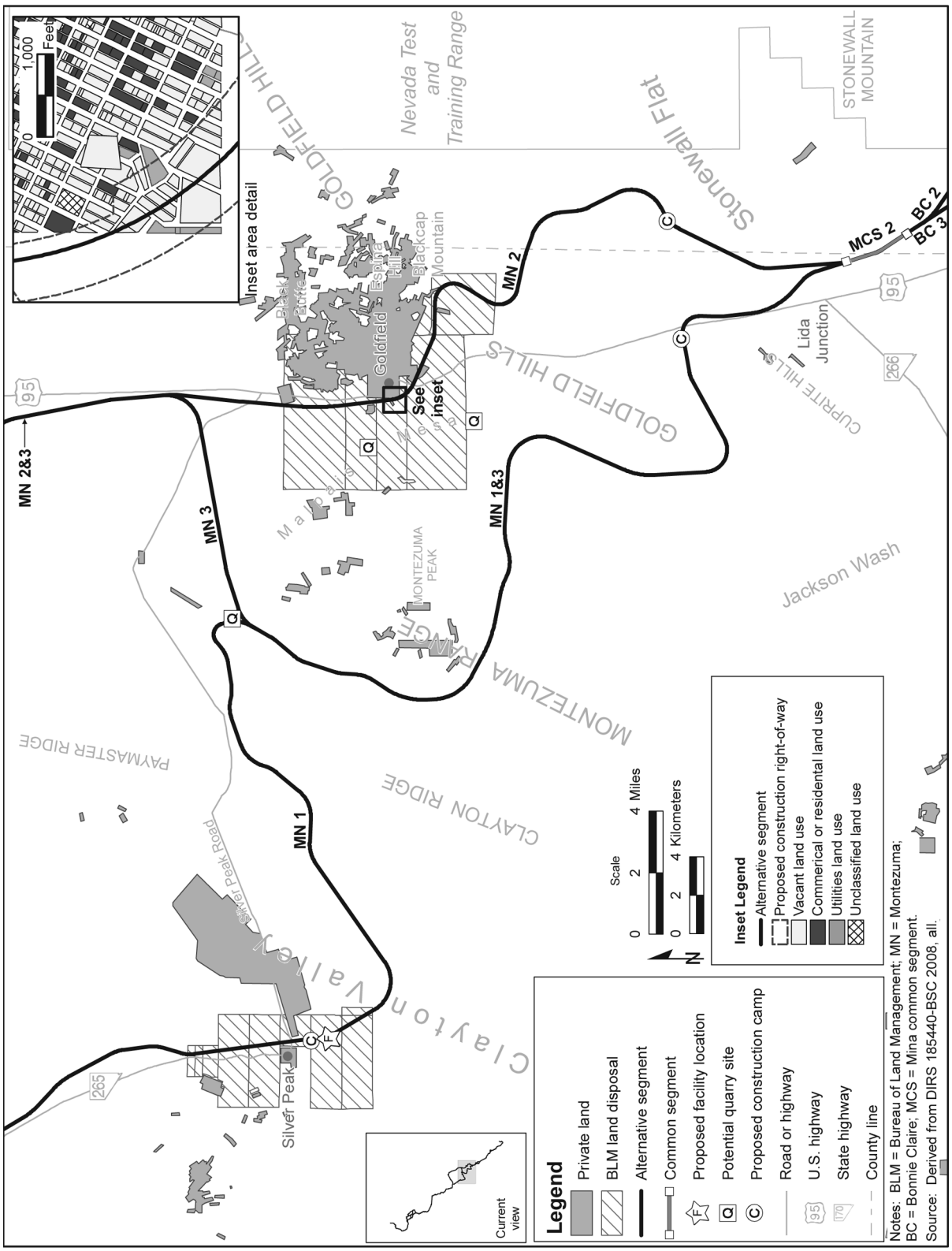


Figure 3-141. Private land within map area 5.

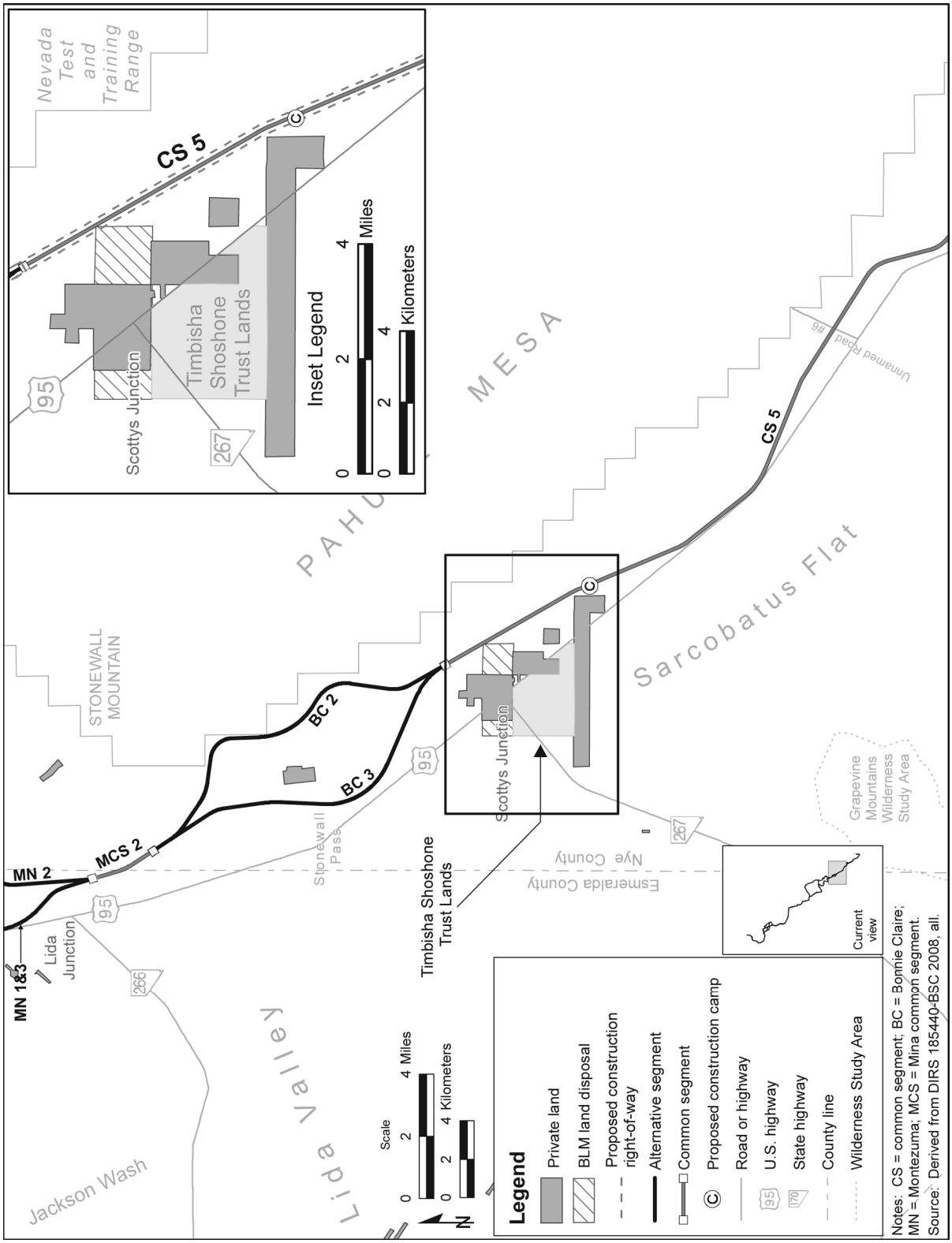


Figure 3-142. Private land within map area 6.

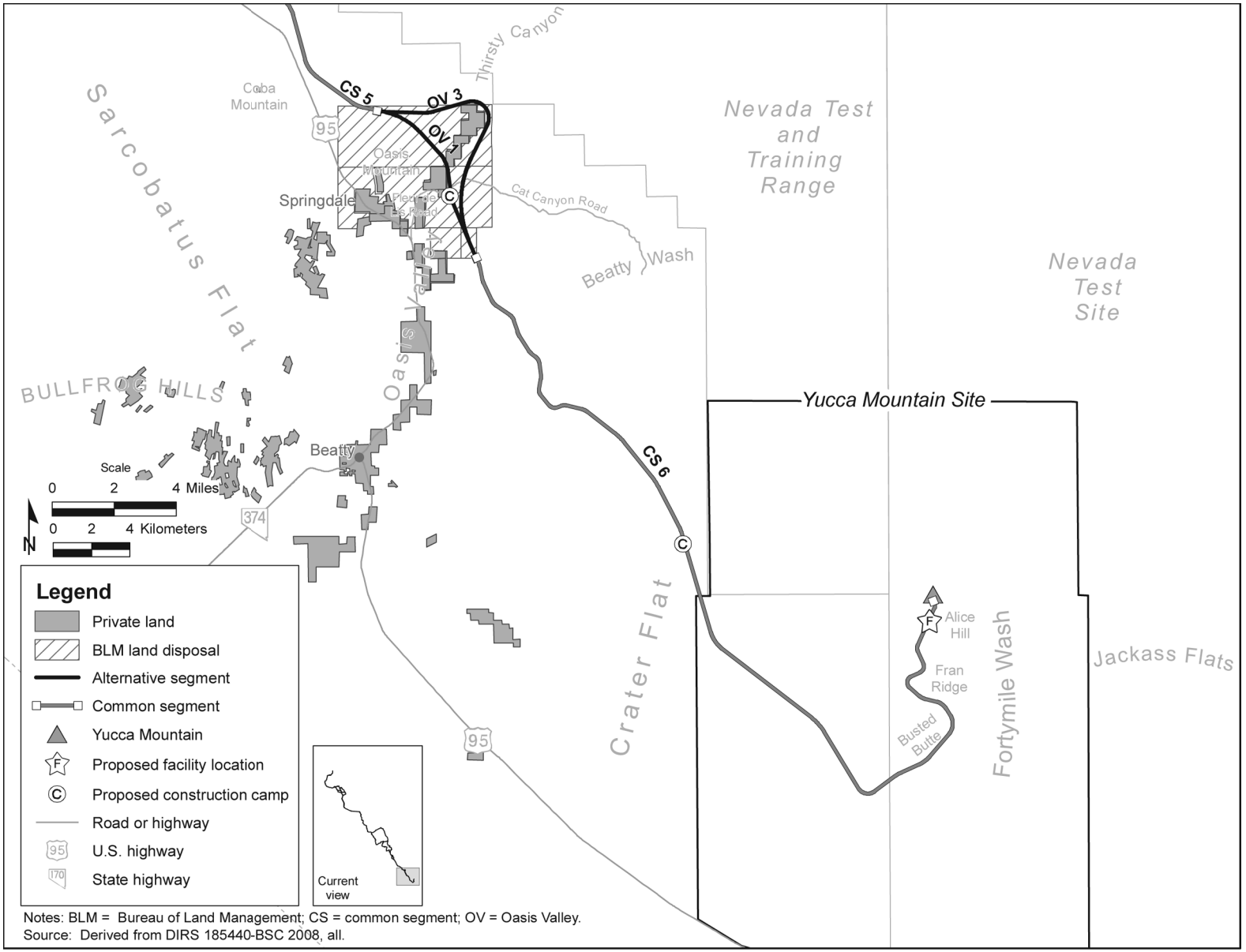


Figure 3-143. Private land within map area 7.

Table 3-82. Distances of existing and proposed rail line segments through the Walker River Paiute Reservation.

Segment	Approximate distance through the Reservation (miles)[a]	Approximate area of Reservation land that would be within the rail line construction right-of-way (acres)[b]
Existing Department of Defense Branchline through Schurz (existing rail to be removed as part of the Proposed Action)	27	Not applicable
Schurz alternative segment 1	32	850
Schurz alternative segment 4	40	1,170
Schurz alternative segment 5	66	1,240
Schurz alternative segment 6	42	1,310

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert square kilometers to acres, multiply by 247.10.

3.3.2.4 Public Land

Several agencies manage public lands near or encompassing the Mina rail alignment, including the BLM, DOE, and the Department of Defense.

3.3.2.4.1 BLM-Administered Land

Approximately 89 percent of the lands along the Mina rail alignment are BLM-administered public lands. Therefore, the proposed railroad project would in large part be subject to BLM land-use plans. The BLM manages public lands under the multiple-use concept, which balances the present and future needs of the American people. The BLM implements this concept through resource management plans, which are long-range, comprehensive land-use plans intended to provide for multiple uses and identify planning objectives and policies for designated areas. Resource management plan objectives are implemented through activity plans, such as allotment management plans and wildlife habitat management plans. BLM resource management plans that apply to the Mina rail alignment are included in the following:

Carson City Field Office Consolidated Resource Management Plan (Carson City Consolidated Resource Management Plan; DIRS 179560-BLM 2001, all)

Tonopah Resource Management Plan and Record of Decision (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)

Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

The northern segments of the Mina rail alignment would pass through public lands covered by the Carson City Consolidated Resource Management Plan. After the Mina rail alignment would cross from Mineral County into Esmeralda County, the land would be covered by the Tonopah Resource Management Plan. A portion of common segment 6 would pass through lands covered by the Las Vegas Resource Management Plan. Table 3-83 lists the distances each Mina rail alignment segment would pass through lands administered by the various BLM districts.

To construct and operate the proposed railroad along the Mina rail alignment, DOE would apply for a BLM ***right-of-way grant***. Section 503 of the Federal Land Policy and Management Act (43 United States Code [U.S.C.] 1761) provides for designation of right-of-way corridors and encourages the utilization of common rights-of-way to minimize environmental impacts and the proliferation of separate rights-of-

Table 3-83. Mina rail alignment crossing distances within each BLM resource management plan area.

Rail line segment	Carson City District/ Resource Management Plan area (miles)[a,b]	Battle Mountain District/Tonopah Resource Management Plan area (miles)	Las Vegas District/Resource Management Plan area (miles)
Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North[c]	43	0	0
Schurz alternative segment 1	32	0	0
Schurz alternative segment 4	40	0	0
Schurz alternative segment 5	44	0	0
Schurz alternative segment 6	45	0	0
Department of Defense Branchline South	22	0	0
Mina common segment 1	53	22	0
Montezuma alternative segment 1	0	73	0
Montezuma alternative segment 2	0	74	0
Montezuma alternative segment 3	0	88	0
Mina common segment 2	0	2	0
Bonnie Claire alternative segment 2	0	13	0
Bonnie Claire alternative segment 3	0	12	0
Common segment 5	0	25	0
Oasis Valley alternative segment 1	0	6	0
Oasis Valley alternative segment 3	0	9	0
Common segment 6	0	14	18
Total rail alignment distance by BLM district (shortest to longest alignment)	150 to 163	154 to 173	18

a. To convert miles to kilometers, multiply by 1.6093.
b. Individual segment lengths are rounded to two significant figures.
c. Within boundary but not under jurisdiction.

way. BLM policy is to encourage prospective applicants to locate their proposals within existing corridors. Resource management plans describe these corridors and right-of-way avoidance areas – areas for which the BLM would avoid granting new rights-of-way unless there are no other options. ***Areas of Critical Environmental Concern*** are generally considered right-of-way avoidance areas.

Resource management plans also designate areas of potential land disposal within their management areas. Therefore, BLM in consultation with DOE must assess whether a railroad along the Mina rail alignment would conflict with or adversely affect land disposal plans. Section 203(a) of the Federal Land Policy and Management Act allows for public land to be sold (disposed of) if it meets one of the following criteria:

- The land is difficult or uneconomic to manage as a part of the public lands.
- The land is not suitable for management by another federal department or agency.

Areas of Critical Environmental Concern are places within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, and other natural systems or processes, or to protect life and safety from natural hazards (DIRS 181386-BLM 2001, p. 2).

- The land was acquired for a specific purpose and it is no longer required for that, or any other, federal purpose.
- Disposal of the land will serve important public objectives that can be achieved prudently or feasibly only if the land is removed from public ownership and these objectives outweigh other public objectives or values that will be served by maintaining the land in federal ownership.

Sections 3.3.2.4.1.1 through 3.3.2.4.1.3 describe the planning areas and objectives of the applicable resource management plans in relation to lands and realty, corridors, and access and recreation.

3.3.2.4.1.1 Carson City Consolidated Resource Management Plan. The BLM Carson City Field Office administers more than 21,000 square kilometers (5.28 million acres) of federal public land in 11 counties in western Nevada and eastern California. Relevant management objectives related to land tenure adjustments, corridors, and access are listed below (DIRS 179560-BLM 2001, all).

- Lands and realty
  - Designate for potential future disposal approximately 750 square kilometers (180,000 acres) of BLM-administered public lands including lands that are difficult and uneconomic to manage (such as scattered parcels south of Hawthorne and in Smith and Mason Valleys, and checkerboard lands near Fernley, Silver Springs, and the Carson Sink [a large playa in northwestern Nevada, formerly the terminus of the Carson River]); land that would support community expansion (such as land west of Yerington; land surrounding Luning, Mina, Sodaville, Fallon, Gabbs, Reno, and Verdi; lands east of Montgomery Pass, near Honey Lake Valley and Dixie Valley); lands with possible agricultural potential (such as Smith Valley, Mason Valley, Honey Lake Valley, and Edwards Creek); and lands along the East Walker River identified for exchange to benefit BLM programs (DIRS 179560-BLM 2001, p. LND-3). The Mina common segment 1 construction right-of-way would overlap the eastern edge of disposal areas near Mina and Sodaville.
  - Transfer of land from federal ownership is subject to the following provision: mineral rights will be reserved to the United States unless there are no known mineral values in the land or the proposed non-mining development of the land is of more value than the minerals and the reservation of mineral rights interferes with such proposed non-mining development (DIRS 179560-BLM 2001, p. LND-7).
  - Rights-of-way will be reserved where appropriate to provide public access prior to disposal of public lands (DIRS 179560-BLM 2001, p. LND-7).
  - When public lands are disposed of or devoted to a public purpose that precludes livestock grazing, the permittee and lessee will be given 2 years prior notification, except in the cases of emergency (for example, military defense requirements in time of war, natural disasters, and national emergency needs) before their grazing permit and grazing lease and grazing preference may be cancelled in whole (DIRS 179560-BLM 2001, pp. LND-7 and 8).
  - Livestock permits would be adjusted, if necessary, to reflect decreases in public land forage available for livestock grazing use within an allotment as a result of land tenure adjustments (DIRS 179560-BLM 2001, p. LND-8).
  - Applicants for major rights-of-way shall submit a plan of development prior to issuance of a land-use authorization that addresses specific construction, operation, maintenance, or termination features that will satisfactorily mitigate the impacts (DIRS 179560-BLM 2001, p. LND-8).
- Corridors
  - Provide for an east-west and north-south network of right-of-way corridors in the field office area of jurisdiction (DIRS 179560-BLM 2001, p. ROW-1).

- Designate 1,104 kilometers (686 miles) of rights-of-way, which include existing transmission lines, and identify 351 kilometers (218 miles) of planning corridors. All corridors are 3 kilometers (2 miles) wide and private lands are not included in these corridors (DIRS 179560-BLM 2001, p. ROW-1).
- Within the Walker Resource Area, designate a corridor (C-F) following the existing major powerline from the Fort Churchill Power Plant to southern Nevada. Portions of this route also contain U.S. Highway 95, a railroad, telephone, and other power lines (DIRS 179560-BLM 2001, p. ROW-2).
- Future right-of-way corridors will be evaluated on a case-by-case basis, but should be as consistent as possible with the Western Regional Corridor Study (DIRS 179560-BLM 2001, p. ROW-3).
- Existing roads and trails will be used whenever possible during construction (DIRS 179560-BLM 2001, p. ROW-4).

- Access and recreation
  - All public lands under Carson City Field Office jurisdiction are designated open to off-highway vehicle use unless they are specifically restricted or closed. Off-highway vehicle use will be eliminated through or in the immediate vicinity of any surface-water source, such as a spring or seep; in any ***riparian*** area associated with meadows, marshes, springs, seeps, ponds, lakes, reservoirs or streams; in any channel bank or streambed of a ***perennial stream***; or in a threatened or endangered plant location (DIRS 179560-BLM 2001, p. REC-7).
  - Off-highway vehicle access is restricted to designated trails and roads on the west side of Walker Lake (DIRS 179560-BLM 2001, p. REC-3).
  - Special Recreation Management Area designation will be maintained for Walker Lake (DIRS 179560-BLM 2001, p. REC-5).
  - The following plans will be followed for recreation activities and planning: Walker Lake Recreation Management Plan (December 1979) and Recreation Project Plan for Walker Lake (April 1992) (DIRS 179560-BLM 2001, p. REC-8).
- Minerals and energy

  Public lands in the area of jurisdiction are open to mineral and energy development activity, although within the Walker Planning Area, about 45 square kilometers (11,000 acres) are either segregated against mineral entry under the Classification and Multiple Use Act or withdrawn from mineral entry by the formal withdrawal process (DIRS 179560-BLM 2001, p. MIN-1).

3.3.2.4.1.2 Tonopah Resource Management Plan. Located in south-central Nevada in Nye and Esmeralda Counties, the Tonopah Planning Area encompasses approximately 25,000 square kilometers (6.1 million acres) of public land and approximately 670 square kilometers (165,000 acres) of private land. Significant resources and program emphases include locatable minerals, livestock grazing, wild horses and burros, realty, cultural resources, and wildlife (DIRS 173224-BLM 1997, p. 1). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below.

- Lands and realty
  - Discretionary disposal of approximately 274 square kilometers (68,000 acres) of public land (DIRS 173224-BLM 1997, p. 2). Approximately 91 square kilometers (230,000 acres) have been identified for potential disposal in the vicinity of the Goldfield, about 2 square kilometers (5,800 acres) have been identified for potential disposal near Scottys Junction, and approximately 160

square kilometers (39,000 acres) have been identified for potential disposal near Beatty (acreage based on GIS data) (DIRS 185440-BSC 2008, all).

- Mina common segment 1 would intersect two parcels designated for disposal at Coaldale Junction and one parcel at Blair Junction. Montezuma alternative segment 1 would intersect nine parcels designated for disposal near Silver Peak. Montezuma alternative segments 2 and 3 would intersect four parcels at Millers, and Montezuma alternative segment 2 would intersect six parcels at Goldfield.

- Corridors
  - Approximately 1,100 kilometers (670 miles) designated for transportation and utility corridors in the planning area (DIRS 173224-BLM 1997, p. 2).
  - Rights-of-way allowed (if compatible with values) on approximately 600 square kilometers (149,000 acres) (DIRS 173224-BLM 1997, p. 2). (There are no right-of-way exclusion areas within the Mina rail alignment region of influence.)
  - Designated right-of-way corridors within the planning area will be 5 kilometers (3 miles) wide except where there are topographic constraints. Grants for rights-of-way are still required for facilities placed within designated corridors. Designation of a corridor does not mean that future rights-of-way are restricted to corridors, nor does it mean that the BLM has committed to approving all right-of-way applications within corridors (DIRS 173224-BLM 1997, p. A-38).
- Access and recreation
  - Vehicles unrestricted on 77 percent of the planning area.
  - Vehicles limited to existing roads and trails in primitive and semi-primitive non-motorized and semi-primitive motorized areas.
  - Designates seven Special Recreation Management Areas (DIRS 173224-BLM 1997, p. 2)

3.3.2.4.1.3 Las Vegas Resource Management Plan. The Las Vegas Resource Management Plan provides a comprehensive framework for managing approximately 13,000 square kilometers (3.3 million acres) of public lands in Clark County and the southern portion of Nye County administered by the BLM Las Vegas Field Office. Significant resources and program emphases in the plan include threatened and ***endangered species***; land disposal actions; wilderness management; wildlife habitat; special status species; riparian areas; forestry and vegetative products; livestock grazing; wild horses and burros; land acquisition priorities; rights-of-way; cultural resources; hazardous materials management; recreation; utility corridors; and minerals (DIRS 176043-BLM 1998, p. 2). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below (DIRS 176043-BLM 1998, Appendix A, pp. 16-18).

- Land and realty
  - Dispose of approximately 710 square kilometers (175,000 acres) of public lands through sale, exchange or recreation and public-purpose patent to provide for the orderly expansion and development of southern Nevada.
  - All public lands within the planning area, unless otherwise classified, segregated or withdrawn, and with the exception of Areas of Critical Environmental Concern and ***Wilderness Study Areas***, are available for land-use leases and permits at the discretion of the BLM.
  - Terminate or modify any unused, outdated, or unnecessary classifications/segregations and withdrawals on public lands to reduce the area of segregation in the plan area.

- Acquire private lands to enhance the recovery of special status species, protect valuable resources, and facilitate the management of adjacent BLM lands.

- Corridors

  All Areas of Critical Environmental Concern and all lands within 0.4 kilometer (0.25 mile) of significant caves, exclusive of any designated corridors, are designated as right-of-way avoidance areas. (There are no Areas of Critical Environmental Concern within the Mina rail alignment region of influence; the closest area is 135 kilometers [84 miles] south of common segment 6.)

- Access and recreation
  - Ensure that a wide range of recreation opportunities are available for recreation users in concert with protecting the natural resources on public lands that attract users.
  - Provide opportunities for off-road vehicle use while protecting wildlife habitat, cultural resources, hydrological and soil resources, non-motorized recreation opportunities, natural and aesthetic values, and other uses of the public land.

The Las Vegas Proposed Resource Management Plan/Final Environmental Impact Statement briefly mentions the Yucca Mountain Project in sections titled "Income and Employment" and "Social Setting, Attitudes, and Values." In the Income and Employment section the document notes that there could be population growth in Amargosa Valley as a result of construction and operation of the Yucca Mountain Project. In the Social Setting, Attitudes, and Values section the document notes that people residing in Las Vegas (urbanites) expressed a higher concern than people residing in rural locations about wildlife and ***ecosystem*** values when recording their ***risk*** assessment for the proposed Yucca Mountain Project in a 1995 social research survey conducted by the University of Nevada Las Vegas (DIRS 176043-BLM 1998, pp. 3-81 and 3-82).

3.3.2.4.1.4 Project-Related Public Land Withdrawals. The BLM announced Public Land Order 7653 on December 28, 2005 (70 *Federal Register* [*FR*] 76854). The Order withdrew 1,249 square kilometers (308,600 acres) of public lands within the Caliente rail corridor from surface and mining entry for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of the proposed railroad to Yucca Mountain. The withdrawal applies only to BLM-administered public lands. The withdrawal area extends approximately 0.8 kilometer (0.5 mile) from either side of the centerline of the proposed rail alignment. The actions covered by this withdrawal meet the BLM definition of ***casual use*** as set forth in 43 Code of Federal Regulations (CFR) 2801.5. On January 10, 2007, the BLM announced that DOE had filed an application requesting a second land withdrawal (72 *FR* 1235). The Department filed the application to cover post-scoping changes in the Caliente rail alignment and to address the addition of the Mina rail alignment. The application requested the withdrawal of an additional 842 square kilometers (208,037 acres) of public lands from surface and mineral entry and the location of new mining claims through December 27, 2015, so DOE could evaluate the lands for the potential construction, operation, and maintenance of a railroad to Yucca Mountain. Chapter 6 of this Rail Alignment EIS includes detailed information about the land withdrawal process.

The BLM granted DOE a right-of-way reservation (N-47748) for Yucca Mountain ***site characterization*** activities, which has been extended to December 31, 2014 (DIRS 102218-BLM 1988, all). This reservation comprises 210 square kilometers (52,000 acres). The land in this reservation is open to public use, with the exception of about 20 square kilometers (5,000 acres) near the site of the proposed ***repository*** that were withdrawn in 1990 from the mining and mineral leasing laws to protect the physical integrity of the repository block. The lands in this reservation not withdrawn from the mining and mineral leasing laws contain a number of ***unpatented mining claims*** (DIRS 155970-DOE 2002, p. 3-9). This existing right-of-way reservation would be the basis for the planned land withdrawal for the Yucca Mountain Site, as described in the *Supplemental Environmental Impact Statement for a Geologic*

Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250F-S1), where the land would transfer from BLM administrative responsibility to DOE control.

The BLM also granted DOE a right-of-way reservation (N-48602) for 72 square kilometers (19,000 acres) of land on the Nevada Test and Training Range for site characterization activities. This land is closed to public access and use. This right-of-way reservation has been extended to March 5, 2014.

Withdrawal: Withholding an area of federal land from settlement, sale, location, or surface entry under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program.

Casual use: Activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements. Examples of casual use include surveying, marking routes, and collecting data to use to prepare grant applications.

Right-of-way: The public lands the BLM authorizes a holder to use or occupy under a grant.

Grant: Any authorization or instrument (for example, easement, lease, license, or permit) the BLM issues under Title V of the Federal Land Policy and Management Act (43 U.S.C. 1761 *et seq.*).

Mineral entry closure: The land is not available for the location of mining claims because the land has been withdrawn from public use, including the operation of the General Mining Law (DIRS 181386-BLM 2001; 43 CFR 3830.5).

Surface entry closure: Land closed to surface entry cannot be used for appropriation of any non-federal interest or claim (other than mining claims), land sales, any public land disposal action, or other action that would cause the title for the land to be transferred away from the Federal Government (DIRS 176452-DOE 2005; 43 CFR 3809.5).

3.3.2.4.2 Department of Defense-Managed Land

3.3.2.4.2.1 Nevada Test and Training Range. The U.S. Department of Defense administers the Nevada Test and Training Range, which the U.S. Air Force uses for training. The Mina rail alignment would not cross onto the Nevada Test and Training Range. Detailed information about current and future uses of the Nevada Test and Training Range is available in the *Proposed Nevada Test and Training Range Resource and Management Plan and Final Environmental Impact Statement* (DIRS 178103-BLM 2003, all).

Most of the airspace above the Nevada Test and Training Range is "restricted" (DIRS 103472-USAF 1999, p. 3.1-2). Restricted airspace consists of areas where nonparticipating aircraft are subject to restriction during scheduled periods when hazardous activities are being performed. Restricted areas designated as joint use by the Federal Aviation Administration allow air traffic control to route nonparticipating aircraft through this airspace when it is not in use or when appropriate separation can be provided. Those areas not designated as joint use cannot be accessed by either non-participating civil or military aircraft at any time (DIRS 103472-USAF 1999, p. 3.1-3).

Restricted area R-4807A is designated joint use and land beneath it is comprised of an electronic battlefield with numerous tactical targets and manned electronic combat threat simulators. Portions of the Mina rail alignment that would be on land below R-4807A include portions of common segment 5, Oasis Valley alternative segments 1 and 2, and a portion of common segment 6 (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6).

Restricted area R-4808S is controlled by DOE for Nevada Test Site activities and is designated joint use. The Federal Aviation Administration Los Angeles Air Route Traffic Control Center also uses R-4808S for civil aircraft overflights (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6). A portion of common segment 6 would be on land below R-4808S as it approached the Yucca Mountain Site.

3.3.2.4.2.2 Hawthorne Army Depot. The Depot extends over approximately 600 square kilometers (150,000 acres). The northwest land area consists of approximately 180 square kilometers (45,000 acres) used primarily for military training. The industrial, administration, and housing area is centrally located and consists of about 1.3 square kilometers (330 acres). The remaining acreage (approximately 400 square kilometers [102,000 acres]) consists of active military storage and ordnance demilitarization areas (DIRS 182761-Larson 2007, p. v). The active military areas consist of unimproved areas that service the magazine and warehouse, and areas used for rifle ranges, test ranges, and open burn/open detonation areas. These areas are surrounded by a large buffer zone of unimproved land, and on the northeast side, by Walker Lake. The Depot does not have a master plan but its land use is governed in part by its Integrated Natural Resource Management Plan (DIRS 181899-Hawthorne Army Depot, all)

There are two mining claims within the Depot. Mining activities are highly regulated, and claim holders are required to provide advance coordination of work on the claims and must be escorted at all times. The mines are not being mined and claim holders obtain access only to make minimal improvements required to continue the claims' active status (DIRS 182761-Larson 2007, pp. vi and vii).

At present, there are no agricultural outleases and livestock grazing is prohibited because of mission security issues, environmental considerations, and the need for strict water-quality controls (DIRS 182761-Larson 2007, p. 2-8). There are recreational areas on Mount Grant and at Walker Lake. The Depot maintains a line of security buoys across the lake to restrict access from the lake to the south shore (DIRS 182761-Larson 2007, pp. 2-7 and 2-16).

The Union Pacific Railroad has a trackage rights agreement with the Department of Defense to operate trains from the Fort Churchill Siding across the Walker River Paiute Reservation to the Thorne Siding at the Depot on Department of Defense track. The Thorne Siding receives approximately one train a month (DIRS 180222-BSC 2006, p. 28).

DOE would construct approximately 11.5 kilometers (7 miles) of new rail line (Mina common segment 1) within the active military area of the Depot. The Department would also construct a Staging Yard, which would occupy 0.20 square kilometer (50 acres) of land on the Depot, north of the existing rail line.

3.3.2.4.3 DOE-Managed Land, Nevada Test Site

Portions of common segment 6 and some railroad operations facilities would be on Nevada Test Site land (see Figure 3-143), which DOE administers. Detailed information about current and future uses of the Nevada Test Site is available in *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all). As discussed previously, land that makes up the proposed Yucca Mountain Site would be withdrawn and transferred to DOE control. Currently, a Memorandum of Agreement between the DOE National Nuclear Security Administration and the Office of Civilian Radioactive Waste Management allows the use of about 235 square kilometers (58,000 acres) on the Nevada Test Site for Yucca Mountain Project activities.

3.3.2.5 General Environmental Setting and Land-Use Characteristics

Major public land uses along the Mina rail alignment include grazing, mineral and energy extraction, and recreation. The rail alignment would cross numerous public roads and trails that provide access to public and private land and would cross BLM-authorized rights-of-way for utilities.

3.3.2.5.1 BLM Grazing Allotments

The Taylor Grazing Act of 1934 (43 U.S.C. 315-316o), as amended, authorizes the Federal Government to issue permits for grazing livestock in grazing districts to settlers, residents, and other livestock owners

for an annual payment of reasonable fees. An applicant who owns a base property or controls a water source may apply to the BLM for a lease or permit to use public lands for the grazing of livestock. The BLM grazing administration regulations (43 U.S.C. 4100.0-5) define a base property as land that has the capability to produce crops or forage that can be used to support authorized livestock for a specified period of the year (land base property), or a privately owned right to water that is suitable for consumption by livestock and is available and accessible to livestock when the public lands are used for livestock grazing (water base property). The area that can be properly grazed by livestock watering at certain water sources is considered the "service area" and becomes the allotment for which the permit is issued (43 CFR Part 4100). The grazing allotments are leased or permitted for 10 years and may be renewed under specific circumstances.

Livestock permitted on grazing allotments include cattle, sheep, goats, horses, and burros. Cattle and sheep are the typical livestock grazed within the Mina rail alignment region of influence. The grazing lease or permit specifies the types and numbers of livestock based on the property acreage, the period of use, and the amount of use in ***animal unit months***. The intent of assigning animal unit months is to allow grazing on public lands without exceeding the capacity of the allotment to sustain livestock (43 CFR Part 4100).

Animal unit month: The forage needed to support one cow, one cow/calf pair, one horse, or five sheep for one month. Approximately 800 pounds of forage (DIRS 184767-BLM 2007, p. G-17).

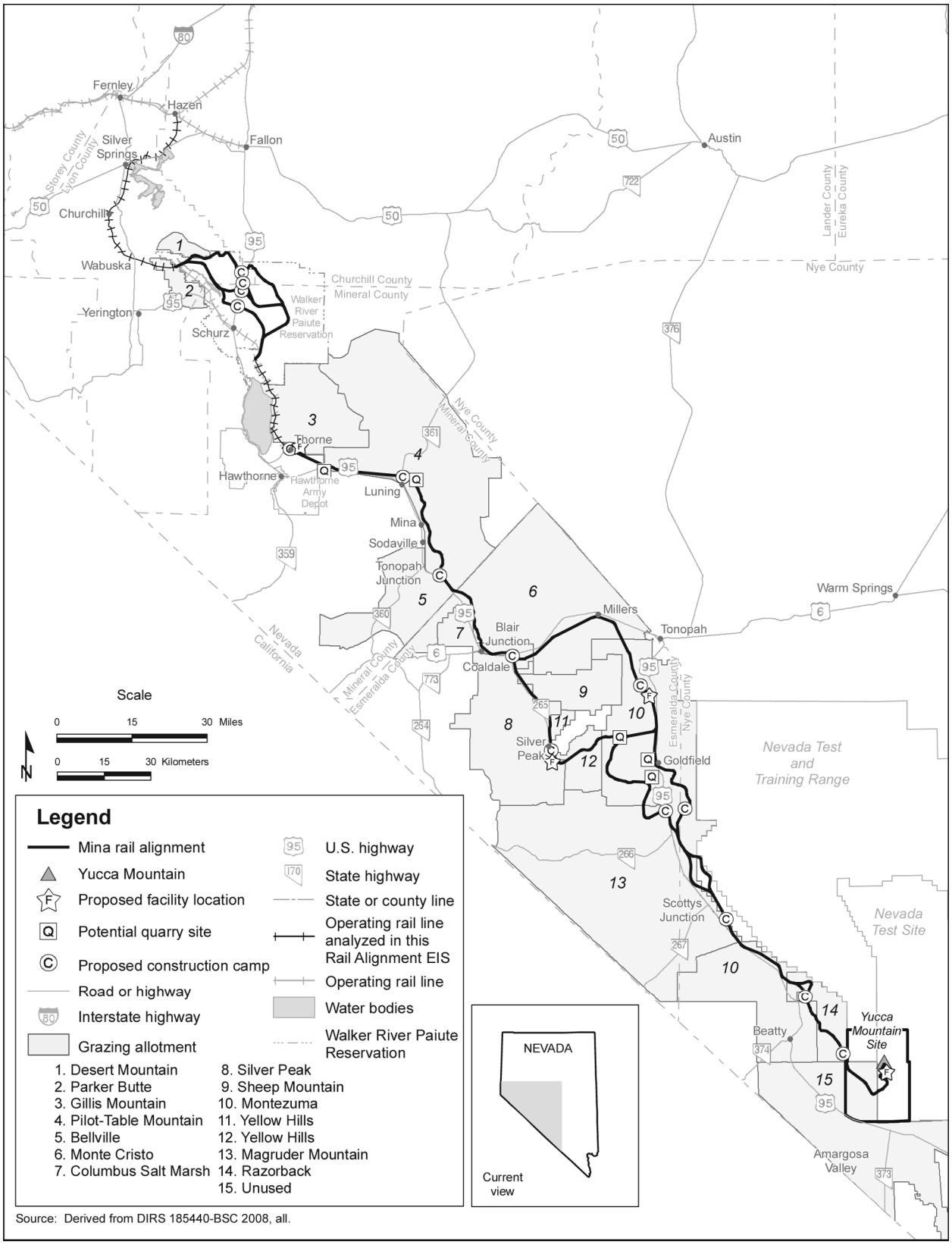
Depending on the combination of common segments and alternative segments, the Mina rail alignment and its support facilities would cross up to 12 active grazing allotments, and 3 inactive allotments (Columbus Salt Marsh, Montezuma, and one labeled Unused) (Figures 3-144 through 3-151). Tables 3-84 and 3-85 list information about grazing allotments within the Mina rail alignment region of influence. Access to a water source is an essential requirement for livestock grazing in the high ***desert*** of Nevada. In accordance with the Nevada State Water Law, the State Engineer in the Nevada Division of Water Resources may issue permits for water rights to applicants who can demonstrate a beneficial use for the water. Once permitted, water rights are treated as property rights and can be bought and sold (DIRS 178301-State of Nevada n.d., all). Because water rights greatly influence the uses and value of land in this generally ***arid*** region, any impacts to water rights could directly impact land use. (See Section 3.3.6 for a description of ***groundwater*** resources.)

It is essential to provide adequate water for livestock within reasonable distances of grazing areas. Stockwater is water that is physically diverted from the natural water course or storage of water for use by livestock or wildlife. There are several methods for developing stockwater, including spring developments; wells, ponds, or dugouts; and pipelines with a trough or tank for storage. Table 3-85 lists stockwater features within the Mina rail alignment region of influence. The locations of the wells and springs near the Mina rail alignment are shown in Figures 3-190 through 3-195 in Section 3.3.6, Groundwater Resources.

3.3.2.5.2 Mineral and Energy Resources

3.3.2.5.2.1 Mineral Resources. Commercial prospecting for minerals of value began in southern Nevada in the mid-1800s and continues to the present. Minerals currently mined include metallic and nonmetallic minerals. Gold and silver are the most important metallic minerals. Nonmetallic minerals include turquoise, decorative rock, perlite, opal, borate, limestone, clay, building stones, silica, aggregates, gypsum, and salt used in industrial processes and building materials (DIRS 150524-Tingley 1998, all).

There is potential mining activity on private land (patented mining claims) and public land (unpatented mining claims). Figure 3-152 shows mining districts and areas near the Mina rail alignment.



Source: Derived from DIRS 185440-BSC 2008, all.

Figure 3-144. Grazing allotments along the Mina rail alignment.

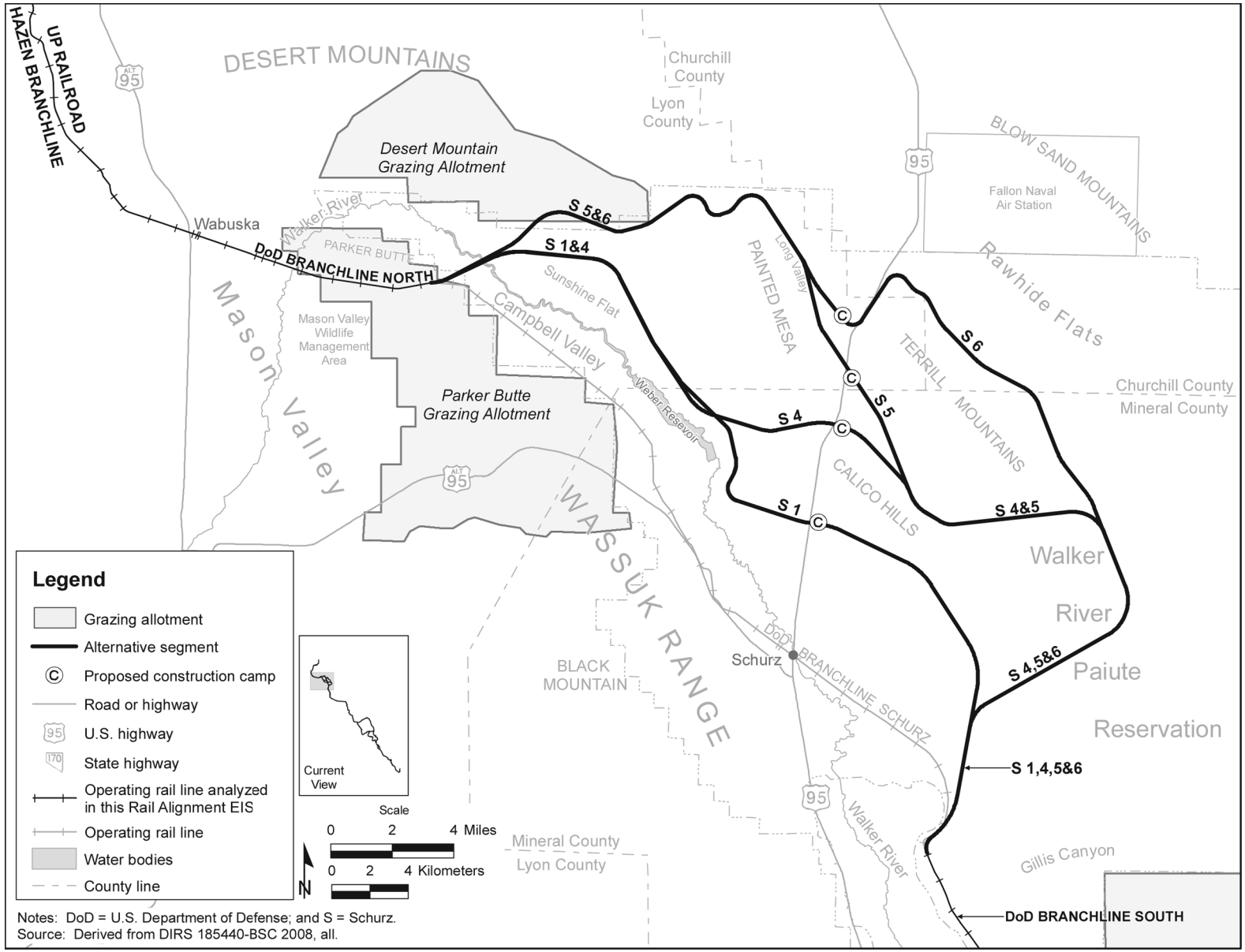


Figure 3-145. Grazing allotments with stockwater features within map area 1.

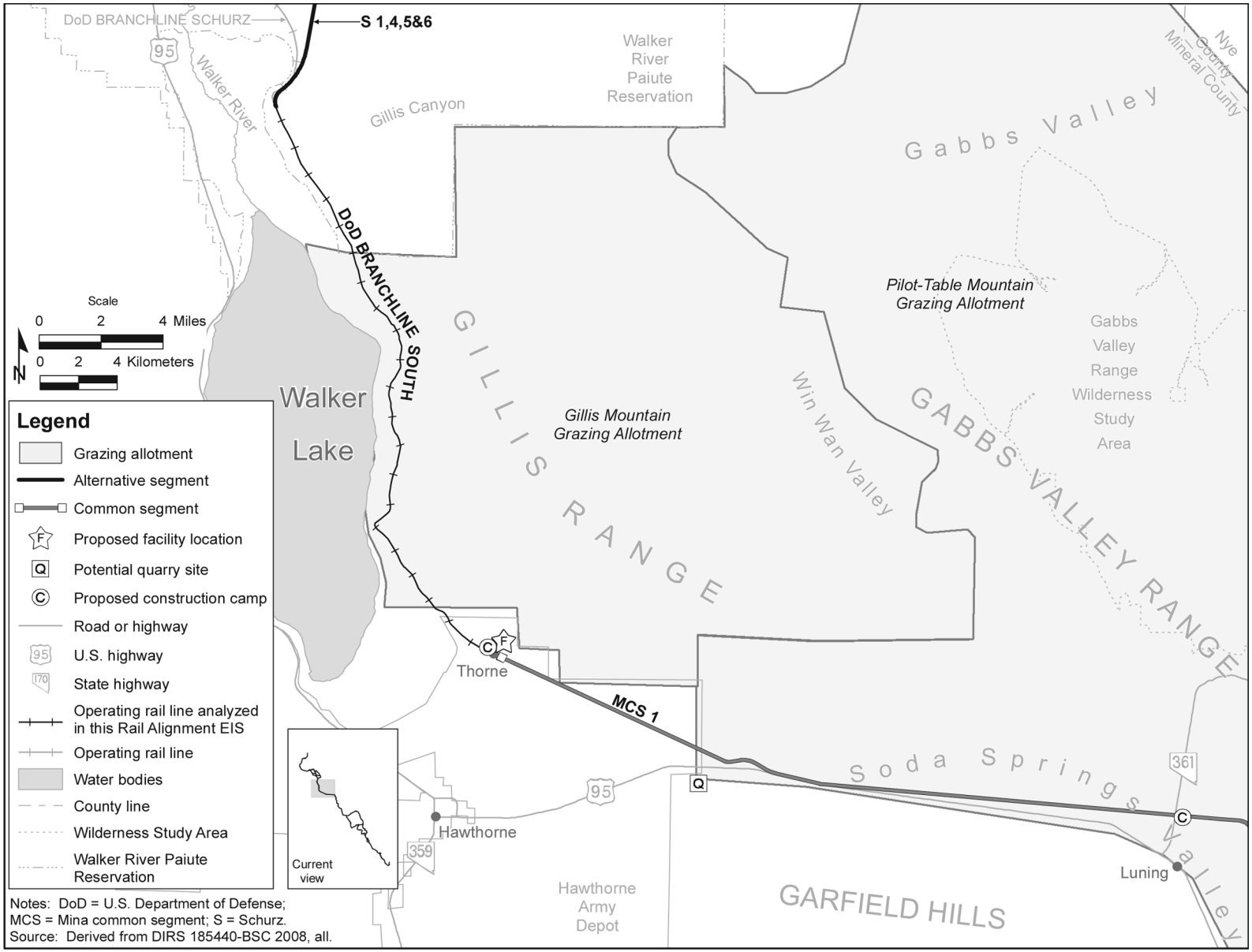


Figure 3-146. Grazing allotments with stockwater features within map area 2.

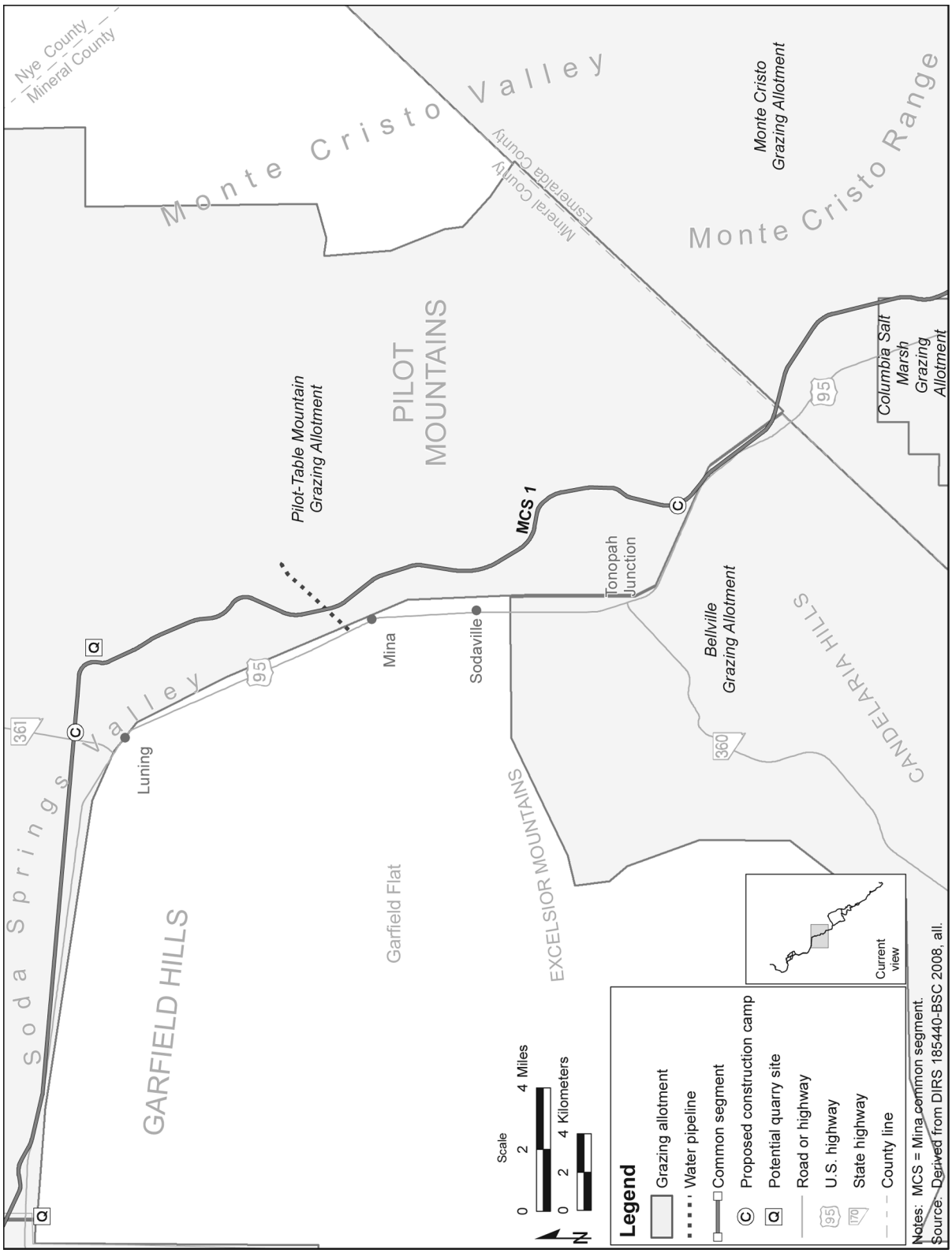


Figure 3-147. Grazing allotments with stockwater features within map area 3.

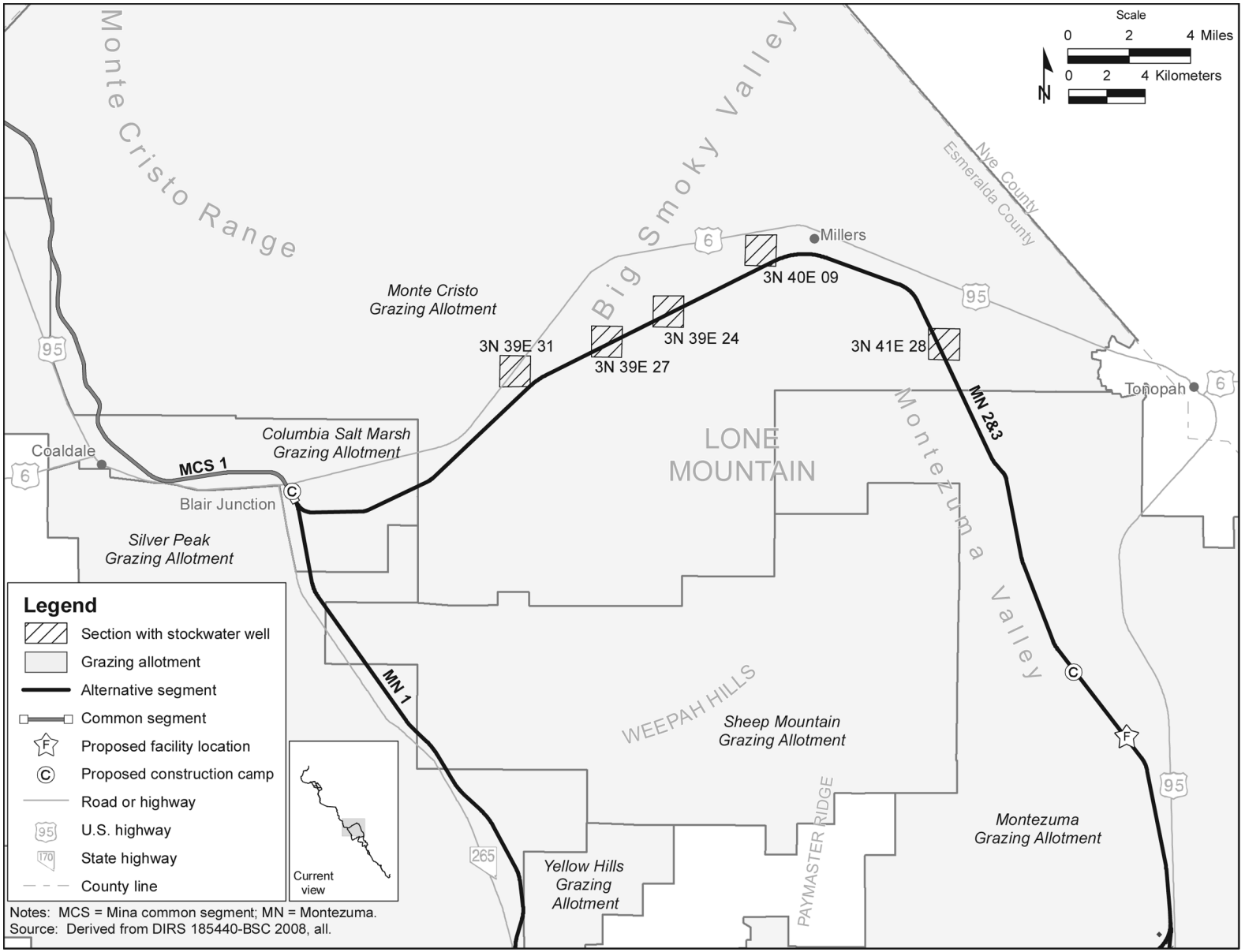


Figure 3-148. Grazing allotments with stockwater features within map area 4.

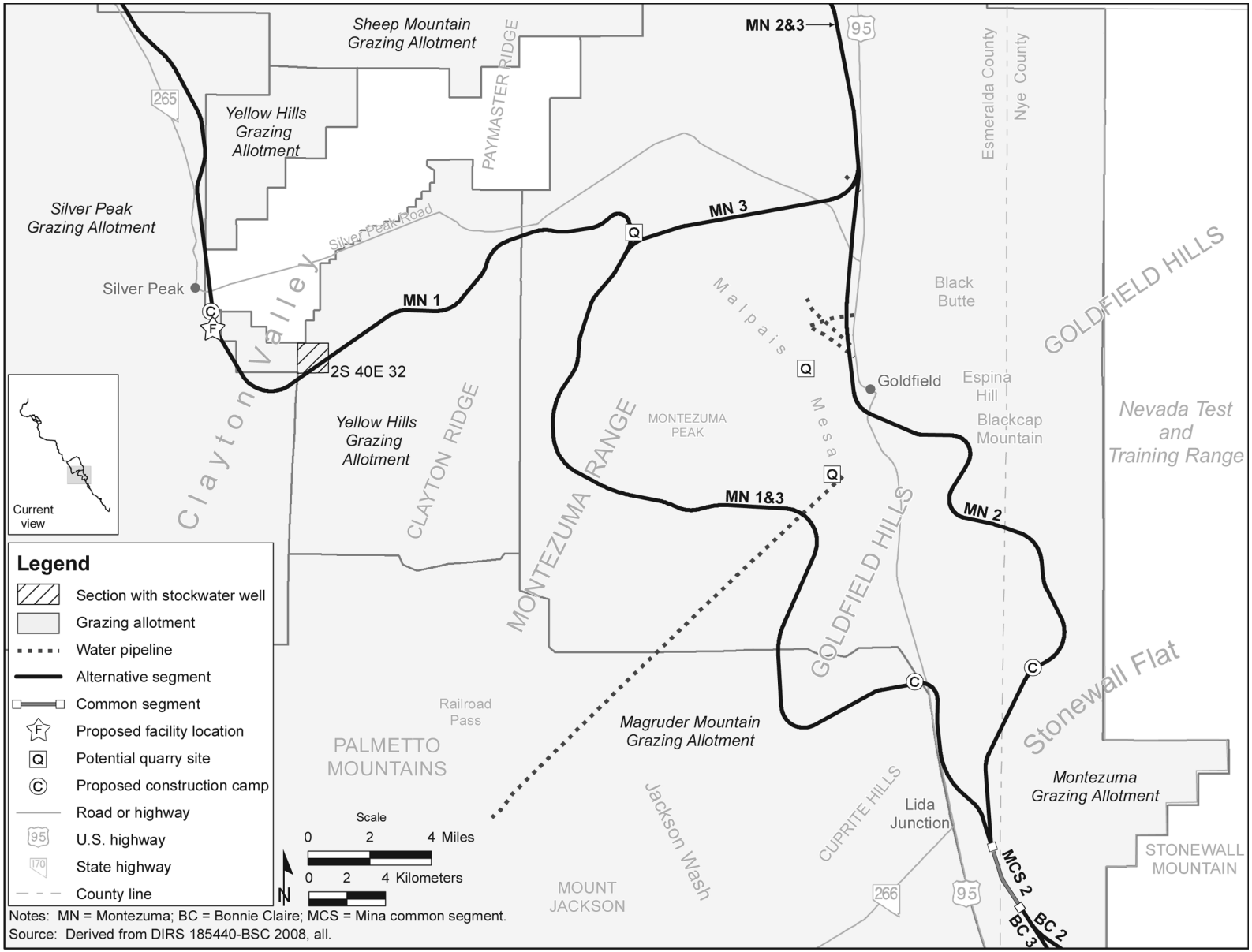


Figure 3-149. Grazing allotments with stockwater features within map area 5.

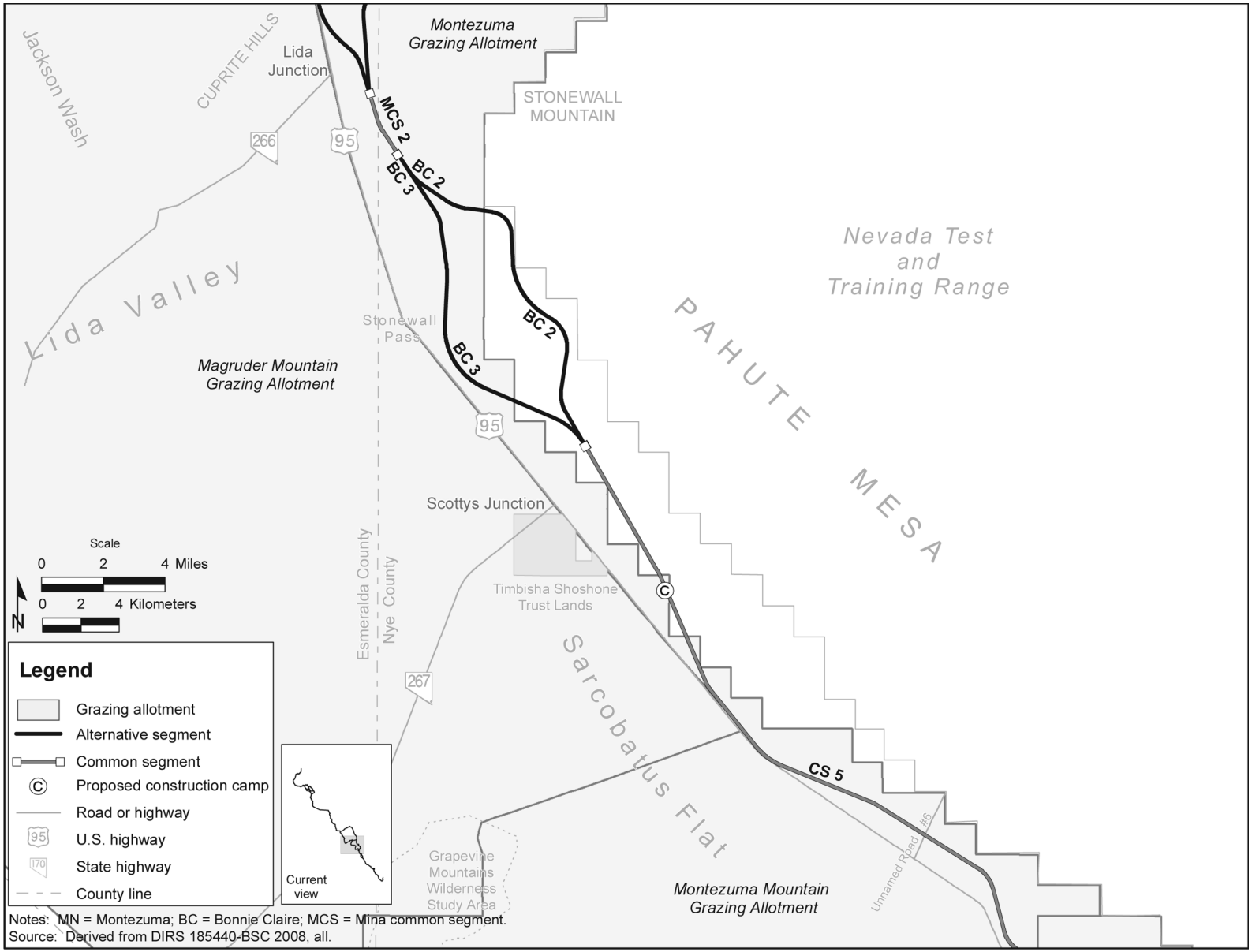


Figure 3-150. Grazing allotments with stockwater features within map area 6.

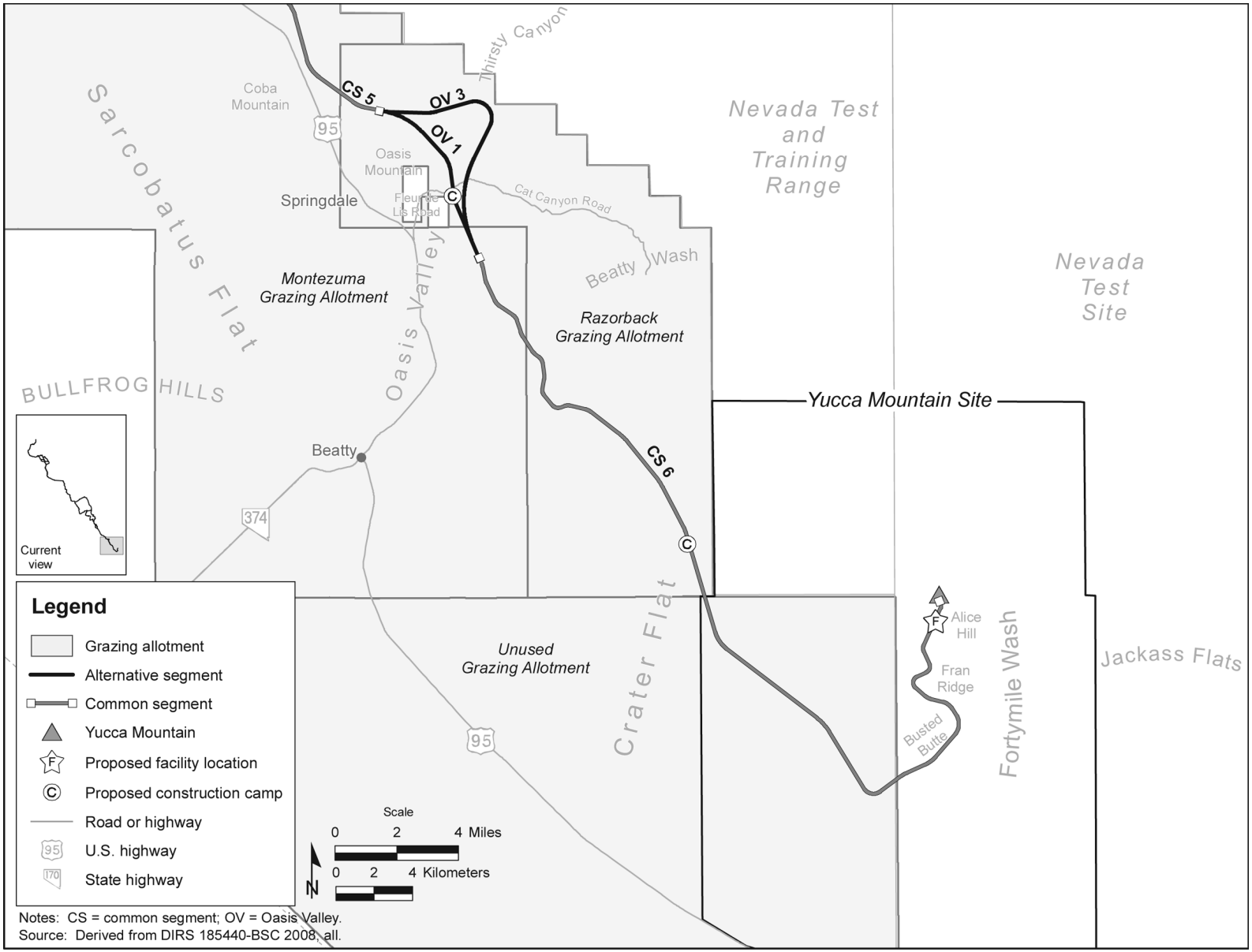
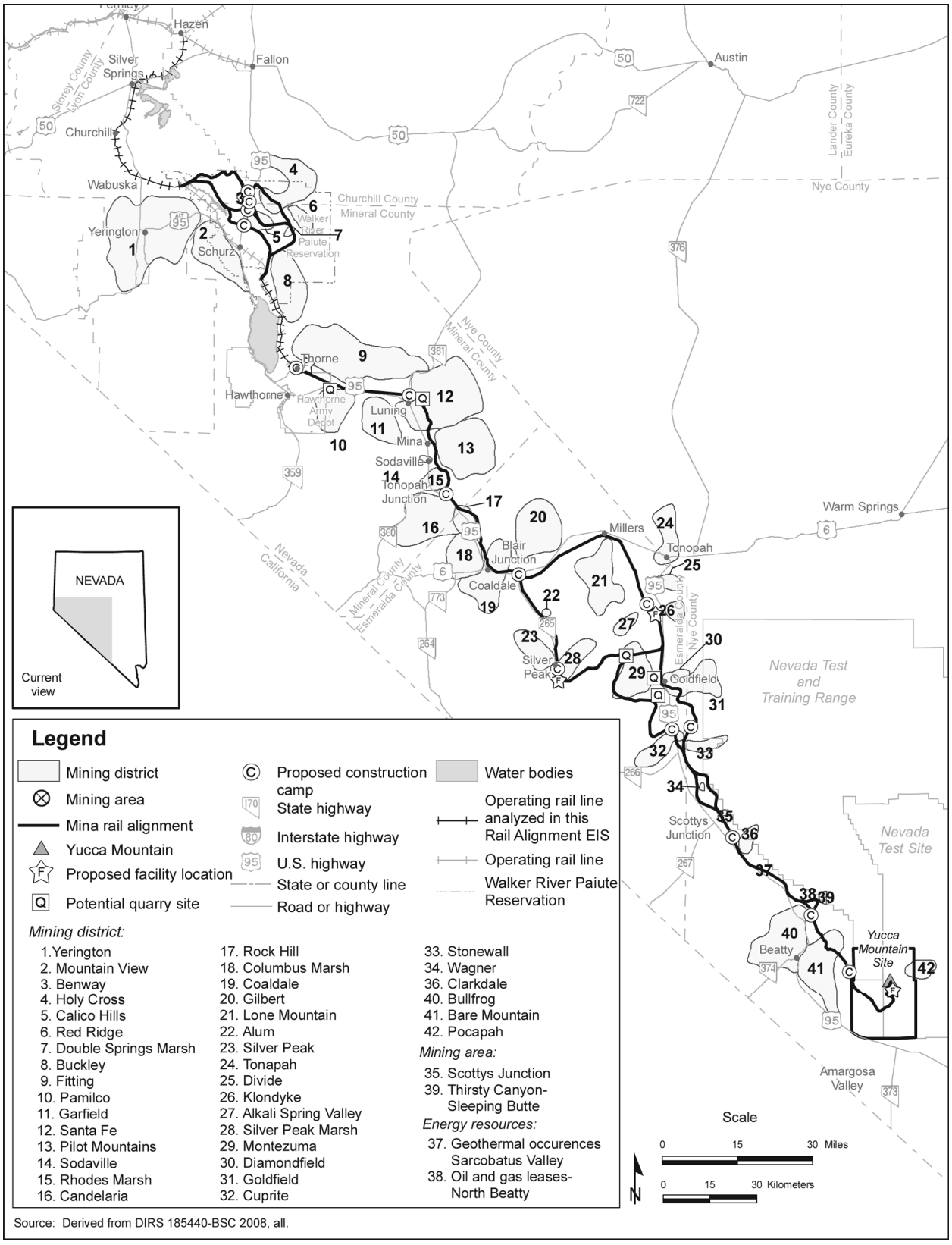


Figure 3-151. Grazing allotments with stockwater features within map area 7.



Source: Derived from DIRS 185440-BSC 2008, all.

Figure 3-152. Mineral and energy resources along the Mina rail alignment.

Table 3-84. Grazing allotment lands within the Mina rail alignment construction right-of-way (page 1 of 2).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (miles)[a]	Area that would be within the construction right-of-way or disturbed (acres)[b]
Union Pacific Railroad Hazen Branchline[c]	Not applicable		
Department of Defense Branchline North[d]	Not applicable		
Schurz alternative segment 1[e]	Parker Butte	1.1	130
Schurz alternative segment 4	Parker Butte	1.1	130
Schurz alternative segment 5	Parker Butte	1.1	130
Schurz alternative segment 5	Desert Mountain	1.9	360
Schurz alternative segment 6	Parker Butte	1.1	130
Schurz alternative segment 6	Desert Mountain	1.9	360
Department of Defense Branchline South[d]	Not applicable		
Staging Yard at Hawthorne	Gillis Mountain	f	63
Mina common segment 1	Pilot-Table Mountain	39	4,570
Mina common segment 1	Gillis Mountain	0.2	9.2
Mina common segment 1	Bellville	2.1	220
Mina common segment 1	Monte Cristo	8.5	1,570
Mina common segment 1	Columbus Salt Marsh	9.7	1,070
Potential Garfield Hills quarry	Garfield Flat	f	320
Potential Gabbs Range quarry	Pilot-Table Mountain	f	240
Montezuma alternative segment 1	Columbus Salt Marsh	2.4	290
Montezuma alternative segment 1	Silver Peak	18	2,000
Montezuma alternative segment 1	Sheep Mountain	3.8	460
Montezuma alternative segment 1	Yellow Hills	10	1,190
Montezuma alternative segment 1	Montezuma	31	3,740
Montezuma alternative segment 1	Magruder Mountain	7.1	860
Potential North Clayton quarry	Montezuma	f	440
Potential Malpais Mesa quarry	Montezuma	f	650
Potential Goldfield ES-7 quarry	Montezuma	f	290
Montezuma alternative segment 2	Columbus Salt Marsh	4.9	530
Montezuma alternative segment 2	Monte Cristo	21	2,570
Montezuma alternative segment 2	Montezuma	48	5,320
Montezuma alternative segment 3	Columbus Salt Marsh	4.9	530

Table 3-84. Grazing allotment lands within the Mina rail alignment construction right-of-way (page 2 of 2).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (miles)[a]	Area that would be within the construction right-of-way or disturbed (acres)[b]
Montezuma alternative segment 3	Monte Cristo	21	2,570
Montezuma alternative segment 3	Montezuma	54	6,500
Montezuma alternative segment 3	Magruder Mountain	7.1	860
Mina common segment 2	Montezuma	2.1	260
Bonnie Claire alternative segment 2	Montezuma	3.5	420
Bonnie Claire alternative segment 3	Montezuma	9.6	1,160
Common segment 5	Montezuma	17	1,960
Common segment 5	Razorback	1.5	180
Common segment 5	Magruder Mountain	0.2	60
Oasis Valley alternative segment 1	Razorback	4.9	590
Oasis Valley alternative segments 1 and 3	Montezuma	1.1	130
Oasis Valley alternative segment 3	Razorback	7.7	940
Common segment 6	Razorback	11	1,320
Common segment 6	Montezuma	3.3	390
Common segment 6	Unused	9.6	1,160

a. To convert miles to kilometers, multiply by 1.6093.
b. To convert acres to square kilometers, multiply by 0.0040469.
c. Use of the Union Pacific Railroad Hazen Branchline would not require new construction.
d. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore, DOE did not analyze these portions of the rail alignment. No other new construction would be required.
e. The Walker Paiute Reservation does not have BLM-administered grazing allotments.
f. Facility would not cross allotment; it would occupy the area listed in the next column.

Table 3-85. Features of grazing allotments within the Mina rail alignment region of influence (page 1 of 2).

Grazing allotment	Area (acres)[a]	Animal unit months	Stockwater features that would be within the construction right-of-way
Parker Butte[b]	30,100	1,669	None
Desert Mountain[c]	22,400	840	None
Gillis Mountain[d]	160,300	1,924	None
Garfield Flat[e]	218,800	3,516	None
Pilot-Table Mountain[f]	512,400	7,900	Mina common segment 1 would cross one pipeline.
Bellville[g]	154,500	303	None
Columbus Salt Marsh[h]	48,900	NA[i]	None
Monte Cristo[h]	469,000	9,352	Two stockwater wells along Montezuma alternative segments 2 and 3.

Table 3-85. Features of grazing allotments within the Mina rail alignment region of influence (page 2 of 2).

Grazing allotment	Area (acres)[a]	Animal unit months	Stockwater features that would be within the construction right-of-way
Silver Peak[j]	352,600	436	None
Sheep Mountain[k]	88,400	1,740	None
Yellow Hills[l]	62,200	1,212	None
Magruder Mountain[m]	660,200	6,300	None
Montezuma[n]	539,300	NA	Montezuma alternative segment 1 would cross one pipeline; Montezuma 2 would cross seven; Montezuma 3 would cross two.
Razorback[n]	72,900	959	None
Unused[n]	526,500	NA	None

a. To convert acres to square kilometers, multiply by 0.0040469.
b. Source: DIRS 181020-BLM 2007, all.
c. Source: DIRS 181023-BLM 2007, all.
d. Source: DIRS 180699-BLM 2007, all.
e. Source: DIRS 181024-BLM 2007, all.
f. Source: DIRS 181025-BLM 2007, all.
g. Source: DIRS 181026-BLM 2007, all.
h. Source: DIRS 182338-Metscher 2007, all.
i. Allotment is inactive; NA = not applicable.
j. Source: DIRS 181027-BLM 2007, all.
k. Source: DIRS 181152-BLM 2007, all.
l. Source: DIRS 181029-BLM 2007, all.
m. Source: DIRS 181021-BLM 2007, all.
n. Source: DIRS 173224-BLM 1997, Appendix A (area of allotment might include private land).

Figures 3-153 through 3-159 show the locations of sections with unpatented mining claims in relation to the construction right-of-way.

The Mina rail alignment would cross some ***mining areas*** and mining districts, as discussed below.

The Schurz alternative segment 1 construction right-of-way would pass through the very southern portion of the Calico Hills Mining District. Schurz alternative segment 4 would pass through the Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 5 would pass through the Benway, Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 6 would pass through the Holy Cross, Double Springs Marsh, and Buckley Mining Districts (see Table 3-86).

Table 3-86. Mining districts the Schurz alternative segments would cross.

Mining district	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Calico Hills	X	X	X	
Double Springs Marsh		X	X	X
Buckley		X	X	X
Benway			X	
Holy Cross				X