U.S. Department of Agriculture
Forest Service
Grand Mesa, Uncompahgre and Gunnison National Forests
Grand Valley Ranger District
Mesa County, Colorado

HIGHTOWER MASTER DEVELOPMENT PLAN ENVIRONMENTAL ASSESSMENT

Sections 8-9, 16-17 and 20 -21, Township 9 South, Range 92 West, 6th P.M., Mesa County, Colorado, Federal Oil and Gas Lease COC-68792

March 2008

Hightower Area

For Information Contact: Niccole Mortenson (nmortenson@fs.fed.us, 970-874-6616) or Liz Mauch (lmauch@fs.fed.us, 970-242-8211)

TABLE OF CONTENTS

APPENDICES

Appendix A – Response To Comments

Appendix B – List of Chemicals Used

ACRONYMS AND ABBREVIATIONS

% ..... percent
AADT ..... annual average daily traffic
AASHTO ..... American Association of State Highway and Transportation Officials
ac ..... acre(s)
ANC ..... acid neutralizing capacity
APDs ..... Applications for Permits to Drill
AQRV ..... air quality related values
ATVs ..... all terrain vehicle
avg ..... average
AUMs ..... Animal Unit Months
bbl ..... barrel
BLM ..... Bureau of Land Management
BMPs ..... Best Management Practices
BOR ..... Bureau of Reclamation
CAA ..... Clean Air Act
CAAQS ..... Colorado Ambient Air Quality Standard
CDOT ..... Colorado Department of Transportation
CDOW ..... Colorado Division of Wildlife
CDPHE ..... Colorado Department of Public Health and Environment
CEQ ..... Council on Environmental Quality
cfs ..... cubit feet per second
CEAA ..... Cumulative Effects Assessment Area
COAs ..... Conditions of Approval
ACOE ..... U.S. Army Corps of Engineers
COGCC ..... Colorado Oil and Gas Conservation Commission
CR ..... County Road
DAU ..... Data Analysis Unit
DOW ..... Colorado Division of Wildlife
EA ..... Environmental Assessment
EIS ..... Environmental Impact Statement
EMS ..... Environmental Management System
ESAL ..... Equivalent Single Axle Load
EO ..... Executive Order
FLPMA ..... Federal Land Policy and Management Act
FS ..... Forest Service
FSH ..... Forest Service Handbook
NFSR ..... National Forest System Road
ft ..... feet (foot)
GMU ..... game management unit
GMUG ..... Grand Mesa, Uncompahgre, and Gunnison National Forests
gpm ..... gallons per minute
GVRD ..... Grand Valley Ranger District
HEI ..... habitat effectiveness index
HGP2 ..... Hells Gulch Phase Two Project

Hightower MDP.....Hightower Master Development Plan
hp.....horse power
HT ..... Hightower
IDT.....Interdisciplinary Team
IRA.....Inventoried Roadless Area
HUC .....Hydrologic Unit Code
IMPROVE..... Interagency Monitoring of Protected Visual Environments
Laramie Energy..... Laramie Energy LLC
LRMP.....Land and Resource Management Plan
max..... maximum
MDP.....Master Development Plan
mil .....millimeter
MIS .....Management Indicator Species
MIS/TESS..... Management Indicator Species/Threatened, Endangered or Sensitive Species
MLA..... Mineral Leasing Act of 1920
MSUPO.....Master Surface Use Plan of Operations
NAAQS.....National Ambient Air Quality Standards
NAGPRA .....Native American Graves Protection and Repatriation Act
NEPA .....National Environmental Policy Act
NFS .....National Forest System
NFSR..... National Forest System Road
NPS ..... National Park Service
NRCS ..... National Resource Conservation Survey
NSO..... No Surface Occupancy
NVUM .....National Visitor Use Monitoring
OHV ..... off-highway vehicle
PBO.....Programmatic Biological Opinion
PSD .....Prevention of Significant Deterioration
PXP……...……Plains Exploration & Production Company
RMP .....Resource Management Plan
RN..... Roaded Natural
ROS..... Recreational Opportunity Spectrum
ROW ..... right-of-way
SMS.....Scenery Management System
SOPA ..... Schedule of Proposed Actions
SP ..... Sunlight to Powderhorn
SPCC..... Spill Prevention Control and Countermeasure Plan
SPM..... Semi-Primitive Motorized
SPNM..... Semi-Primitive Non-Motorized
SUA..... Special Use Authorization
SUPO .....Surface Use Plan of Operation
SVR.....Standard Visual Range
SWMP.....Storm Water Management Plan
TESS .....Threatened, Endangered, or Sensitive Species
TSD..... Technical Support Document

USDA.....U.S. Department of Agriculture
USGS ..... U.S. Geological Survey
VQOs .....Visual Quality Objectives
WEM.....Waivers, Exceptions, Modifications
WIZ ..... Water Influence Zone
WRNF .....White River National Forest

EXECUTIVE SUMMARY

The Forest Service (FS) has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental effects that would result from the Proposed Action and alternatives.

Alternatives Considered

The Forest Service evaluated the following alternatives:

- Alternative 1 – No Action (as required by NEPA)
- Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipeline and a Compressor Facility
- Alternative 3 – All Buried Pipeline – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipeline, including produced water lines. A compressor and tank battery site is included (central facility).

Environmental Effects

The Proposed Action will disturb approximately 55 acres in the short term during drilling location construction and pipeline installation. Alternative 3 will disturb approximately 85.5 acres in the short term. Following interim reclamation, long term disturbances are reduced to 12.5 acres for the Proposed Action and 14.8 acres for Alternative 3. Although the soil and vegetation effects are greater under Alternative 3, the long term visual effects will be reduced by burying the pipeline. Both action alternatives will have near field visual effects from the compressor stations and drill pad 20-6. Alternative 3 has less traffic during the production phase on National Forest System Roads than the Proposed Action, since the produced water will be transported via pipeline to the central facility near the forest boundary, versus trucking water from each drilling location under the Proposed Action.

Winter drilling operations under Alternatives 2 and 3 require snow removal on two NFSRs to access all five drilling locations. During the production phase water disposal during the winter will require snow removal in order to access facilities. Alternative 2 requires snowplowing to the five drilling locations (4.7 miles) while Alternative 3 requires snowplowing (0.5 miles) to the central facility.

Project Design Criteria

Project Design Criteria provide key environmental protections are included as part of the Proposed Action and Alternative 3. These Design Criteria were identified by the Forest Service and BLM to avoid or minimize environmental effects to specific resources. They include elements of the project design, lease stipulations, land management plan requirements, best management practices, statutory or regulatory requirements, and others. These measures are expected to eliminate or reduce effects associated with aspects of the project.

CHAPTER 1 PURPOSE AND NEED

1.0 DOCUMENT STRUCTURE

The Forest Service (FS) has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This EA discloses the direct, indirect, and cumulative environmental effects that would result from the Proposed Action and alternatives. The document is organized into five chapters:

- *Purpose and Need:* The section includes information on the background behind the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the FS informed the public of the proposal and how the public responded.
- *Comparison of Alternatives* I*ncluding the Proposed Action*: This section includes discussion of issues associated with the Proposed Action. It also provides a more detailed description of the Proposed Action, as well as alternative methods for achieving the stated purpose. These alternatives were developed based on key issues raised by the public and other agencies. This section also identifies possible mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.
- *Affected Environment and Environmental Consequences:* This section describes the environmental effects of implementing the Proposed Action and alternatives to the Proposed Action.
  Within each section, the affected environment is described first, followed by the effects of the No Action Alternative that provides a baseline for evaluation and comparison of the other alternatives that follow.
- *Agencies and Persons Consulted:* This section provides a list of preparers and agencies consulted during the development of the EA.
- *Appendices:* The appendices provide more detailed information to support the analyses presented in the EA.

Additional documentation, including more detailed analyses of project-area resources, can be found in the project planning record located at the Grand Valley Ranger District (GVRD) Office in Grand Junction, Colorado.

1.1 Background

Plains Exploration & Production Company (PXP) forwarded a proposal (initiated originally by Laramie Energy, LLC) to the Grand Mesa, Uncompahgre and Gunnison National Forests (GMUG) to begin natural gas exploration and potential production operations on its Federal Oil and Gas Lease (COC-68792) on the Grand Valley Ranger District (GVRD) of the GMUG, in Mesa County, Colorado.

The Hightower Master Development Plan (Hightower MDP) includes a Master Surface Use Plan of Operations (MSUPO) and Master Drilling Plan (DP) that incorporates access needs, exploration drilling, testing and construction of wellhead production facilities, a gas gathering system and compression facilities. The MSUPO details the associated design, construction, and operational

criteria for the proposed drilling activities. The DP brings forward the expected downhole design of gas wells in the lease.

Under the Mineral Leasing Act of 1920, as amended by the Federal Onshore Oil and Gas Leasing Reform Act of 1987, the FS has the authority and responsibility for regulating surface-disturbing activities pursuant to any federal oil and gas lease underlying National Forest System (NFS) Lands. The FS must approve Surface Use Plans of Operations (SUPOs) for all wells on federal mineral leases underlying FS-administered surface (36 CFR 228.107) before the Bureau of Land Management (BLM) can approve Applications for Permit to Drill (APD). This EA documents the environmental analysis and information necessary for the Authorized FS Officer to make an informed decision on authorizing the Operator to conduct oil and gas operations on NFS lands.

The BLM is participating in the analysis per the terms of the Memorandum of Understanding between the BLM and FS dated April 2006.

This EA also provides information for BLM to use when evaluating site-specific APDs in the future.

1.2 Project Location

Drilling locations, access roads, and a majority of the gas gathering system would occur in Sections 20 and 21, Township 9 South, Range 92 West, 6th P.M., Mesa County, Colorado on Federal oil and gas lease COC-68792. Additional gas gathering and transmission pipelines, and compression facilities are proposed in Sections 8 and 17, Township 9 South, Range. 92 West, 6th P.M. The general location is displayed in Figure 1.2. All of the activities proposed under Alternatives 2 (Proposed Action) and Alternative 3 are shown in Figures 2.3 and Figure 2.4, respectively.

1.3 Proposed Action in Brief

The GMUG proposes to authorize the oil and gas operator to conduct the surface operations proposed in the Hightower MDP and MSUPO. This authorization would allow the operator to access, drill, test, and complete up to thirty-two (32) wells on five (5) drilling locations, which are referred to as the HT 20-6, HT 20-11, HT 21-2, HT 21-10 and HT 21-12. If initial exploration wells find gas in paying quantities, the MDP anticipates installation of production facilities and a down hole well spacing of 40 acres. The MDP incorporates directional drilling operations. The authorization would also allow the operator to access, install, and operate a gas gathering system and compression facilities to transport produced gas from the wellheads to the Hells Gulch to Buzzard Creek Interconnect natural gas pipeline north of the project area.

Operations would include the following performed by the Operator:

- Clearing and leveling five (5), approximately five and one half (5 ½) acre multiple well drilling locations.
- Rerouting approximately 300 feet of existing road NFSR 266 to accommodate proposed drill location 20-6 and to provide a safer intersection of the access road with NFSR 266.
- Constructing, gravelling and maintaining approximately 1.1 mile of administrative access roads to the drilling locations (closed to the public).
- Surfacing or upgrading to needed structural capacity approximately 7 miles of NFSRs 265, 266 and 270.
- Constructing, operating and maintaining one (1) fenced and gated compressor site approximately 3.7 acres in size to hold two (2) 1500 hp compressors, up to three (3) 300 barrel storage tanks, and one (1) dehydrator unit.
- Constructing approximately 4.3 miles of a combination of 8-inch to 12-inch diameter buried and surface pipeline as follows: 2.0 miles of surface gas gathering line, approximately 2.3 mile buried gathering line.

- Moving in and rigging up of drilling equipment, followed by a completion rig, and subsequent removal of this equipment. Each well would be drilled in approximately 15 to 20 days and completed in about 14 days. It is estimated that the time required to drill and complete each well would be approximately 35 days. The exact dates of construction and drilling would be determined by multiple factors, including project approval by the FS, APD approval by the BLM, weather conditions, and resource and site specific conditions (e.g., biological conditions such as nesting raptors).
- Testing wells for production capability, and if producible quantities of gas are found:
    - Installing wellhead production equipment to include: one (1) wellhead and production meter per well; two (2) 2-phase separators per drilling location; up to five
    - (5) 400-bbl (barrel unit) produced water/condensate storage tanks per drilling location; and remote telemetry equipment.
    - Completing each well for production, including casing and cementing each well per BLM and State requirements.
- Performing interim reclamation on as much of each drilling location as possible once completion operations have ceased.
- Long-term operation and maintenance of the production facilities if producible quantities of gas are found.
- Conducting final reclamation operations.

The Proposed Action includes authorizing year-round drilling operations, beginning in the summer of 2008. It also includes considering granting an exception to the No Surface Occupancy (NSO) lease stipulation for Riparian/Wetland/Floodplain protection for the following locations:

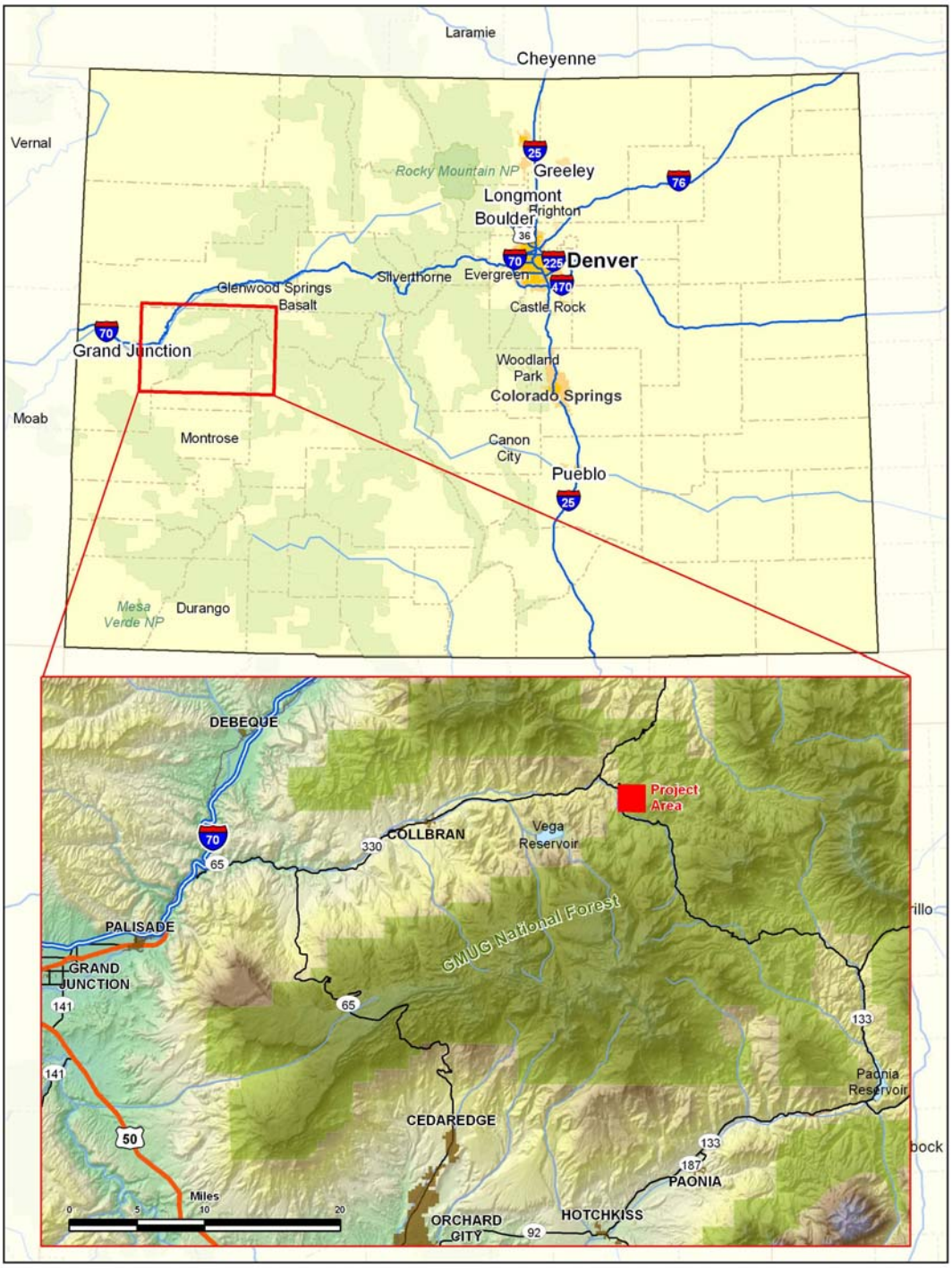
- 21-12 to 20-11 gathering line
- 20-6 to lease boundary gathering line
- 21-2 access road

It also includes granting an exception to the No Surface Occupancy (NSO) lease stipulation for High Geologic Hazard areas for a portion of the 21-12 to 20-11 gathering pipeline.

Specific details of the proposed action are provided in Chapter 2.

Drilling, completion, production, and reclamation procedures and equipment are described in detail in Alternative 2, The Proposed Action (Chapter 2). Drilling and completion operations are expected in the project area for approximately 2 years. The entire project could be completed in approximately 16 months after all roads, gathering lines and drilling locations are constructed, barring unforeseen events and issues (PXP 2006). If producible, the average life of each well is expected to be 20 to 30 plus years. If exploration activities do not find producible quantities of gas, or when the natural gas reservoir is depleted and wells are no longer capable of producing in economic quantities, each well would be plugged and abandoned under applicable BLM and State abandonment procedures. The Operator would reclaim drilling locations and decommission roads consistent with a reclamation plan approved by the FS. The reclamation plan associated with the Proposed Action is described in more detail under Alternative 2, The Proposed Action (Chapter 2).

Figure 1.2 General Location of the Hightower MDP



1.4 Purpose of and Need for Action

The GMUG has identified a need to authorize an oil and gas operator to use National Forest System (NFS) lands, subject to terms and conditions of Federal Oil and Gas Lease COC-68792 for operations associated with exploring for and developing natural gas, and to construct, operate and maintain a pipeline and compression facility subject to terms and conditions of a FS Special Use Authorization. Operations would occur in the Hightower area of the Grand Mesa National Forest. The GMUG Responsible Official's decision will be based on this environmental analysis of the Hightower MDP Proposed Action and alternatives.

The Grand Junction Field Office of the Bureau of Land Management (BLM) has identified a need to participate in this analysis to facilitate approval of site-specific APDs when and if they are received (43 CFR 3160).

The purpose of the agencies actions is to facilitate production of energy resources, and allow the operator to exercise lease rights and perform operations that allow exploration, production and transmission of federal natural gas resources.

This project would contribute to meeting the need for energy resources developed and produced in an environmentally sound manner. The project responds to the goals and objectives outlined in the *Amended Land and Resource Management Plan Grand Mesa, Uncompahgre and Gunnison National Forests* (1991) (GMUG LRMP), *Final Oil and Gas Leasing Environmental Impact Statement Grand Mesa, Uncompahgre and Gunnison National Forests* (1993) (Oil and Gas Leasing EIS) and *Grand Junction Resource Area Resource Management Plan and Record of Decision* (1987) (BLM RMP). By providing for oil and gas leasing and development in this area, the GMUG LRMP and BLM RMP acknowledged that the area could at some future time support facilities necessary for production of natural gas. The GMUG LRMP also identified the use of design features and standard mitigations (Conditions of Approval) necessary for additional resource protection as identified in this analysis. The BLM RMP supports oil and gas leasing and development in the area with respect to management of mineral resources and administration of drilling, production, and downhole operations associated with oil and gas exploration and development.

Lands disturbed as part of the project would be reclaimed to its planned use as the desired future condition of the area. The proposed action is designed to be consistent with moving the area towards that desired condition.

1.5 Authorizing Actions

The exploration and development of federal oil and gas resources are under the authority of the Mineral Leasing Act of 1920 (MLA), as amended, the Mining and Minerals Policy Act of 1970, National Environmental Policy Act of 1969, Federal Onshore Oil and Gas Leasing Reform Act of 1987, as revised, and the Energy Policy Act of 2005. Regulations governing oil and gas operations on NFS lands are cited in 36 CFR Part 228 § E. These regulations promote cooperation between the Forest Service, BLM, industry and the public. Executive Order (EO) 13212 (May 18, 2001) provides for expeditious review of permits and other actions to increase the supply of natural gas while maintaining safety, public health, and environmental protections. The proposed actions would conform to the overall guidance of the GMUG LRMP and the GMUG Oil and Gas Leasing EIS. Regulations related to Forest Service consideration of requests to modify, waive or grant exceptions to lease stipulations are cited in 36 CFR 228.104. The BLM and the FS oversee oil and gas activities according to the On-Shore Orders brought forward in the BLM regulations and adopted by the FS. On Shore Order No. 1 describes the roles and responsibilities of each agency and oil/gas operators when reviewing and approving proposals to conduct lease operations. On Shore Order No. 1 was revised in 2007, and brought forth revisions to required information in APDs, among other changes.

The revised On Shore Order No. 1 also included provisions for using and approving multiple well projects with Master Development Plans. This project will follow the provisions brought forth in On Shore Order No. 1 as implemented starting May 2007. Drilling of federal minerals is also subject to BLM's Onshore Oil and Gas Orders (43 CFR 3164) pertaining to diligent development and efficient recovery, compliance with federal, state and local laws, protection of the environment, site security, gas measurement, and disposal of produced water.

Management of federal minerals also follows the Mining and Mineral Policy Act of 1970, which states in part that it is the "continuing policy of the federal government in the national interest to foster and encourage private enterprise in the development of economically sound and stable domestic mining minerals and mineral reclamation industries, … (and) the orderly and economic development of domestic mineral resources…", and the Federal Land Policy and Management Act (FLPMA) which states that NFS and Public lands are to be managed in a manner that recognizes the need for domestic sources of minerals. Under regulations of the Mining and Mineral Policy Act of 1970 and the Federal Land Policy Management Act of 1976, the responsible federal agencies must ensure the following:

1) Adverse environmental effects on public land surface resources are minimized to the extent practical;
2) Measures must be included to provide for reclamation, where practicable; and,
3) The proposed operation will comply with other federal and state laws and regulations.

This NEPA analysis considers the potential environmental effects associated with surface development.

Forest Service Manual 2800, Zero Code, directs the Forest Service to:

1) Encourage and facilitate the orderly exploration, development, and production of mineral and energy resources within the NFS in order to maintain a viable, healthy minerals industry and to promote self-sufficiency in those mineral and energy resources necessary for economic growth and national defense;
2) Ensure that exploration, development and production of mineral resources are conducted in an environmentally sound manner and that these activities are considered fully in the planning and management of other NFS resources; and,
3) Ensure that lands disturbed by mineral and energy activities are reclaimed for other productive uses.

The Forest Service considers mineral exploration and development to be a part of its management program (GMUG Amended LRMP, Page II-61). It cooperates with the Department of Interior through its agent, the BLM, in administering lawful development of leaseable minerals. While the Forest Service is mainly involved with surface resource management, the agency recognizes that mineral development is ordinarily in the public interest and can be compatible with the purposes for which the NFS lands are managed.

The Energy Policy Act of 2005 contains direction for approving oil and gas operations, and timely processing of applications, along with direction for lease stipulations. This project is being handled consistent with this Act.

Executive Order (EO) 13212 (May 18, 2001) provides for expeditious review of permits and other actions to increase the supply of natural gas while maintaining safety, public health and environmental protections. This project is being handled according to the provisions of this Order.

Applicable Special Uses authorities and regulations:

The Organic Administration Act of June 4, 1897 gives the Secretary of Agriculture authority to authorize the use of NFS lands.

The Act of November 16, 1973 amends Section 28 of the 1920 Mineral Leasing Act, authorizing the FS to issue authorizations to non-federal entities for oil and gas pipeline rights-of-way and related facilities located wholly on NFS land. The designation includes only pipelines and directly related facilities for the transportation of oil, natural gas, synthetic liquid orgaseous fuel, and any refined product produced there from.

Title V of the Federal Land Policy Management Act (FLPMA) gives authority to issue permits….to occupy, use or traverse NFS lands.

36 CFR Part 251, Subpart B provides direction for special uses management on NFS lands.

1.6 Forest Plan Consistency

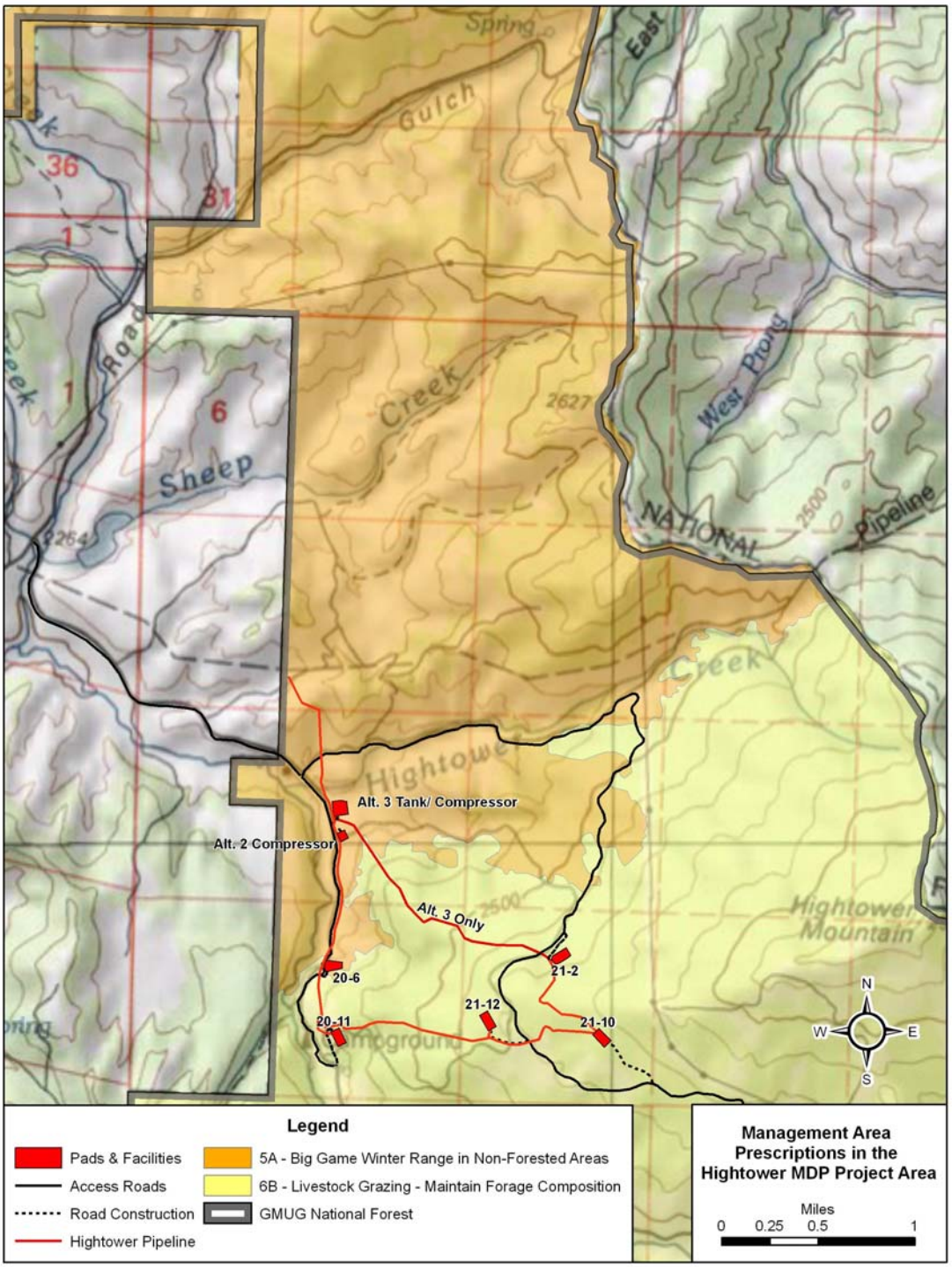
The GMUG LRMP (1991), as amended by the GMUG Oil and Gas Leasing EIS and ROD (1993), and the BLM RMP (January 1987) made provisions for oil and gas leasing.

The proposed actions would conform to the overall guidance of the GMUG LRMP and the GMUG Oil and Gas Leasing EIS.

The LRMP guides natural resource management activities and establishes management standards and guidelines for the GMUG. The following management area prescriptions are designated for the Hightower MDP project area (see Figure 1.6):

- 5A – Big Game Winter Areas in Non-Forest Areas: Emphasis is on forage and cover for big game animals during winter. Semi-primitive non-motorized, semi-primitive motorized and roaded natural recreation opportunities are provided. Motorized recreation is managed to prevent unacceptable stress on big game animals. Vegetation is managed to enhance diversity. Livestock grazing is compatible.
- 6B – Emphasis on management for livestock grazing. Range condition is maintained through use of forage improvement practices, livestock management, and regulation of other resource activities.
- 9A – Emphasis is on riparian area management, including the aquatic ecosystem, the riparian ecosystem and adjacent ecosystems within 100 feet of perennial streams and shores of still waterbodies managed as an integrated riparian area. Goals are to provide healthy, self-perpetuating plant communities, meet water quality standards, provide habitat for viable populations of wildlife and fish, and provide stable stream channels and still waterbody shorelines. Note that this management unit is not specifically mapped, however it applies to all lands where the resource occurs, therefore it is not shown in Figure 1.6

Figure 1.6. Management Prescriptions in the Hightower Project Area



1.7 Decision Framework

The GMUG Forest Supervisor is the NEPA Responsible Official for the Forest Service. The decision is the approval, with appropriate protections for surface resources (Conditions of Approval), of the activities proposed in the Hightower MDP and MSUPO, including necessary access and related gas gathering and compression facilities. Specific components of the decision include:

- The decision includes whether or not to grant an exception to a lease stipulations for NSO Wetland/Floodplain/Riparian area protection to the three locations described in Section 2.2.17.
- The decision includes whether or not to grant an exception to lease stipulations for approximately 213 feet of pipeline for NSO high geologic hazard areas.
- The decision includes whether or not to issue a minor GMUG LRMP amendment for visual resources to change the designation of the 20-6 drilling location and compressor site location from partial retention to modification due to the anticipated duration of project operation phase activities.
- Authorizing use of NFS lands for compression facilities and a gas transportation pipeline under a special use authorization.

Subsequent processing of site-specific Applications for Permit to Drill (APD) and related authorizations (i.e., road use permit, etc.) would constitute implementation of the decision so long as they are within the scope and framework of the approved MDP and MSUPO.

Because the Hightower MDP is primarily a surface use plan submitted to the FS, the BLM does not have any actual decisions to make at this time. However, the BLM Grand Junction Field Office Manager has the responsibility to review the master drilling plan (DP); and because of this responsibility, BLM geologists and petroleum engineers have reviewed the MDP for this project and provided input for this analysis. The purpose of BLM's involvement at this level is to identify typical downhole concerns and appropriate actions for the general area. As individual applications for permit to drill (APDs) are submitted during the course of project implementation, the FS would be responsible for ensuring the site-specific surface use plan of operations meet the design criteria and conditions of approval identified for the MSUPO for the Hightower MDP. The FS would then provide BLM with a list of Conditions Of Approval for a particular location. The BLM has the final approval authority for individual APD's including the downhole (or technical engineering) portion.

Federal oil and gas leases grant exclusive rights for the lessee to explore for and produce the oil and gas resources on the lease. Because of that, even if all or certain individual drill locations are not approved at this time, the proponent could still apply in the future to drill at those locations by submitting individual APDs. Additional NEPA analysis would be required before any activities could take place at those locations. Additional NEPA analysis will also be required for any actions, including any additional drilling locations, access routes or pipelines locations, which are outside the scope of the Proposed Action or alternatives addressed in this EA.

1.8 Public Involvement

The Council on Environmental Quality (CEQ) regulations require an "early and open process for determining the scope of issues to be addressed and for identifying significant issues related to a Proposed Action" (40 CFR 1501.7). In order to satisfy this CEQ requirement, the Responsible Official selected an Interdisciplinary Team (IDT) and charged that team to request input from the public to determine their concerns and issues with the proposal, develop alternatives to the proposal that respond to those issues, analyze the environmental effects of the proposed project, and prepare

the environmental document. The IDT reviewed existing information about the Hightower MDP and actions similar to the proposal.

The project has been, and is listed on the GMUG Schedule of Proposed Actions (SOPA). The public "scoping" and official comment period notice addressing the Proposed Action was published in the Grand Junction Daily Sentinel on February 6, 2007. Project information was directly mailed to approximately 45 local, state and federal agencies, tribal governments, adjacent landowners, organizations, and other parties interested in proposed activities on the GMUG.

Sixteen comment letters from private individuals; organizations; local, state and federal government agencies; and environmental groups were received in response to the scoping notice/official comment period. Responses to these comments can be found in Appendix A of this document.

The Grand Valley Ranger District hosted a field trip to the project area in June, 2007 to discuss the project. Field trip was attended by company representatives, Colorado Division of Wildlife, Wilderness Workshop, Western Slope Environmental Resource Council, and Western Colorado Congress.

Project information including opportunities to comment, has been posted at an information board located in the project area since the fall of 2006. Brochures were distributed during the 2006 and 2007 big game hunting seasons to hunters in the project area and made available in the Collbran and Grand Junction offices. Information was also published in the DOW's 2007 Big Game Hunting Statistics booklet.

1.9 Issues

Using the comments from the public and other agencies, the IDT developed a list of issues and concerns to address. The FS separated the issues into two groups: key and non-key issues.

Key issues were defined as those that drive an alternative to the proposed action, or drive the need for specific design criteria.

The key and non-key issues are discussed below in Sections 1.9.1 and 1.9.2.

1.9.1 Key Issues

The FS identified issues raised during internal and external scoping (see Section 1.8) and described in Table 1.9.1 that resulted in additional alternatives or project design being developed.

1.9.2 Non-Key Issues

Non-key issues that will not be analyzed are identified as those that are: 1) outside the scope of the Proposed Action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) already part of the project design or required analysis; 4) irrelevant to the decision to be made; or 5) conjectural and not supported by scientific or factual evidence. Appendix A lists the non-key issues that have not been brought forward for analysis, and the rationale for why they were not included in the analysis

Other non-key issues that area brought forward in the analysis are listed in Table 1.9.2.

Table 1.9.1 Key Issues

Resource	Key Issue	Where Addressed
Geology, Geologic Hazards, Minerals, Soils	Cut and fill operations will destabilize areas of mapped moderate geological hazards and slump-prone soils at the 20-6 drilling location and the 20-11 access road.	This issue drove the need for site-specific geotechnical analysis. See Design Criteria Table Section 2.2.15, Chapter 3 Sections 3.2 and 3.3
Transportation, Roads, Travel Management	Increased traffic volume due to construction, drilling, development and production activities could result in more vehicular accidents along NFSR 265 and 266, potentially damage 265 roadbed.	Alternative 3 was developed in response to these concerns. See Design Criteria Table Section 2.2.15, and effects on Transportation system in Section 3.12.
Wildlife	Year round access needed to haul produced water from each wellpad will disrupt wildlife.	Alternative 3 was developed in response to this concern. Effects to wildlife are analyzed in sections 38 and 3.9.

Table 1.9.2 Non-Key Issues Carried Forward in Analysis

Resource	Issue	Where Addressed
Geology, Geologic Hazards, Minerals, Soils	Disturbance of fine-textured soils in the Project area will create erosion control problems	Design Criteria Section 2.2.15, Sections 3.2 and 3.3.
Water Resources-Surface and Ground Water	Drilling locations HT 20-6 and HT 21-10, as well as the access to location HT 21-2, could encroach on Water Influence Zones (WIZs).	Design Criteria Section 2.2.15, Sections 3.4 and 3.5.
	Drilling and production activities could affect ground water quantity and quality.	Design Criteria Section 2.2.15, Section 3.4
	Construction operations could reduce surface water quality through sedimentation and spills.	Design Criteria Section 2.2.15, Section 3.4
Air Quality	Construction and traffic-related fugitive dust and vehicle emissions could reduce local air quality and air quality at nearby Class I areas.	Design Criteria Section 2.2.15, Section 3.1
Vegetation	Placement of the HT 21-2, HT 21-10 and HT 21-12 drilling locations results in type conversion from aspen to non-forest, removing approximately 17 acres from suitable timber base.	Design Criteria Section 2.2.15, Section 3.6

Resource	Issue	Where Addressed
Vegetation	Drilling locations HT 21-2 and HT 21-10, portions of access roads and pipelines are located in regenerating harvest units and would result in the loss of aspen regeneration thus decreasing age and structural diversity.	Design Criteria Section 2.2.15, Section 3.6
	Ground disturbing activities may result in the spread of noxious weeds, particularly knapweed	Design Criteria Section 2.2.15, Section 3.6
Range Resources	Livestock movement on and off allotment may be impeded by project activities	Design Criteria Section 2.2.15, Section 3.7
Wildlife	Increased human activity and vegetation disturbance may adversely affect wildlife species and their habitat	Design Criteria Section 2.2.1 addressed in Section 3.8.
	Noise from compressor may disrupt breeding cycles of birds	Design Criteria Section 2.2.15, Section 3.9
Special Status Species	Threatened, endangered or sensitive species (TES) and management indicator species (MIS) may be affected by project activities	Design Criteria Section 2.2.15. Required analysis. Sections 3.8 and 3.9
	Water use associated with well drilling and completion and dust suppression will cause water depletion to the Colorado River Basin and could affect the four endangered fish of the Colorado River	Section 3.8.
Cultural Resources	Project activities could encounter cultural or heritage resources.	Design Criteria Section 2.2.15, Section 3.10
Transportation	Project activities will result in increased traffic through the town of Collbran, along the Peninsula Road and in the project area.	FS has no jurisdiction over traffic in county or local municipalities. Proponent is responsible for obtaining any necessary permits or approvals from these entities. See also Section 3.12
	Pipeline corridor construction could promote illegal non-system travel.	Design Criteria Section 2.2.15, Section 3.11
Visual Resources	The compressor station and proposed pad HT 20-6 will change foreground views along NFSR 266.	Design Criteria Section 2.2.15, Section 3.13. Minor Forest Plan Amendment required
Noise	Noise resulting from project activities could have a negative effect on dispersed recreation.	Design Criteria Section 2.2.15, Section 3.11
Recreation	Big game hunters may experience reduced success in the project area due to wildlife disruptions from project activities.	Design Criteria Section 2.2.15, Section 3.11
	Winter project activity and snowplowing on NFSR 266 could create user conflicts with snowmobilers where use overlaps.	Design Criteria Section 2.2.15, Sections 3.11 and 3.12

CHAPTER 2 ALTERNATIVES IN DETAIL

2.0 Alternatives in Detail, including the Proposed Action

This chapter describes and compares the alternatives considered for the Hightower project. It includes a description and map of each alternative considered in detail. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker.

The general location of the project was described in Section 1 and shown in Figure 1.2. The No-Action Alternative is required by the NEPA process and described below as a basis for comparison. Alternatives 2 and 3 disturbances are essentially in the same location and differ in only a few key points. The primary differences on the ground are the gas gathering lines and pipeline routes, and the difference in size, function and location of the compressor versus central facility (See Figures 2.3 and 2.4).

Development of the Proposed Action The Hightower MDP Proposed Action was developed through a series of reviews and field visits involving FS interdisciplinary specialists including: a wildlife biologist; hydrologist; soil scientist; geologist; roads engineer; minerals specialists; and BLM and Colorado Division of Wildlife (CDOW) personnel. The Proposed Action was developed between June and December 2006.

The Proposed Action was developed to: a) be consistent with lease terms and conditions; b) incorporate Design Criteria and BMPs (Table 2.2.15); c) use existing roads to the maximum extent possible; d) place drilling locations and the compression facility where a minimum of cut and fill would be needed; e) have the least amount of surface disturbance; and f) have the minimum amount of effect to existing surface resources.

2.1 Alternative 1 – No Action

Consideration of the No-Action alternative is required by CEQ regulations (40 CFR 1502.14). Under the No Action Alternative the Hightower MDP and MSUPOs would not be approved as submitted. Selection of the No-Action alternative would not authorize occupancy or surface use of the federal oil and gas leases at this time. All activities and natural processes currently permitted or occurring would continue. No additional mitigation or monitoring would be required as part of this alternative other than meeting Forest Plan and LRMP directions, standards and guidelines. If the No-Action alternative was selected for all or parts of the Hightower MDP operations, then the proponent could reapply for drilling or placements of operations on the lease in the future to exercise their lease rights.

2.2 Activities Common to all Action Alternatives

A summary of operations proposed for all action alternatives includes the following performed by the Operator:

- Clearing and leveling five (5), approximately five and one half (5 ½) acre multiple well drilling locations.
- Rerouting approximately 300 feet of existing road NFSR 266 to minimize disturbance to hillside and unstable slopes and accommodate proposed drill location 20-6.
- Constructing, gravelling and maintaining approximately 1.1 mile of administrative access roads to the drilling locations (closed to the public).

- Surfacing or upgrading to needed structural capacity approximately 4 miles of NFSRs 265, 266 and 270.
- Constructing, operating and maintaining one compressor site (or central facility) as specified by alternative.
- Constructing a combination of 8-inch to 12-inch diameter buried or surface gathering pipeline as specified by alternative.[1]
- Constructing a sales (aka transmission) pipeline from the compressor site north to tie-in with the Hells Gulch-Buzzard Creek interconnect pipeline.
- Moving in and rigging up of drilling equipment, followed by a completion rig, and subsequent removal of this equipment which includes year-round drilling operations
- Testing wells for production capability, and if producible quantities of gas are found:
  - Installing wellhead production equipment.
  - Completing each well for production, including casing and cementing each well per BLM and State requirements.
- Performing interim reclamation on as much of each drilling location as possible once completion operations have ceased, and conducting final reclamation.
- Long-term operation and maintenance of the production facilities if producible quantities of gas are found.
- Harvest timber in two off site aspen regeneration clearcuts to replace regenerating aspen at the 21-2 and 21-10 pads.

The following sections describe in detail the various common components of all action alternatives including drill locations, access roads, ancillary facilities, drilling and completion activities, production activities, reclamation, and compression facilities. Locations of the drilling locations, access routes, and compression facilities are shown on Figure 2.3 for the Proposed Action and Figure 2.4 for Alternative 3.

The proposed activities were designed according to, and incorporate the Design Criteria shown in Table 2.2.15. These Design Criteria incorporate Best Management Practices (BMPs), in addition to Forest Plan Management Area standards and guidelines, and statutory and regulatory constraints. The Design Criteria function to avoid undesirable effects, and therefore, the need for mitigation, upon implementation of the project. Most of the Design Criteria were included in the proponent proposal, the Forest Service identified additional Design Criteria as noted in Table 2.2.15.

2.2.1 Drilling Locations

The Proposed Action and Alternative 3 include construction of five drilling locations. Each proposed drilling location will be constructed to create a three (3) acre temporary working surface to accommodate drilling equipment, piping, a truck/equipment turn-around location and would have an average of six (6) wells, most of which will be drilled using directional drilling techniques. The total disturbed area at each drilling location, including cut and fill slopes and soil stockpiles, will be approximately five and one half (5.5) acres. The proposed drilling location will be cleared of vegetation and leveled using cut-and-fill construction techniques. Specific information for each of the proposed drilling locations is given in Table 2.2.1.

[1] For the purposes of this analysis, the term "pipelines" will refer collectively to gas gathering lines between the drilling locations, and the sales line between the compression facility and the tie-in to an existing gas transportation line.

Each drilling location will have one (1) reserve pit (to catch drill cuttings and fluids and one (1) cuttings pit to permanently store dried drill cuttings constructed in cut material. Reserve pits and the 20-6 cuttings pit (slope stability concern) would be lined with impervious heavy plastic material (i.e., man-made synthetic) with heat treated seams and a minimum burst strength of 125 pounds/square inch. The liner would be chemically compatible with all substances that might be stored in the pit. Measures would be taken, as needed, to protect the integrity of the liner.

During drilling the pit will be fenced on three sides with 8 foot tall fencing to preclude moose entry; the fourth side will be fenced after drilling activities are finished. The fence will remain until the pit is reclaimed. If producible gas is found, more than half of each drilling location will be reclaimed following drilling and completion of all wells at each pad. If exploration does not find gas in paying quantities, the drill locations would be reclaimed in their entirety.

Topsoil and subsoil will be segregated and removed from each drilling location during construction and stockpiled along the edge of the pad for later use in reclamation. Bioengineered or other appropriate wildlife/livestock-friendly sediment and erosion control measures will be implemented, as appropriate, to minimize the loss of soil resources and to protect water quality. Construction of each drilling location would take approximately ten (10) to fourteen (14) days to complete and could occur during the spring, summer or fall.

Stormwater management procedures will be incorporated into the design and construction of each pad. Measures include appropriate sediment and erosion control measures and secondary containment around the perimeter of the working area of each drilling location.

Table 2.2.1 Drilling Locations

Drilling Location	Description
Hightower 20-6 Drilling Location (SE¼NW¼ Section 20, T9S, R92W, 6th P.M.)	This drilling location would support six (6) individual wells. The location is adjacent to a reclaimed drill site with a plugged and abandoned well. Due to the location of adjacent drainages on the north and south side of the old well site, the drilling location was relocated south of the old well site to prevent encroachment on the drainages. The majority of the vegetation is grasses, sagebrush and mountain shrub community.
Hightower 20-11 Drilling Location (NE¼SW¼ Section 20, T9S, R92W, 6th P.M.)	This drilling location would support six (6) individual wells. The location is on an ancient landslide feature that does not show signs of recent movement. The pad encroaches on one ephemeral drainage, and one drainage to the southeast which appears to be an old road with ruts that water now follows. A stormwater control ditch will divert water around and south and north sides of the pad. It is located in grasses, some sagebrush, and oakbrush.
Hightower 21-2 Pad Drilling Location (NW¼NE¼ Section 21, T9S, R92W, 6th P.M.)	This drilling location would support seven (7) individual wells. Access to the drilling location will be from a temporary timber sale road exiting NFSR 265. The pad is located in an aspen clearcut and the 1,050 feet access road will be constructed as a ditched and graveled road, capable of accommodating heavy truck traffic. The location is in an aspen clearcut created during the previous timber sale in 2003-2006. Aspen saplings are now approximately 4 to 8 feet tall. Vegetation surrounding the clearcut is mature aspen stands. Part of the Proposed Action includes handling the existing timber slash (chipping, etc) to use for reclamation purposes on the site.
Hightower 21-10 Drilling Location (NW¼SE¼ Section 21, T9S, R92W, 6th P.M.)	This drilling location would support six (6) individual wells. The location is also located in a regenerating aspen clearcut. Aspen saplings are now approximately 4 to 8 feet tall. The vegetation surrounding the clearcut is mature aspen stands. In addition, a wetland area is approximately 75 feet to the south of the proposed pad location. Stormwater mitigation measures will be implemented to insure no effects to wetlands will result from the oil and gas operations.
Hightower 21-12 Drilling Location (NW¼SW¼ Section 21, T9S, R92W, 6th P.M.)	This drilling location would support seven (7) individual wells. The location is in a forested stand of mature aspen and oak brush. Aspen trees will need to be removed for both the access road construction and the drilling location construction.

2.2.2 Access Roads

The proposed drilling locations and compressor facility would be accessed using the existing National Forest System Roads (NFSRs) 265, 266 and 270. Administrative access roads, some following former temporary roads used for the Hightower Timber Sale, will be constructed and would connect the proposed drilling locations and facilities with NFSRs 265 and 266. For the purpose of reference within this document, roads accessing the drilling locations and compressor site from NFSRs 265 and 266 will be referred to as "new access roads".

The new access roads would be constructed to an applicable structural section to support traffic for the life of activity and will be gated at their intersections with NFSR 265 and 266 with motorized vehicle access allowed only to the proponent, their contractors, the FS and BLM for inspections, operations and administrative purposes.

To access the project area, approximately 85-90% of the project traffic will travel east from Collbran, Colorado, on County Road (CR) 330E to the intersection of NFSR 265. From the Forest Boundary, traffic would travel approximately 0.2 miles on NFSR 265 to the intersection with NFSR 266. Drilling locations 21-2, 21-10 and 21-12 would be accessed off NFSR 265 about three (3) miles past the intersection. The compressor facility and drilling locations 20-6 and 20-11 would be accessed off NFSR 266 approximately one-half (0.5) mile, one (1) mile, and one and one-half (1.5) miles, respectively, from the intersection. NFSR 270 is anticipated to be utilized for activities such as water hauling and personnel conveyance. An estimated 10-15% of project related traffic will use NFSR 270, primarily light duty trucks, possibly water trucks, drill rigs and completion rigs (PXP, C.Clark, 2007).

Approximately 1.1 miles of new access road will be needed for the proposed drilling locations. Access roads will be built to the minimum widths required to accommodate critical vehicle dimensions. Lengths of the proposed access roads are listed in Table 2.2.2. Also refer to Figure 2.3 and Figure 2.4.

Where needed, roadway turnouts will be engineered into the project. On average, the turnouts will be 100 feet long, 16 feet wide and have 50-foot long transitions on each end. The number of turnouts and disturbance will be determined during the engineering of the access roads.

Improvements to NFSRs 265, 266 and 270 will ensure that the area retains the same road character as is currently present (single lane with pullouts as needed). Improvements, including application of rock, to these roads drilling locations will be necessary to accommodate heavy equipment traffic. Engineered drawings of road design, subject to FS approval, will be required as stated in the Design Criteria.

Additional curve widening may be required of existing roads to accept the project's "critical design" vehicle (the longest/widest vehicle expected to be hauled on the road). This disturbance, if needed, should already be included in the existing road corridor disturbance.

Road watering and/or dust suppression treatment will be conducted on all project roads to reduce fugitive dust emissions during periods of heavy use or on an as needed basis. Chemical dust suppressant treatments (i.e., magnesium chloride) will not be used within 50 feet of streams, ponds or wetlands and will only be applied by Mesa County under the County's maintenance agreement. The proponent will be expected to coordinate with the FS and County concerning the application of magnesium chloride.

Table 2.2.2. Summary of Proposed Access Roads

Road Segment	Construction Type	Length (ft)	Length (miles)
To Compressor	New	325	0.1
To 20-6	New	300	0.1
To 20-11	New	1200	0.2
To 21-2	New (former timber access)	1,050	0.2
To 21-10	New (former timber access)	1700	0.3
To 21-12	New	1300	0.2
Access Total		5875	1.1

2.2.3 Disturbance Estimates

For purposes of this proposal, short-term disturbance is defined as the disturbance of vegetation and soils that will remain until interim reclamation results in the re-vegetation of the reclaimed area with soil-stabilizing herbaceous and shrub species (approximately one to three years). Long-term disturbance is defined as the disturbance to vegetation and soils that will remain for the life of the proposed wells (if producible quantities of gas are found, i.e., 20 to 30 plus years), plus the time required to successfully reclaim the area with soil-stabilizing herbaceous and shrub species (approximately one to three years).

Construction of the five (5) Hightower drilling locations including cut and fill slopes and soil stockpiles will each result in the disturbance of approximately five and one half (5 ½) acres (total of 27 acres for drilling locations-one location is smaller) of vegetation and soils and one (1) 3.7 acre or 5.5 compressor location. The proponent will implement several measures designed to minimize drilling location and compressor facility size and cut and fill requirements. Once the proposed wells are completed, a portion of each drilling location will remain in place to house well facilities. Approximately four (4) of the five and one half (5 ½) acres of each drilling location will be reclaimed to FS standards and requirements. Tables 2.3.3 and 2.4.3 show pad and compressor site dimensions for the Proposed Action and Alternative 3.

Construction of new access roads, assuming an 14-18-foot travel width, is anticipated to have an average construction width that ranges from 24 to 50 feet, which primarily depends on existing ground slopes and soils. Engineered design of the access roads will be completed once final surveys are completed. The new access roads will be designed according to the AASHTO Standards for Low Volume Roads or equivalent design standard. Evaluation of design cross-sections will finalize an average disturbance area. Disturbance beyond the finished travel surface is for drainage ditches, gravel shoulders, and cut and fill slopes. After completion of road construction and installation of the gathering system, the road cut and fill slopes will be re-vegetated.

If engineering studies determine turnouts will be needed for safety, each turnout will have a disturbance area of 0.04 acres.

For both action alternatives, 13 acres of additional mature aspen will be harvested for the purpose of replacing lost regeneration of aspen at two drilling locations. The HT 21-2 and 21-10 drilling locations, portions of their access roads and pipelines, are within the boundaries of two Hightower Timber Sale units. The two areas selected for aspen removal have already been analyzed for effects in the *Hightower-Porter Mountain Timber Sales Environmental Assessment;* the Decision Notice and Finding of No Significant Impact was issued on December 18, 2001. There will be minor soil

disturbance related to this harvest as timber operations in the area have been occurring primarily when there is snow pack or very dry conditions.

2.2.4 Well Drilling and Completion

Once construction of each drilling location is completed, drilling equipment will be moved on to the drilling site. A rotary drilling rig will be set up on the location and will be powered by diesel-electric engines. Diesel fuel for the rig and generators will be delivered by tanker trucks to a fuel tank located on the drilling location. Drilling fluids and cuttings will be stored in the lined reserve pit and cuttings pit respectively. Appendix B contains a list of drilling, completion and fracing fluids typically used in the Piceance Basin by the proponent. Following completion of the proposed wells at each pad, drill fluids will be recycled and re-used at another location. The pits will be allowed to dry, the liner will be cut and the remainder buried during interim reclamation.

Estimated depth for the Hightower wells is approximately 8,500 feet. The target formations are the Williams Fork, Cozzette and Corcoran sands. Any shallow water zones encountered during drilling will be properly protected by casing and cementing, and will be reported to the appropriate agencies. All potentially productive hydrocarbon zones will be cemented off. After the completion of drilling operations, the producing formation will be logged and production casing run and cemented, in accordance with the drilling program approved in the APD. This will isolate all formations in the hole and will effectively eliminate communication between hydrocarbon bearing zones and water aquifers or other mineral resources.

If producible quantities of gas are found, once all wells are drilled and production casing set, the drilling rig will move off and a completion unit will move on site to begin completion operations. The casing will be perforated in potentially productive zones, the producing formation will be hydraulically fractured if necessary, production tubing will be run, and the wells will be tested for initial production rates.

If necessary, the producing formation will be hydraulically fractured in the designated productive zones. Hydraulic fracturing will be accomplished by pumping a mixture of sand proppant and "slick" water down the well bore under pressure, through perforations in the casing, and into the formation. Currently, the proponent uses a slick water mixture of: water; a clay-stabilization additive (ClayFix II); a friction reducer (FR-56); and a non-emulsifier (19N). The clay stabilization additive prevents the clays in the formation from swelling, the friction reducer does as it name implies, and the non-emulsifier prevents acid and oil emulsions. An emulsion is simply where one fluid is evenly dispersed in another. As the formation fractures, the resulting void space will be filled with the sand proppant to keep the fractures open and facilitate the flow of gas to the well bore. All liquids produced following completion operations will be placed in production tanks, temporary storage tanks, or frac tanks, as appropriate. The wells will be 'flowed back' into a closed top tank to measure recovery. The fluid is then filtered after recovery and reused in the next well. Flaring gas is not proposed and would be vented to the atmosphere; however for emergency situations a flare pit will be constructed on each pad. Once the pipeline is in place, the proponent would follow green completion and test gas into the pipeline.

2.2.5 Pipeline Construction

Gas gathering lines (between the drilling locations) and sales pipeline (from the compressor facility to the tie in with an existing gas transportation line) will be designed and constructed in accordance with U.S. Department of Transportation (DOT) Regulation 49 CFR 192, Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards, 18 CFR 2.69, Guidelines to be Followed

by Natural Gas Pipeline Companies in the Planning, Clearing and Maintenance of Rights of Way and the Construction of Above Ground Facilities.

Pipelines will cross NFSR 265 in three places and 266 in two places, as well as Hightower Creek. The proponent will submit a Plan of Development for the pipelines at the time they submit the SUPO. Buried pipeline will be placed in a trench a minimum of three feet deep to provide security from failure that could result from the crossing of surface equipment. Prior to disturbance, a crew will install erosion control devices. Merchantable timber will be cleared under a timber sale contract and the remaining vegetation will be cleared with brush hogs, excavators and bulldozers, and used during reclamation.

The pipeline ditch excavation technique employed depends on soil conditions encountered. A combination of backhoes and trenching machines, supplemented by mechanical rippers and excavators would be used for excavation. Spoils and topsoil will be segregated and placed on one side of ditch. The opposite side of ditch will be used for pipe welding and x-ray inspection. Pipe will be placed in the trench, backfilled and compacted. The surface will be prepared for revegetation by replacing topsoil and installing erosion control structures.

Another pipeline construction technique that could be employed is boring, in which horizontal directional drilling technology is used. Both an entry pit and exit pit would be excavated. At the entry pit a hydraulic ram would be used to form a straight bore hole beneath the surface, to the exit pit. The bore hole may be cased and the pipeline then placed within the casing. Erosion control measures would be used to limit erosion and storm water transport from the entry and exit pits as well as from the excavation spoils to surface water. For stream crossings the entry and exit pits are located far enough from the streambank and at sufficient elevation to avoid inundation by storm flow stream levels and to minimize migration of groundwater into the pits.

The pipeline corridor will be re-seeded with a FS approved seed mixture. Seed will either be broadcast at twice the specified rate or drilled as the terrain allows. The pipe will then be hydrostatically tested per a Hydrostatic Testing Plan approved by the FS.

2.2.6 Drilling Water and Dust Suppression Water

Water for use during drilling will be obtained from an adjudicated source off NFS lands. No surface or groundwater on NFS lands would be used for project activities. Approximately 1.2 acre-feet (10,000 barrels) of water will be needed for the drilling process for each well. Drilling water will be recycled and reused on subsequent wells as often as possible. Total estimated water usage for the project, including dust suppression needs (0.4 acre-feet) and hydrostatic testing (0.2 acre-feet) of pipelines, is about 39 acre feet. The GMUG has a blanket Biological Opinion from USFWS (TAILS 65413-2007-F-0119) which covers this water depletion.

2.2.7 Dry Hole / Non-producing Wells

If any or all of the initially drilled Hightower wells are dry holes or non-producers (during this exploration project, decisions regarding economics and production feasibility will be made by the proponent), the entire drilling location and access road will be restored to conditions detailed in the approved SUPO for the particular location. Well bores will be plugged and abandoned, following the procedures of the COGCC and BLM. All surface production equipment will be removed.

2.2.8 Project-related Vehicle and Equipment Traffic

Vehicle traffic can be broken down by activity: timber harvest, pipeline construction, drilling location and road construction, drilling, completion and production activities. A roads use analysis for the Hightower project was conducted and is located in the project file (Sorenson Engineering, 3/13/07). Table 2.2.8 summarizes the total amount of vehicle trips and average daily traffic for each activity. This traffic will occur during active operations with most vehicle trips occurring during business hours. Some activities will occur concurrently (i.e., pipeline construction, drilling and completion activities to overlap).

Table 2.2.8. Summary of Projected Traffic in the Hightower Vicinity by Activity.

Activity	Total activity one way truck trips	Average Daily One Way Traffic	Maximum one way trips/day
# Aspen replacement timber sale, 13.3 acres, 266 ccf	162 one way trips over 27 days	6	8
Pipeline construction	674 one way trips over 38 days	18	32
Construct pads (6), access roads and gravel NFSR 266	1900 one way trips over 113 days	17	20
Drill 32 wells on 5 pads	2573 one way trips over 382 days	7	30
Complete 32 wells on 5 pads	8764 one way trips over 206 days	43	100
* Produced water disposal	8 one way trips per day for life of wells	8	16 early in life of wells, to decrease over time to 8.

Notes: # Timber sale assumes one full sized log truck and two light duty trucks. Mileage traveled on NFS varies by alternative for produced water disposal. Alternative 2 entails approximately 4.7 miles of one way travel to reach all five drilling locations; Alternative 3 involves approximately 0.5 miles of one way travel to the central facility

2.2.9 Construction Maintenance & Sanitation

Trash containers and portable toilets will be used in the Hightower project during construction. The toilet holding tanks will be pumped regularly, and the contents disposed of at a municipal sewage facility in accordance with applicable rules and regulations regarding sewage treatment and disposal. Accumulated trash and non-flammable waste materials will be hauled to an approved landfill once a week or as often as necessary. All debris and waste materials not contained in the bear-proof trash containers will be cleaned up, removed from the project, and disposed of at an approved landfill. Cleanup will occur every day. No potentially harmful materials or substances will be left in the project area or vicinity. Scrap metal and other recyclable refuse will be hauled off site on a regular basis.

2.2.10 Spill Procedures

If any spills of oil, fuels, salt water, or other fluids were to occur during the construction, drilling or operational phase of the project, FS and BLM would be contacted immediately, and would follow the Notice to Lessees 3A instructions, as applicable. Other regulatory agencies, such as the COGCC, would be contacted, as necessary. Strict cleanup efforts will be initiated immediately and conducted

in accordance with applicable regulations. This will be true at all stages of the project including drilling, completion, operation and abandonment of the wells. Prior to project activities starting, a Spill Prevention, Control, and Countermeasure (SPCC) plan, in accordance with U.S. Environmental Protection Agency requirements (if needed), will be submitted to the FS and BLM for acceptance and approval. Production fluid storage facilities would use secondary containment.

2.2.11 Interim Drilling Location and Pipeline Reclamation

Following drilling and well development (if producible quantities of gas are found), the drilling equipment, supplies and trash will be removed. Each drilling location size will be reduced to approximately 1.3 acre working surface. The unused areas of the drilling location will be reclaimed with seed mixtures approved by the FS. The remaining areas of land will remain un-reclaimed for the life of the wells in order to house production facilities and provide continued access to those facilities. The reserve pit will have all fluids removed and be allowed to dry sufficiently to allow reclamation. The reserve pit liner will be cut at the mud line, removed and disposed in a landfill. The lower portion of the liner will be backfilled. Only dry cuttings will be buried in cuttings pit.

Pipeline reclamation grading will include restoring to contour and closing/blocking the pipeline corridor. Revegetation will be conducted concurrently with revegetation of road cut and fill slopes.

Backfilling, leveling and re-contouring of disturbed areas will be accomplished as soon as practical after construction operations. Subsurface ripping or other methods will be used to reduce compaction and stockpiled topsoil will be evenly distributed to a depth similar to that originally present over the reclaimed area. The seedbed will be prepared by disking or similar implement. A certified weed-free seed mixture recommended by the FS will be used. Seeding will be done as soon as possible after seedbed preparation to increase germination success and to expedite site stabilization.

A surface mulch, preferably of chipped or shredded slash, will be applied to seeded areas where necessary. As needed, reclaimed area will be fenced according to FS specifications. Annual or noxious weeds will be controlled on all disturbed areas as directed by the FS, using approved chemical and/or mechanical methods. The restoration will be monitored for successful revegetation following FS direction.

2.2.12 Well Operation and Maintenance

If gas in producible quantities is found, radio telemetry will be installed at each drilling location to allow remote monitoring of the wellhead and ancillary equipment. Producing gas wells will be visited on an as-needed basis, estimated to be about twice per week, to inspect well site facilities and perform other routine maintenance activities. Wellhead and ancillary equipment integrity will be visually inspected on a regular basis.

2.2.13 Well Abandonment and Reclamation

If producible quantities of gas are found, it is estimated that the life span of individual wells may vary. However, a typical well can produce 20 to 30 plus years. Abandonment of the drilling locations, wellbores and facilities will be performed in compliance with all applicable FS, BLM and COGCC regulations. At the time of final abandonment, all surface production equipment will be removed and the drilling location and access road will be decommissioned and reclaimed according to FS specifications, the approved SUPO, and applicable COAs.

The FS will require a reclamation bond on each of the SUPOs under the authority of 36 CFR 228, Subpart E, Section 228.109. For surface disturbing activities authorized under a Special Use Permit, reclamation bonding falls under 36 CFR 251, Section 251.56e.

2.2.14 Project Schedule

The Proposed Action includes drilling 32 natural gas wells from five (5) locations and will occur over about 16 months (assuming 3 drill rigs and 2 completion rigs operating year-round), following clearance to proceed. Construction of the access roads, drilling locations and pipelines could begin in the summer/fall of 2008, and drilling could begin in the spring of 2009. As the project is exploratory, if gas in producible quantities is found, all 32 wells will likely be drilled during a 2009 to 2010 timeframe.

The Proposed Action and Alternative 3 include conducting drilling and completion operations within the shortest timeframe possible to limit the actual time it will take to complete the project. Thus, drilling operations would occur throughout the year continuing for about 16 consecutive months, barring unforeseen circumstances and rig availability. A drilling rig would move on to the drilling location and drill all of the wells on the location. Then, the drill rig will de-mob and a completion rig will move on and complete each of the wells on the location. Each well will be drilled in approximately 15 to 20 days and completed in about 14 days. It is estimated that the time required to drill and complete each well will be approximately 35 days.

Timber harvest in aspen replacement cutting units and along road and pipeline routes will occur per the terms of the Timber Sale contract.

The exact dates of construction and drilling will be determined by multiple factors including, but not limited to: MDP approval by the FS; submission of site-specific APDs, followed by FS review of the SUPOs and BLM review of the drilling plans and APD approval; weather conditions; and resource and site-specific conditions (e.g., completion of any other required surveys, or whether there are any active raptor nests near the proposed drilling locations, etc.), and proponent receipt of other permits such as the special use authorization for the compressor and pipeline.

A tentative scenario of the sequence of events is described below:

Harvest timber associated with clearing of locations and aspen replacement cutting units. Upgrade roads where needed and build access roads. Construct drilling locations, compressor facility and pipeline. Drill and complete the wells.

2.2.15 Design Criteria

The Action Alternatives were designed to incorporate the design criteria shown in Table 2.2.15. These design criteria include industry and FS Best Management Practices (BMPs), lease stipulations FS management area standards, guidelines, statutory and regulatory constraints. Because the Design Criteria are built into the project, the need for mitigation is greatly reduced during project implementation. Many of the design criteria were developed by the project proponent in consultation with the FS to ensure consistency with the Forest Plan, oil and gas lease and other requirements as noted in Table 2.2.15. The Design Criteria are built into the Proposed Action and Alternative 3, and will be implemented where appropriate to avoid any undesirable effects associated with the project. Effects that could not be effectively reduced or eliminated through these criteria and practices will be mitigated and are discussed in Chapter 3.

Table 2.2.15. Design Criteria.

Design Criteria/BMP	Resource	Proposed by/Reference
ROADS/TRANSPORTATION		
Proponent and the FS will conduct a pre-use road condition assessment for affected FS roads.	Roads	FS Road Use Permit , FSH 7709.56
Roads will be designed/upgraded using a structural design standard sufficient to support project traffic (i.e., AASHTO Guidelines for Geometric Design of Very Low-Volume Local Roads) or equivalent design standards as approved by FS. Engineering analysis will be conducted for all routes requiring horizontal and vertical alignment with respect to critical vehicle and design vehicle. Design vehicle shall be defined. Roadway structural design sections will be per AASHTO 1993 Pavement Design Guide. All design elements shall be approved and stamped by a Colorado Registered PE having pavement structural design expertise.	Roads, safety	FSM 7100-zero code FSH 7709.56 AASHTO (ISBN:1-56051-166-4)
Operator will have a FS Road Use Permit for all phases of operations. Proponent will follow all conditions of road use permit with regard to traffic control, road maintenance and winter operations to protect forest visitors and forest resources. Road closures resulting from construction activities will be planned ahead and the FS shall be notified at least 48 hours in advance.	Public and operational safety	Regional Forester Order R2-2007-01 GMUG Order FS-01-01
Identify specific locations of drainage features and BMPs on road construction plans, and submit for FS approval prior to construction	Soil, water, fish	Company/FS/BLM, FSH 7709.56 Road Use Permit The Gold Book
Outslope/cross-slope access roads to promote removal of water from the road surface. Install relief ditches at regular intervals to direct drainage off of the road grade and into vegetated areas.	Soil, water, fish	Company/FS The Gold Book FSH 2509.25 Forest Plan Pg III-74
Use gravel or crushed rock on the running surface of the road to reduce ongoing erosion of the road by vehicle traffic. Material must meet specifications of FP-03.	Soil, water, fish, air, recreation, road	Company/FS FSH 7709.56, FSH 2509.25 FHWA-FLH-03-002

Design Criteria/BMP	Resource	Proposed by/Reference
Rutting that compromises the structural integrity of the roads is not permitted. Such rutting could result in use of that road ceasing immediately and remaining shut down until repairs and improvements are made to prevent additional rutting. Standards for rutting will be described in the Road Use Permit.	Roads/Resource Protection	FS FSM 7709.56, FSH 2509.25, GMUG Engineering Forest Standard
Access roads will be gated and closed to the general public. Monitor personnel to ensure access is not abused; i.e., no access during non-working hours for purposes unrelated to the project such as hunting or off-roading.	Wildlife, public safety, Soils, recreation	Company/FS The Gold Book, Road Use Permit (16 U.S.C. 535 & 537), FSM 7709.56, Oil and Gas Leasing FEIS, App. H
Perform dust abatement on roads during construction and development activities using water. Proponent will coordinate with the FS and Mesa County Road and Bridge Dept in regard to any chemical dust suppressant treatment along NFSR 265, 266 and 270.	Air, visuals, water, safety, road	Company/FS Road Use Permit (16 U.S.C. 535 & 537), BMP Schedule A Agreement w/ Mesa Cty Rd and Bridge
A designated snowmobile parking area to allow access to the S-P trail will be maintained and plowed by the proponent along NSFR 266.	Roads, Recreation	FS
When feasible, project workers will car pool to and from surrounding cities and towns to minimize vehicle-related emissions and fugitive dust.	Air, visuals, roads	Company BMP
Power-wash all construction equipment (including the trailers hauling construction equipment) and vehicles prior to the start of construction. If vehicle has been taken away from project area and used off-pavement, washing is required prior to re-entering the forest.	Vegetation, noxious and invasive weeds	Company/FS BMP, Noxious and Invasive Weed Management Plan for Oil and Gas Operators (3/07) Road Use Permit
Proponent will abide by the Grand Mesa Travel Management decision, December 1994 which states: Motorized travel on the Grand Mesa National Forest is restricted to designated roads and trails.	Watershed, soils, water, wildlife, safety	FS Grand Mesa Travel Management Plan
To reduce conflicts with recreationists, mobilization and demobilization of drilling equipment, completion equipment and fracing units will not occur during Friday, Saturday and Sunday of the opening weekends of the combined muzzleloader and archery season (when the two seasons overlap), the first rifle season, and the	Recreation, safety	FS –District's Standard Operating Procedure DOW recommendation/Public Interest

Design Criteria/BMP	Resource	Proposed by/Reference
second rifle season-for a total of three weekends. In addition, to the extent possible, mobilization and demobilization will be scheduled during weekdays and will avoid weekends and holidays.		
PIPELINE CONSTRUCTION		
For pipeline crossing wetlands: Wetlands will be located and field marked prior to pipeline construction activity. All construction equipment will be placed on mats and the mats will be removed upon completion. Sediment barriers will be installed on the down slope side of the work area to prevent flow of sediment into adjacent wetlands. The barriers will be maintained until final stabilization is complete. After backfilling the trench, the wetland area will be restored to its original contours.	Soil, Watershed	Company/FS USDOT Regulations 49 CFR 192 & 18 CFR 2.69
For pipeline construction adjacent to roads, trench shall be a minimum of 5 feet deep where located under bar ditches to allow for maintenance of the ditches without compromising the pipeline, and minimum of 3 feet depth elsewhere.	Soil, watershed, roads	Company
For pipeline construction across NFSRs 265 and 266 using open cut technique: trench shall minimum of 5 feet deep. Backfill materials shall meet FP-03 specifications and shall be applied and compacted in 6 inch lifts with optimum moisture and compaction techniques. Road shall be resurfaced to at least the original condition by smoothing and blading to match the crown and shoulder slopes of the adjacent road prism.	Roads	Company/FS
Stream and wetland crossings will be identified and appropriate construction techniques (open cut or boring) will be described in the Stormwater Management Plan.A map depicting the location of inventoried wetlands, intermittent and perennial stream crossings will be included in the SWMP. The SWMP will include a set of BMP's and each crossing will reference the proper BMPs to employ.	Soils, wetlands, watershed	Company/FS
For pipeline crossing Hightower Creek (intermittent stream): If open trench technique is used, spoils and topsoil shall be segregated and stored at least 30 feet away from high water mark. Work will be done in as short a time as possible and during times when stream flow is minimal or non-existent. If saturated or unstable soils are present, all work within the stream will be	Watershed, soils	Company/FS

Design Criteria/BMP	Resource	Proposed by/Reference
conducted from wooden mats. Erosion control measures and other BMPs outlined in the Stormwater Management Plan will be implemented. Upon completion, the stream bed will be replaced matching the pre-disturbance stream contours. Native stream bed material will be used to stabilize the stream bed. Additional stabilization measure may be used to stabilize the stream banks (i.e. erosion matting, rip-rap, trench plugs)		
Pipeline corridors will be signed and closed or physically blocked to prevent illegal travel.	Soil, recreation	FS - Grand Mesa Travel Management Plan
If hydrostatic testing is planned for checking pipeline integrity, a hydrostatic test plan shall be prepared by the proponent and submitted for approval by the Authorized Officer. The plan shall be designed to minimize soil erosion, protect water quality, protect aquatic species and minimize disturbance to streambanks and streambeds.	Soil, water	BLM FSH 2509.25, Watershed Conservation Practices Handbook
GEOHAZARDS		
Stabilize steep cut slopes that will remain unreclaimed over a winter or longer, by placing native boulders or concrete “eco”-blocks. Conduct a geotechnical evaluation prior to activity at the 20-6 wellpad and the access road to the 20-11 pad, to assure proper placement of extra weight to avoid accentuation of slope movement	Soil, water, fish	Company/FS FSH 2509.25
Conduct slope stability monitoring before and after construction on sites 20-6 and access road to 20-11	Watershed, soils	FS-in response to moderate geologic hazards present.
Avoid all high geologic hazard areas.	Soil, water, roads	FS Lease Stipulation, BLM Manual 1624 & 3101, FSM 1650 & 2820, 43CFR 3101.1, 36 CFR 228.104
WATERSHED AND SOILS		
Follow BLM and State well casing requirements to protect shallow ground water.	Water	FS/BLM/STATE 43 CFR 3162 and 3164

Conduct drilling, completion and other well operations in accordance with BLM and COGCC rules to prevent communication between surface aquifers and producing formations.	Water, soil	BLM and State regulatory requirement The Gold Book, 43 CFR 3162 and 3164
Impervious secondary containment structures shall be constructed and maintained around any petroleum product and produced water storage tanks, or other toxic liquids subject to 40 CFR 112 and be capable of holding 1-1/2 times the volume of the largest tank. Load valves shall be located within the diked area.	Water, soil	The Gold Book, 40 CFR 112 Oil and Gas Leasing Analysis FEIS, pg H-20
A minimum of two feet of freeboard will be maintained between the maximum fluid level and the top of the berm. The pits will be designed to exclude all surface runoff. Pits will be constructed in cut portion of well site	Water	Oil and Gas Leasing Analysis FEIS, pg H-20
Drill pads, staging and storage areas, roads and pipelines will not be located in wetlands, floodplains or riparian areas unless specifically approved by authorizing officer.	Soil, water	Lease Stipulation, BLM Manual 1624 & 3101, FSM 1650 & 2820, 43CFR 3101.1, 36 CFR 228.104, EO 11990 & 11988
Roads will cross streams at right angles, and access across wetlands, floodplains, and riparian areas will be minimized.	Soil, water	BLM Manual 1624 & 3101, FSM 1650 & 2820, 43CFR 3101.1, 36 CFR 228.104, EO 11990 & 11988, Forest Plan Pg III-187
Adhere to permit conditions identified by the Army Corps of Engineers (ACE) in any/all 404 permits issued for the proposed dredge and fill operations in jurisdictional drainages/wetlands.	Soil, water, fish	Company FSH 2509.25, 404 Permit
Within water influence zones, an adequate vegetative buffer or filter strip will be maintained to filter runoff from the road before it reaches the creek, wherever possible.	Soil, water, fish	Company/FS FSH 2509.25

Maintain channel stability, stream profile and vegetative cover in at least their current condition. Avoid altering vegetation cover which causes stream instability, loss of channel cross-sectional area and the loss of water quality.	Watershed, soils	FS Forest Plan Pg III-183 Road Use Permit
Prevent debris from management activity accumulating within stream channels, and protect naturally accumulated large organic debris.	Water	Forest Plan Pg III-52
Protect all disturbed areas within 100 feet of a watershed influence zone WIZ) with silt fence or other sediment trapping materials specified by the Forest Service.	Soil, vegetation, water	Company/FS FSH 2509.25
Restrict use of heavy construction equipment to periods when the soil is least susceptible to compaction or rutting, in order to prevent permanent damage to soil and to avoid compaction and disturbance in riparian ecosystems.	Water, soil	FS Forest Plan Pg III-52, Pg III-184
Minimize sediment yields to the riparian area caused by construction activities, by completing or treating active construction projects prior to expected significant runoff periods.	Watershed, soils	FS Forest Plan Pg III-187
EROSION CONTROL		
Special mitigation techniques will be required on slopes between 40 & 60% including erosion control devices and water control.	Soil, water	Lease Stipulation, BLM Manual 1624 & 3101, FSM 1650 & 2820, 43CFR 3101.1, 36 CFR 228.104
Place geotextile material on soils beneath gravel surfacing at well pads and facilities site where geotechnical evaluation determines it is necessary.	Soil, water, fish	Company The Gold Book
Armour fill slopes (drilling locations, compressor facility, roads) with excavated rock and/or slash vegetation (brush, branches, and other slash vegetation) to reduce the velocity of rain drops and subsequent erosion. Install brush barrier or other natural sediment control devices along the toe of the drilling location fill slopes.	Soil, water, fish	Company/FS FSH 2509.25, BMP

Roadside ditches will be allowed to vegetate or include large rocks or stones to slow the velocity of drainage and allow sediment to settle out.	Soil, water, fish	Company/FS FSH 2509.25
Install water bars or hay bale dikes perpendicular to the flow direction of the ditch (when drainage ditches are installed to direct runoff away from the road) to reduce runoff velocity and to settle out sediment.	Soil, water, fish	Company/FS FSH 2509.25 Road Use Permit
Install sediment traps in problem locations where insufficient vegetative buffering is available to filter runoff prior to entering any tributaries.	Soil, water, fish	Company/FS FSH 2509.25, Forest Plan Pg III-187
Design and implement storm water management plan in accordance with standards set forth by the CDPHE.	Soil, water, vegetation, fish	Company/FS/BLM/State Storm Water Permit, EMS, The Gold Book
Design and engineer any planned construction on steep slopes according to Forest Service standards and design criteria, including an erosion control and maintenance plan. The authorized FS officer will approve water bar placement and design.	Soil, vegetation, water	Company/FS The Gold Book, FSH 2509.25, Reclamation Plan
Chip or shred aspen and other slash, and use it as mulch during reclamation or on slopes to reduce erosion.	Soils, vegetation	FS BMP
RECLAMATION		
Proponent will prepare an interim and a final reclamation plan as part of the SUPO, subject to FS approval.	Vegetation	The Gold Book, SUPO,43 CFR 3160, FSM 2840
Stabilize disturbed areas during and after construction activity to control erosion and sedimentation, so as not to encroach off site areas. Re-vegetate with certified weed-free seed mixes of native plant species indigenous to the project area, as determined by the FS. Successful re-vegetation is defined as 80% cover of adjacent undisturbed ground within a 5 year period. Successful re-vegetation may require re-seeding, applying fertilizer and periodic watering.	Soil, water, fish, wildlife, visuals,	Company/FS The Gold Book , FSH 2509.25, Forest Plan, Pg III-52 and III-75, Noxious and Invasive Weed Management Plan for Oil and Gas Operators (3/07

Handle topsoil carefully during stripping, stockpiling, and backfilling operations so that soil horizons are not blended and the fertility of the topsoil layer is not compromised. Segregate and store topsoil separately, minimize the stockpile depth to maintain soil fertility, not to exceed six feet depth. Immediately apply seed and mulch, and maintain it in a vegetated condition until needed for reclamation.	Soil, vegetation	Company/FS The Gold Book, FSH 2509.25, Reclamation Plan, Forest Plan Pg III-73
Reclaim all areas not necessary for the continued operation of the wells following well completion. Areas where soil has been disturbed should be re-seeded within 30 days, subject to weather conditions.	Soil, vegetation, water, visual	Company/FS The Gold Book, Forest Plan Pg III-74
Re-seed cutbanks as soon as possible (hydro-mulch seeded and fertilized, if necessary) in order to stabilize these disturbed sites.	Soil, vegetation, water, visual	Company/FS The Gold Book, FSH 2509.25
Use ripping or another roughening method as prescribed by FS to reduce compaction prior to replacement of the topsoil and seeding.	Soil, vegetation, water	Company/FS The Gold Book, FSH 2509.25, Reclamation Plan
Inoculate topsoil that has been stored for more than 3 years with mycorrhizae fungi before spreading to improve soil fertility.	Soil, vegetation	FS
Weed control will be conducted on all areas disturbed by project activities through an Approved Pesticide Use and Weed Control Plan approved by the Authorized Officer.	Soils, vegetation, noxious and invasive weeds, visual	Company/FS BMP, Noxious and Invasive Weed Management Plan for Oil and Gas Operators (3/07), Reclamation Plan, The Gold Book
Perform weed monitoring on all areas disturbed by project activities, and continue reclamation measures annually (or as frequently as the Authorized Officer determines) throughout the 20 to 30 plus year life of the wells.	Soils, vegetation, noxious and invasive weeds.	Company/FS BMP, Noxious and Invasive Weed Management Plan for Oil and Gas Operators (3/07), Reclamation Plan, The Gold Book
Minimize vegetation removal as much as possible during project design, to reduce vegetation effects.	Soils, vegetation, noxious and invasive weeds, visual	Company/FS BMP, FSH 2509.25
Revegetate all areas capable of supporting vegetation disturbed during road construction and/or reconstruction to stabilize the area and reduce soil erosion.	Soils, vegetation, water	FS Forest Plan Pg III-74

Strive to return disturbed areas to the approximate mix of grasses, shrubs, and trees present before the disturbance.	Wildlife, vegetation, visuals	Company The Gold Book
Final abandonment: Equipment will be removed from pads. Access roads and pads will be re-contoured and revegetated per FS specifications. After seeding, lop and scatter stockpiled trees and slash over the disturbed area.	Vegetation	FS BMP
When constructing reserve pits, remove large rocks and sharp objects. Line pit with an impermeable synthetic liner with heat treated seams and a minimum of 125 lbs/sq inch burst strength to contain all drilling mud and fluids. During reclamation when the pit is dry, the liner will be cut at mud level. The above mud level portion will be disposed of at an approved landfill, and the below mud level portion will be folded to contain cuttings, buried in the pit, and covered with a minimum of three feet of cover.	Water	Company/FS The Gold Book, 43 CFR 3160 Oil and Gas Leasing Analysis FEIS, pg H-20-21
Due to slope stability concerns with 20-6 pad the cuttings pit, in addition to the reserve pit, will be lined with an impermeable synthetic liner with heat treated seams and a minimum of 125 lbs/sq inch burst strength to contain all cuttings. It is felt that water accumulation in the cuttings may destabilize this portion of the slope after reclamation activities. When the pit is dry, the liner will be cut at cuttings level. The cut portion will be disposed of at an approved landfill, and the lower portion will be folded to contain cuttings, buried in the pit, and covered with a minimum of three feet of cover.		The Gold Book, 43 CFR 3160 Oil and Gas Leasing Analysis FEIS, pg H-20-21
Complete pit and interim site reclamation within 60 days after well completion or as soon thereafter within the appropriate spring or fall planting season.	Water	FS
NOISE		
Install mufflers on all internal combustion engines and certain compressor components.		Company/FS/BLM The Gold Book
House the compressor unit in a noise reducing building to minimize effects to big game winter range and breeding birds in spring/summer.		Company/FS
Ensure facilities meet Colorado sound requirements.	Wildlife, recreation	Company/FS COGCC Noise control regulations

VISUALS		
Paint surface facilities a standard environmental color selected by the Forest Service to better blend the facilities with their surroundings and thereby reduce visual effects.	Visuals	Company/FS The Gold Book , Forest Plan Pg III-146
Where possible, surface facilities will be screened from view to minimize visibility. Use a combination of low profile equipment, vegetative screening or berming.	Visuals	FS Visual Resource Protection Plan (VRPP)
Minimize access routes into the project area. Follow land contours to minimize clearings, cuts and fills.	Visuals/soil	FS VRPP
Design and locate vegetative manipulations for clearings and structures in the landscape to retain the form, line, color and texture of the landscape.	Visuals	FS VRPP
Remove equipment and structures not needed to operate and maintain facilities.	Visuals	FS VRPP
Promptly remove survey stakes, flagging and other construction related debris.	Visuals	FS VRPP
When possible, feather the edges of cleared pipeline corridor to blend into the surrounding landscape.	Visuals	FS VRPP
Cut all stumps to 12 inches or less in height.	Visuals/timber	FS, VRPP
Log landings along NFSR 265 are prohibited	Visuals/timber	FS
If cull log decks can be seen from NFSR 265, these decks will be chipped or used for reclamation purposes.	Visuals/timber	FS
If outdoor lighting is required, direct the light to where it is needed and where possible, use low pressure sodium light sources. Keep lighting to the minimum needed for safe operations.	Visuals	FS VRPP
WILDLIFE		
Prior to any construction between March 1 and July 31, survey areas within 0.25 miles of the proposed disturbance for the presence of active raptor nests. If active raptor nests are documented, consult with the district Wildlife Biologist before proceeding.	Wildlife	Company The Gold Book

Survey for Boreal Toads in ponded wetlands within 0.5 miles of drilling locations, roads and pipelines prior to surface disturbance. Surveys should be conducted in late May or early June for egg masses and/or toadlets.	Wildlife	FS
Prior to ground-disturbing activities, conduct surveys for endangered or threatened species.	Wildlife	Lease Stipulation, BLM Manual 1624 & 3101, FSM 1650 & 2820, ESA (16 U.S.C.A. §§1531-1534), 43 CFR 3160
In big game winter range, no exploration, drilling or development is allowed from December 1-April 30 (unless specifically approved by authorized officer)	Wildlife	Lease Stipulation, BLM Manual 1624 & 3101, FSM 1650 & 2820, 43CFR 3101.1, 36 CFR 228.104
Limit road use to periods when animals are not present on winter range.	Wildlife	Lease Stipulation, BLM Manual 1624 & 3101, FSM 1650 & 2820, 43CFR 3101.1, 36 CFR 228.104
Install netting on unreclaimed reserve pits to deter birds from landing on water from May through October.	Wildlife	Company/FS BMP/The Gold Book
Install screens or other devices on production equipment to prevent entry by birds.	Wildlife	FS, COGCC Migratory Bird Policy
Fence the reserve pit with 8 foot tall fence to prevent wildlife and livestock entry.	Wildlife, livestock	The Gold Book, DOW recommendation for moose, 43 CFR 3160
Place escape ramps/ladders in reserve pits while open, to prevent small mammal entrapment. Escape ramps will be placed every 50' along the reserve pit slope and at each corner of the pit. Escape ramps shall be at least 24" wide, well anchored, and extend from the bottom to the top of the pit.	Wildlife	DOW recommendation/BMP
Manage the site to minimize garbage accumulation. No overnight food storage or storage in open containers will be allowed. Use bear-proof trash receptacles and empty them often.	Wildlife	Company/FS/DOW BMP
Project employees are prohibited from carrying archery equipment or firearms or bringing dogs to the project area.	Wildlife	Company/FS The Gold Book

LIVESTOCK		
To reduce conflicts with grazing on/off dates, the company will call, notify and coordinate activities with designated permittees on the Buzzard and Porter allotments as well as contact the FS Range Conservationist for any mob or de-mob activities planned during or near on/off dates (6/16 and 10/10 for Buzzard allotment, and 7/1 and 9/30 for Porter allotment). Dates for livestock movement may vary from year to year, so coordination each year is essential to reduce conflicts.	Livestock	FS requirement
TIMBER		
Lop and scatter slash to a maximum depth of 24 inches in the aspen clearcut units.	Timber	FS Forest Plan Direction on long term productivity, down woody debris and regeneration needs
Scatter up to a maximum of 10-20 tons/acre of large cull logs in the aspen clearcut units. No more than 50% of the ground surface should be covered in large cull logs; deck excessive amounts of large cull logs at landing sites. For pipelines, road and drilling location construction, lop and stockpile slash for erosion control and for interim and final reclamation.	Timber	FS Forest Plan Direction on long term productivity, down woody debris and regeneration needs.
CULTURAL		
Prior to the construction process, complete a Class III cultural resources survey on all areas proposed for surface disturbance. Should any significant cultural resources be located, the Forest Service archeologist will make recommendations for avoidance or mitigation. Proponent will then coordinate with the Forest Service on appropriate measures to be implemented.	Cultural	Company/FS/BLM Section 106 NHPA (36 CFR 800), Lease Stipulation, The Gold Book, 43 CFR 3160
HAZARDOUS MATERIALS		
Operators of onshore Federal oil and gas leases shall report **all** spills, discharges, or other undesirable events.	Water	BLM NTL-3A (CFR 221.5, 221.7, and 221.36), SPCC Plan

If spills occur, remove contaminated soil from NFS lands and properly dispose of it prior to backfilling and reclamation.	Water	FS BMP
Refueling and lubricating are not allowed within 100 feet of wetlands, water bodies and drainages. Do not store hazardous materials, chemicals, fuels, etc. within 100 feet of wetland or surface waters unless it is within the confines of the constructed well pad.	Water	FS BMP
Include control and containment mitigation in the Spill Prevention Controls and Countermeasures (SPCC) Plan, Emergency Response Plan, and Safety Plan in the event of a release of hazardous substances or materials. Copies of plans will be provided to USFS prior to construction onsite visit, so review could be completed prior to any disturbance operations.	Water	FS SPCC
Concentration of non-exempt hazardous substances in pit at time of reclamation will not exceed the standards of CERCLA as amended by SARA. All oil and gas drilling-related CERCLA hazardous substances that are removed from a location must be disposed of in accordance with applicable Federal and State regulations.	Water	FS/BLM The Gold Book, 42 USC 9605 as amended by SARA (PL 99-499, 42 USC 9601(14), 42 USC 6921(2)(a), EPA 530-95-003, Oil and Gas Leasing FEIS, pg H-20
MISCELLANEOUS		
Drill rigs will be powered by Tier 2 engines or better.	Air	Company
Implement technology to reduce greenhouse gas emissions following EPA Natural Gas Star BMPs.	Air	Company
Wells will be directionally drilled from multi-well pads.	Soils, wildlife, roads	Company, Gold Book pg 15
Hydraulic fracturing fluids will be recovered to a tank.	Water, soils	Company
Install remote telemetry monitoring equipment.	Soil, water, fish, wildlife, roads	Company

All equipment with an internal or external combustion engine shall have a spark arresting device properly installed, maintained and in effective working order meeting either USDA Forest Service Standard 5100-a (as amended) or Society of Automotive Engineers (SAE) recommended practice J335(b) and J350(a). All equipment, including welding trucks, will be equipped with fire extinguishers and other fire fighting equipment as required by the Forest Service and outlined in the Surface Use Plan of Operations (SUPO).	Public safety, soil, water, air, vegetation	FS Order # R2-2007-01
Proponent shall abide by all FS wildfire restrictions or seek exemption from the authorized officer for certain activities. Depending upon the Stage of Restriction, prohibited activities may include smoking, using explosive material, welding or using an acetylene or similar torch with open flame, operating a chainsaw	Public safety, wildfire	FS Regional Policy regarding Wildfire Stage Restrictions
Backfill all pits (exceptions flare pit, and also, see reserve pit under water quality section), cellars, rat holes or other holes unnecessary for further operations immediately after the drill rig is released.	Safety	FS
As part of the SUPO, the proponent will submit a Spill Prevention Controls and Countermeasures (SPCC) Plan, a Stormwater Management (SWPP) Plan, and a Fire/Emergency/Health and Safety Plan to the FS for review/approval.	Other, Administration	FS/BLM 40 CFR 112
The GMUG monitors some project activities under the established Environmental Management System (EMS). Certain parts of the Hightower MDP fall under this purview, and the FS will conduct specific inspections for consistency with the EMS.	Monitoring	FS, EMS

2.2.16 Additional Permits and Plans Required or that May Be Required

The oil and gas operator is responsible for obtaining any other required permits prior to any construction activities starting. Therefore, the proponent will need to have all necessary Federal, State, and Mesa County permits and additional plans in place including, but not limited to, the following:

Table 2.2.16. Hightower MDP Potential Federal, State and Local Permits

Federal Permits	**Summary**	**Applicable Project Component**
U.S. Dept of the Interior (BLM)		
Application for Permit to Drill	Contains site specific Drilling Plan and Surface Use Plan of Operations (SUPO). Subject to approval by BLM and FS (SUPO only)	Must be submitted for all wells
U.S. Dept of Agriculture (USFS)		
Timber Sale Contract	Required for removal of merchantable timber.	Road and pipeline construction corridors, drilling locations
Road Use Permit	Commercial use and maintenance of National Forest System Roads. Requires performance bond prior to use of NFSR's.	NFSRs 265, 266 and 270
Special Use Permit(s)	To authorize facilities on NFS lands which are not covered under the SUPO	Gas pipeline downstream from the point of measurement; water lines
Surface Reclamation Bond	Bonds must be posted prior to surface disturbance for new construction. Bond amount will be determined at APD stage.	For new access roads, NFSR re-routes, drilling locations, compressor facility, pipeline.
U.S. Army Corps of Engineers (ACE)		
404 Permit	For placement of fill material in waters of the U.S. or adjacent wetlands	Any surface disturbing activity affecting waters of the U.S. or wetlands
State Permits, Approvals and Authorizing Actions	**Summary**	**Applicable Project Component**
Colorado Dept of Public Health and Environment (CDPHE)		
Air Pollution Emissions Permit or Notice per Colorado Regulation #3	Regulate/permit air emissions from stationary sources under EPA's National Ambient Air Quality Standards (NAAQS)	Facilities subject to Colo Regulation #3 which could include compressors, boilers, condensate tanks, internal combustion engines, fugitive VOC emissions
Hydrostatic testing discharge permit	Regulates discharges of water during pipeline integrity testing	Project gas pipelines
Stormwater Discharge Permit	Stormwater Construction Permit	Applies to all construction activities
Colorado Department of Transportation		
Transport permit	Permit for oversize, over length and over weight loads	Transporting equipment /materials on state highways

Colorado Dept. of Natural Resources, Oil and Gas Conservation Commission		
Rules and regulations	Drilling and spacing orders, safety regulations	Well facilities
Drilling application	Submitted for each well, generally after approval of the APD from the BLM.	All wells
Local permits, approvals and authorizing actions	**Summary**	**Applicable Project Component**
Mesa County road use authorization	Overweight and over length loads on county roads	Transportation of equipment/materials on county roads only

2.2.17 Waivers, Exceptions, Modifications (WEM's)

The Proposed Action includes considering granting exceptions to the NSO lease stipulation for Wetland/Floodplain/Riparian area protection for the following locations:

- 21-12 to 20-11: gathering line will cross one (1) drainage in SW1/4 of Section 20.
- 20-6 to lease boundary: gathering line crosses three (3) drainages in NW1/4 of Section 20.
- 21-2 access road: crosses one (1) drainage located in the center of the N1/2 of Section 21.

In addition the action alternatives include considering granting an exception to the NSO lease stipulation for High Geologic Hazards for about 200 feet of the 21-12 to 20-11 gathering line located in the center, N1/2 S1/2 of Section 20. See Figures 2.3 and 2.4.

2.2.18 Minor Forest Plan Amendment

The Proposed Action and Alternative 3 include considering a minor Forest Plan Amendment to change visual quality objective from "partial retention" to "modification" for the compressor area (or the combined facility) and the 20-6 pad to allow alteration of existing viewshed (natural terrain, form, line, color and texture) for the duration of these facilities.

2.2.19 Other Project Considerations

The prior timber sale primarily lopped and scattered tops, limbs and cull logs. Some of that slash will be used for reclamation and soil stabilization purposes.

2.3 Alternative 2 –Proposed Action – 32 Gas Wells Directionally Drilled From Five Locations with Surface and Buried Pipelines and a Compressor Facility

Selection of Alternative 2 could include approving all or parts of the project as proposed in Activities Common to all Action Alternatives and the following sections, along with identifying any mitigation measures that may be necessary and granting exceptions as listed in 2.2.17.

2.3.1 Compressor Site (NE¼SW¼ Section 17, T9S, R92W, 6th P.M.)

The site would be located adjacent to and accessed from NFSR 266, and authorized under a Special Use Authorization. The site is located in sagebrush and grasses and is immediately south of a small ridge that will buffer some noise and provide some concealment from the public traveling south on FS 265.

The 3.7 acre site would house two 1,500-hp compressors, a gas dehydration unit, and three (3) 300-barrel storage tanks for water and condensate. The site will be fenced around the perimeter and gated. To allow easier access to the compressor site, the roadbed of NFSR 266 will be raised approximately five (5) feet, adjacent to the facility to minimize the amount of additional cut and grade to the entrance. The access road would be designed for heavy truck traffic as well as winter operations.

The compressor site would be authorized under a FS SUA, and is not subject to the terms of the oil and gas lease, however the compressor location is subject to standards and guidelines in the LRMP and any mitigation that may be identified in the NEPA analysis.

2.3.2 Pipeline System

If producible quantities of gas are found, then an estimated 4.3 miles of 8-inch and 12-inch welded steel gas gathering line would be needed to carry gas from wells to the proposed compression facility (see also Section 2.2.5).
Gas gathering lines (those that run from the drilling locations to the compressor facility under Alternative 2) will either be buried adjacent to existing NFSRs or new access roads, run cross-country and be buried, or laid on the surface in some sections to reduce visual and surface effects as shown on Figure 2.3. In addition, because of the geologically unstable nature of some of the areas the gathering lines will be crossing, surface pipe can move independently if a slump should happen to occur, preventing the line from parting. Some incidental vegetation removal may be required to lay the surface lines. Gathering lines along existing roads will follow the road corridor but will stay outside of the road bed and shoulders to prevent any unnecessary damage to the roads or road drainage feature. For gathering lines buried in new road construction, the pipeline will be installed along the uphill or cut side of the access road. Any disturbance to existing and proposed road surfaces will be repaired and surfacing replaced in conjunction with gathering line placement. Any culvert inlets and catch basins will be reconstructed in conjunction with gathering line placement.

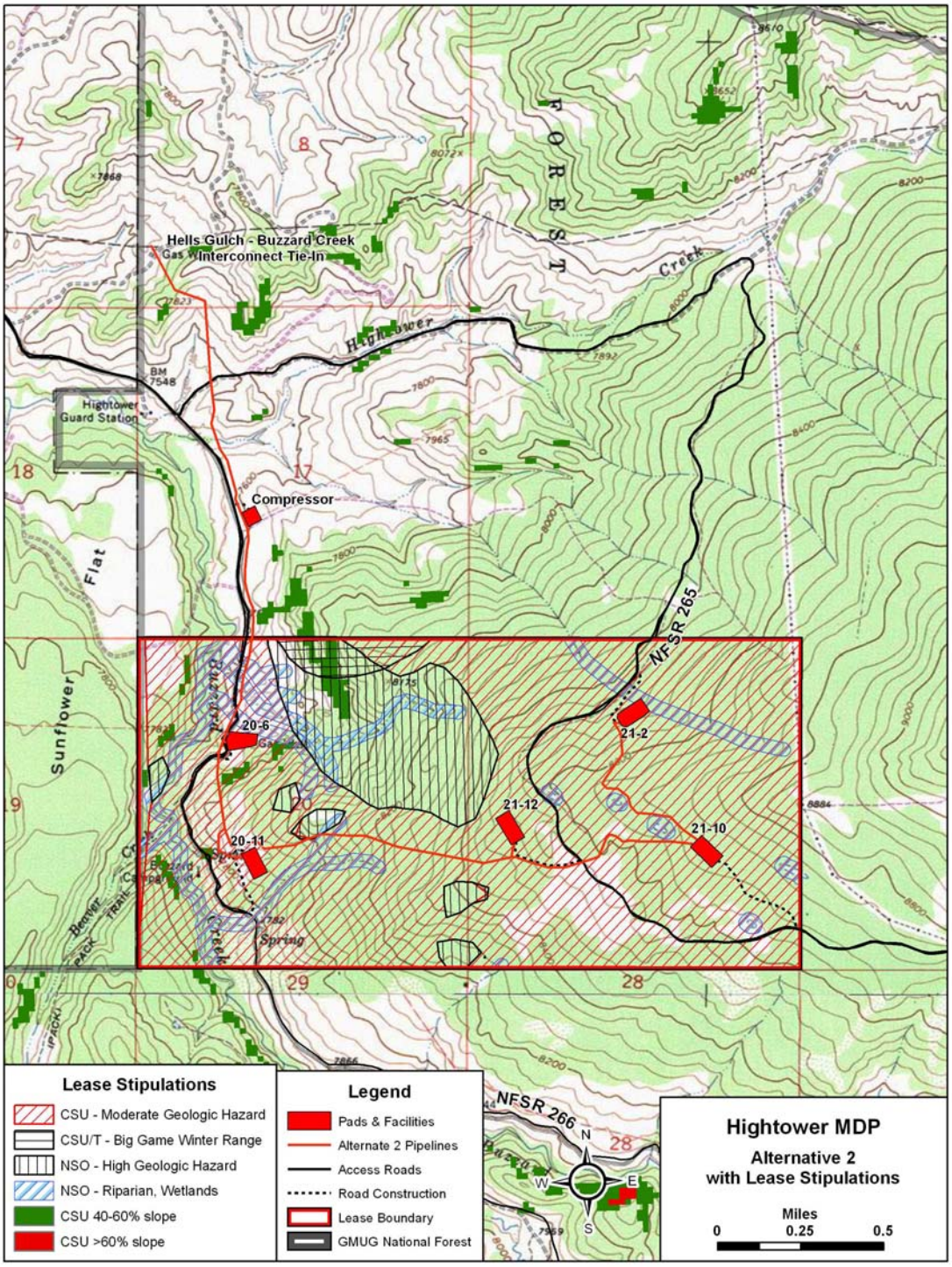
Alternative 2 also include 0.9 miles of 12 inch buried sales pipeline from the compressor station north to tie into the existing Hells Gulch-Buzzard Creek Interconnect Pipeline for transport to Duke's (formerly Momentum Energy's) processing facility near Molina or to the Quester facility south of Silt for final treatment.

The gas gathering and sales line segments under Alternative 2 are listed in Table 2.3.2.

Table 2.3.2. Summary of Pipeline Segments, Alternative 2.

Pipeline Segment	Construction Type	Length (ft)	Length (miles)
Sales line	Buried	4600'	0.9
Compressor to 21-2	n/a	n/a	n/a
21-2 to 21-10	Surface	3078'	0.3
21-10 to NFSR 265	Surface	1900'	.4
NFSR 265 to 21-12 tie	Buried @ access road	1300'	.2
21-12	Buried	284'	0.05
21-12 tie 20-11 tie	Surface	4922'	0.9
20-11	Surface	799'	0.2
20-11 tie to 20-6 tie	Surface	1393'	0.3
20-6	Buried	156'	0.03
20-6 tie to compressor	Buried	4282'	0.8
Total length	**Buried** **Surface**	10,622' 12,092'	2.0 2.3

Figure 2.3 Proposed Action (Alternative 2).



2.3.3 Disturbance Estimates

Table 2.3.3 summarizes the short term disturbance for Alternative 2 of the Hightower project. Of the estimated 55 acre disturbance due to construction of the project, approximately 42.5 acres will be short-term disturbance and reclaimed during interim reclamation. The travel surface of access roads and a portion of each drilling location will remain un-vegetated for the life of the project.

The assumption is that surface gathering lines will have minimal short-term and no long-term disturbance. Other than incidental vegetation removal/trimming during pipeline construction, no blading of the surface line route will be required. After interim reclamation, approximately one (1) acre of each drilling location will remain un-vegetated for the life of the project. Except for vertical cuts, after re-vegetation of access road cut and fill slopes, the average disturbed width of roads (including shoulders and ditches on either side) will be reduced to 24 feet (includes running surfaces, crown and ditch and vertical cuts). The area of road and pipeline disturbance will be reduced from 24.8 acres to 3.2 acres. The cross-country buried pipeline will be reclaimed and re-vegetate the entire length resulting in zero acres of long term disturbance. The compressor facility will remain at 3.7 acres of long-term disturbance. Therefore, after successful vegetation of access road cut and fill slopes, the majority of each drilling location, and the buried cross-country pipeline, it is estimated that approximately 12.5 acres of FS land will remain un-vegetated for the approximate 20 to 30 plus year project life (Table 2.3.3).

Table 2.3.3. Disturbance Estimates, Alternative 2.

Disturbance Area Description	Short term Dimensions	Short term acres disturbed -includes cut and fill slopes except where noted	Long term disturbance acres-working area remaining, cuts and fills are reclaimed.
Compressor site	400’ x 400’	3.7	3.7
20-6 pad	245 x 496	4.5	1.0
20-11 pad	250 x 495	5.8	1.4
21-2 pad	260 x 495	6.1	1.1
21-10 pad	250 x 475	5.2	1.3
21-12 pad	250 x 495	5.4	1.3
Access Roads	5875’ x 24’	3.2	3.2
Pipeline	9322’ x 75’ construction width (buried line*) 12,092 x 20’ construction width (surface line)	21.6	0
TOTAL DISTURBANCE		55.0 acres	12.5 acres

Note: total pipeline length shown does not include 1,300 ft segment along the access road to the 21-12, as this segment is counted in the road dimensions.

2.3.4 Ancillary Features

If producible quantities of gas are found, the drilling locations could have the following: one (1) wellhead and production meter per producing well; two (2) two-phase multi-well separator packages on each drilling location; up to five (5) 400-bbl produced-water/condensate storage tanks per drilling location; and remote telemetry equipment.

Production measurement for the wells, as identified in the Onshore Oil and Gas Order No. 5 will be on-lease at the well site. Remote telemetry equipment for production monitoring purposes is used as much as possible to reduce the amount of vehicular traffic.

Natural gas produced within the Hightower project area would be transported via the gas gathering system to the Hightower compression facility, compressed, and then moved on to the Hells Gulch to Buzzard Interconnect Pipeline then to a larger transmission line for final treatment at one of the facilities earlier identified (See section 2.3.2).

2.3.5 Well Operation and Maintenance

Periodic access to well locations by tanker trucks will be required year-round to remove produced water from the drilling locations to disposal facilities. To facilitate winter access for removal of produced water, snow removal along NFSR 265, NFSR 266, and lease access roads will be conducted as necessary. Winter road use operations would be authorized under a Road Use Permit.

2.3.6 Produced Water Disposal

If producible quantities of gas are found, then water produced from gas extraction will need to be handled. Produced water will be stored in tanks at each well location and will be hauled off by truck and disposed at a regional commercial disposal facility or will be delivered when possible to the Hells Gulch to Buzzard Interconnect Pipeline from the processed gas at the compressor and then transported to a regional commercial facility.

The estimated amount of traffic associated with produced water disposal would be four (4) 80-barrel tanker trucks making one (1) trip per day, assuming all 32 proposed wells are producing. Approximately 4.7 miles of NFSRs 265 and 266 would be traveled to service all five drillpads. Based on experience in other producing gas fields to the east of the Hightower area, more truck trips may be needed during the first six (6) months of production. However, this is anticipated to decrease to the four (4) per day noted above. A produced water study was prepared by the proponent, and is in the project file.

2.4 Alternative 3 –All Buried Pipelines and Central Facility

Alternative 3 was developed by the IDT to address the frequency of tanker truck traffic to haul away produced water. Alternative 3 is the same as Alternative 2, except that a) all gas gathering lines would be buried, b) produced water would be transported to a central facility via water lines that would be installed in the same trench as the gas lines, c) it includes an additional 7,819 feet of gas gathering line between the central facility and the 21-2 location, d) it includes building a central tank battery and compressor facility (hereinafter referred to as the central facility), and e) could reduce the amount of well site facilities.

The following activities were described in the Proposed Action and remain the same for Alternative 3: Well Drilling and Completion, Dry Hole/Non-Producing Wells, Project-Related Vehicle and Equipment Traffic (reduced with Alternative 3), Construction Maintenance, Spill Procedures, Interim Drilling Location and Pipeline Corridor Reclamation, Additional Permit Requirements and Plans, Waivers, Exceptions and Modifications (WEMS) and Design Criteria.

Alternative 3 will have a larger amount of short term disturbance than Alternative 2 on account of additional buried pipeline, a larger footprint for the central facility and increased clearing for all buried pipelines (see Table 2.4.3). Alternative 3 will reduce the frequency of access required to service the pads, as produced water will be transported via pipeline to the central facility. Snowplowing would be limited to accessing the central facility and maintaining a snowmobile

parking areas nearby. Winter access to well sites for routine servicing would be via snowcat or snowmobile.

2.4.1 Combined Central Tank Battery/Compressor Facility (Central Facility) (Center, E1/2 W1/2 Section 7, T9S, R92W, 6th P.M.)

The site would be located adjacent to and accessed from NFSR 266. The site is located in sagebrush and grass meadow flats approximately 300 feet north of the compressor location in Alternative 2.

The central facility encompasses approximately 5.5 acres and would house one 2,000 barrel condensate storage tank and two 2,000 barrel water storage tanks, two compressors, a three phase production unit, and a truck turn around (possibly to accommodate the "super" tanker trucks, capable of transporting 150 barrels with additional 80-barrel trailer capacity). The site will be fenced around the perimeter and gated.

2.4.2 Pipeline System

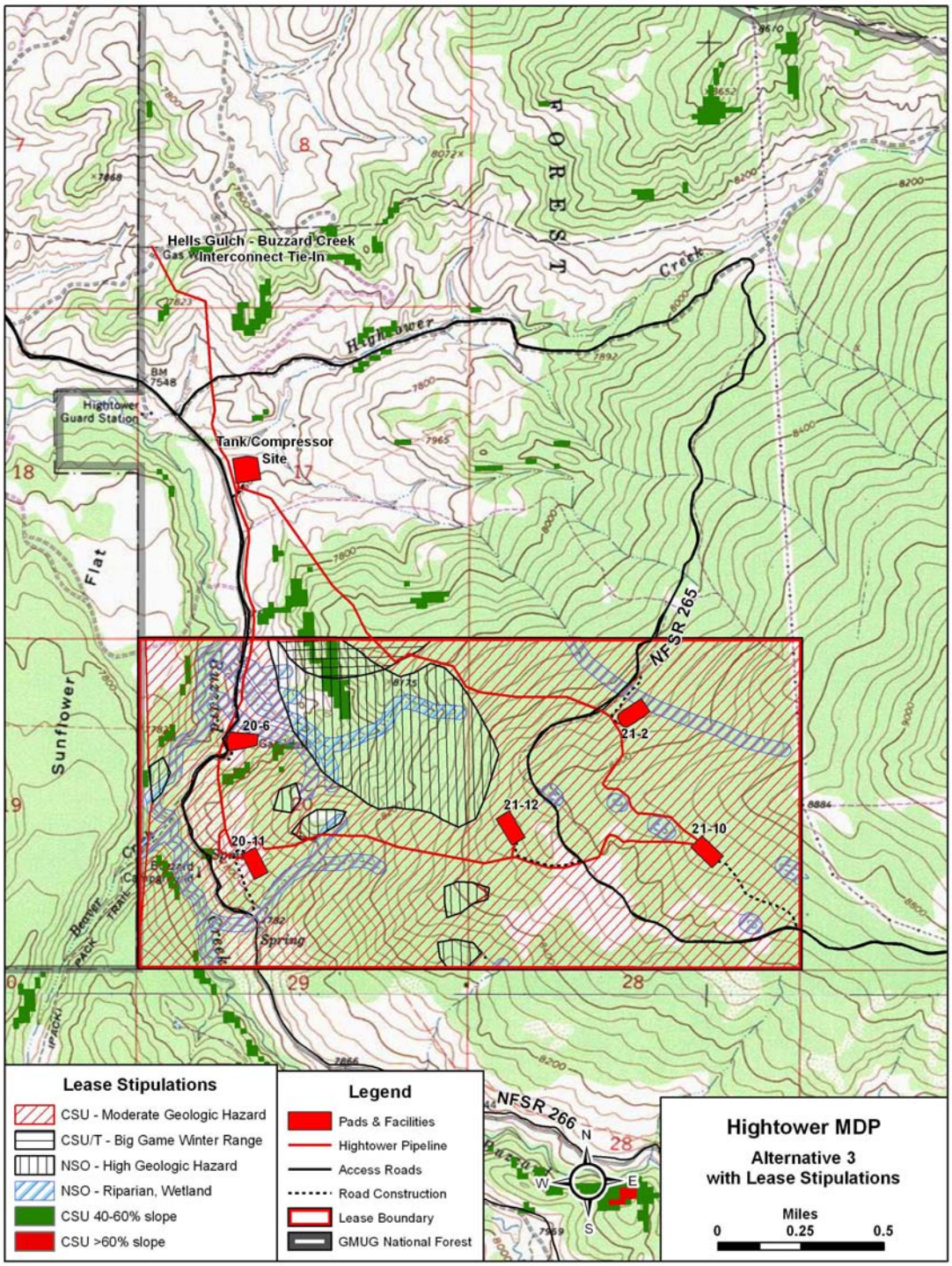
Under Alternative 3, approximately 5.5 miles of 8-inch and 12-inch welded steel gas gathering line will be needed to carry gas from individual wells to the central facility. Water and condensate lines will be placed in the same trench as the gas lines and will transport produced water from the drilling locations to the central facility to be further transported (see Section 2.4.6 Produced Water Disposal). Although the waterline's main purpose would be to transport produced water to the central facility, these lines will be capable of bi-directional use so that water could be pumped from the central facility to wells during drilling and completion.

All gas gathering and water lines associated with Alternative 3 will be buried adjacent to existing forest road corridors or cross-country. Gas pipelines along existing roads will follow the road corridor, but will stay outside of the road bed and shoulders to prevent any unnecessary damage to the roads themselves. For pipe buried in new access road construction, the lines will be installed along the uphill or cut side of the access road. Alternative 3 pipeline segments are listed in Table 2.4.2.

Table 2.4.2. Summary of Pipeline Segments, Alternative 3.

Pipeline Segment	Construction Type	Length (ft)	Length (miles)
Sales line (from the central facility to Hells Gulch-Buzzard Creek Interconnect)	Buried	4600'	0.9
Compressor to 21-2	Buried	7819'	1.5
21-2 to 21-10	Buried	3078'	0.6
21-10 to NFSR 265	Buried	1900'	0.4
NFSR 265 to 21-12 tie	Buried	1300'	0.2
21-12	Buried	284'	0.1
21-12 tie 20-11 tie	Buried	4922'	0.9
20-11	Buried	799'	0.2
20-11 tie to 20-6 tie	Buried	1393'	0.3
20-6	Buried	156'	0.03
20-6 tie to compressor	Buried	4282'	0.8
Total length	Buried	30,533'	5.8

Figure 2.4. Alternative 3 – All Buried Lines



2.4.3 Disturbance Estimates

Table 2.4.3 summarizes the short-term and long-term disturbance for the Hightower project under Alternative 3. Of the estimated 85.5 acre disturbance due to construction of the project, approximately 70.7 acres will be short-term disturbance and reclaimed during interim reclamation. The travel surface of access roads and a portion of each drilling location will remain un-vegetated for the life of the project.

After interim reclamation, approximately one (1) acre of each drilling location will remain un-vegetated for the life of the project. Except for vertical cuts, after re-vegetation of access road cut and fill slopes, the average disturbed width will be reduced to 24 feet. The area of new access road and pipeline disturbance will be reduced from 53.5 acres to 3.2 acres. The cross-country buried pipeline will be reclaimed and re-vegetate the entire length resulting in zero acres of long term disturbance. The central facility will remain at 5.5 acres long-term. After successful interim reclamation of access road cut and fill slopes, the majority of each drilling location and the buried cross-country pipeline, it is estimated that approximately 14.8 acres of FS land will remain un-vegetated for the approximate 20 to 30 plus year project life.

Table 2.4.3. Disturbance Estimates, Alternative 3.

Disturbance Area Description	Short term Dimensions	Short term acres disturbed -includes cut and fill slopes except where noted	Long term disturbance acres-working area remaining, cuts and fills are reclaimed.
Central facility	400’ x 400’	5.5	5.5
20-6 pad	245 x 496	4.5	1.0
20-11 pad	250 x 495	5.8	1.4
21-2 pad	260 x 495	6.1	1.1
21-10 pad	250 x 475	5.2	1.3
21-12 pad	250 x 495	5.4	1.3
Access Roads	5875’ x 24’	3.2	3.2
Pipeline	29,233’ x 75’ construction width (buried line*)	50.3	0
TOTAL DISTURBANCE		85.5 acres	14.8 acres

Note: Total pipeline length shown above does not include 1,300 ft segment along access road to the 21-12 as this segment is counted with the road dimensions.

2.4.4 Ancillary Features

Under this alternative, if producible quantities of gas are found, the drilling locations could have the following: one (1) wellhead allocation meter per producing well; two (2) two-phase multi-well separator packages per drilling location; one (1) 100-300-bbl produced-water/condensate storage tanks per well bore; one (1) 1000 gallon glycol storage tank per drilling location; one (1) 1000 gallon scale inhibitor tank per drilling location; and remote telemetry equipment.

Production measurement for the wells, as identified in the Onshore Oil and Gas Order No. 5 will be on-lease at the well site. A sales metering station will be located on the south end of the central facility, prior to compression.

2.4.5 Well Operation and Maintenance

Same as Alternative 2, except that winter access to service drilling locations will be by snowcat or snowmobile for routine maintenance. Snowplowing would be authorized under a Road Use Permit to the central facility and to maintain a snowmobile parking area just south of the central facility. Emergency access to well sites requiring snow removal would be under a separate authorization and handled on a case by case basis.

2.4.6 Produced Water Disposal

Tanks on the well sties are generally for testing, short term storage, and for emergency back up purposes. However, produced water may be held in interim storage on the well locations in the storage tanks and periodically transferred via pipeline to the central facility or transferred immediately to the central tank battery. Pickup trucks would service the area as needed when roads are open, and water hauling would occur from storage tanks at the central facility to an off site commercial water disposal facility. However, the option may also exist, depending on scheduling of construction, to transport produced water directly via a buried waterline connecting the central facility to the Hells Gulch to Buzzard Interconnect Pipeline.

The estimated amount of traffic associated with hauling produced water, is the same as Alternative 2, except that year round travel on NFSRs 265 and 266 is reduced from 4.7 miles of forest road to 0.5 miles of forest road. Further, the central facility could accommodate the "super" tanker trucks with capacity for transporting 150 barrels and an additional 80 barrels in a tank trailer. Snow removal to the central facility will be required and would be authorized under a Road Use Permit.

2.4.7 Project Schedule

Same as Proposed Action, with addition of longer construction of central facility, additional pipeline segment from the 21-2 to the central facility, and buried gas and water lines in same trench.

2.5 Alternatives Not Considered in Detail

Other alternatives for the Hightower MDP were considered during development of the Proposed Action. Certain options were evaluated; however, were not carried forward for detailed analysis for the reasons described below.

2.5.1 Use Fewer Drill Sites

Initial options considered for the Hightower MDP included using three (3) drilling locations, one of which would have 16 directionally drilled wells. Field evaluation of this potential location indicated that the size of the drill site could not be field-fit without damaging existing ponds and riparian areas, and would encroach on some unstable soils; therefore, this concept was not considered further.

2.5.2 Site Selection

Field evaluation of other conceptual drill locations were reviewed and modified to protect surface resources and minimize surface effects. These modifications included the following:

- A conceptual drill location in the NE1/4, SW1/4, Section 21, immediately east of NFSR 265, was relocated to the north and west to eliminate effects on visual quality adjacent to NFSR 265.

- Drill location HT 20-6 is located on a reclaimed well site with a plugged and abandoned well and was reviewed several times to assess the most reasonable site orientation. Due to the location

of adjacent drainages on the north and south side of the old well site, it was agreed to relocate the 20-6 pad down slope of the reclaimed well to reduce encroachment on the drainages. The FS also recommended 300-400 feet of re-alignment of NFSR 266 to allow placement of the pad to minimize disturbance. The FS Soil Scientist was also concerned about encroaching on the toe of a landslide feature and the amount of cut and fill that would be needed. This location has been fit to the landscape to have the least amount of surface disturbance and eliminate encroachment on wetlands.

- Additional components of designing the project included identifying a suitable site for the compression facility. Placement of the compressor site was adjusted/modified during surveying to reduce the visual effect and the amount of cut and fill required. Field reviews also considered optimal placement of the gas gathering system.

- The apparent crossing of a pond by the pipeline between the 21-2 and 21-10 was re-routed to the east to avoid this feature.

2.5.3 Use of Injection Wells to Handle Produced Water

During development of the Proposed Action, consideration was given to installing water injection wells on the drilling locations so that produced water could be injected on site, thereby, eliminating the need for trucking produced water year-round. Currently, data is being collected to identify a subsurface layer where the mineral estate would not be affected. Any future proposal for a disposal well will require a separate environmental analysis. If this action is approved, by other federal and state permitting agencies, it will be an appurtenance at the compressor site and will not result in additional surface disturbance to National Forest System lands.

2.5.4 Seasonal Drilling Operations

The Forest Service also considered drilling operations to occur in the snow free months. This was not considered in detail because portions of the oil and gas regulatory framework limit the agency's ability to limit operations on an oil and gas lease for more than 60 days if operations proposed are consistent with lease terms. As the proposal brought forward by the company and accepted by the agency included winter operations that were not otherwise limited by timing limitations on the lease, this was carried forward as the proposed action. Further, the FS assessed that should seasonal drilling be used, that implementation of the project would occur over a period of 5 years or more, thereby extending the time in which recreationists, other permittees and on-going uses of the area would be influenced. Input from interested parties did not raise specific concerns regarding winter use.

2.6 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in Table 2.6 is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2.6. Comparison of Alternatives Effects Summary

Resource Area	No Action	Alternative 2 Proposed Action	Alternative 3
Drilling locations (Short-Term) Drilling locations (Long-Term)	n/a	27 acres disturbed 6.1 acres disturbed	27 acres disturbed 6.1 acres disturbed
Roads (Long- and Short-Term)	n/a	3.2 acres disturbed	3.2 acres disturbed
Gathering Lines (Short-Term only)	n/a	21.6 acres disturbed	50.3 acres disturbed
Project Disturbance (short term) **Project Disturbance (long term)**	**n/a**	**55 acres** **12.5 acres**	**85.5 acres** **14.8 acres**
Length of buried pipe not removed (in feet) during final reclamation	n/a	10,622	30,533
Length of surface pipe	n/a	12,092	0
Alt 2 Compressor (Long- and Short-Term) or Alt 3 Central Facility (Long- and Short-Term)	n/a	3.7 acres disturbed	5.5 acres disturbed
Air Quality	Regional trend indicates decline in air quality	No effects above established Significant Impact Levels. One day in three years may see visibility effects greater than 0.5 deciviews at Maroon Bells Wilderness Area (Class I area) and Raggeds Wilderness (Class II area). Negligible contributions to to alpine lakes.	Same as Alt 2.
Geologic Hazards	Current activities and processes would continue	No overall contribution to instability. Two sites of specific study survey and monitoring needed.	Same as Alt. 2
Soils	Current activities and processes would continue	Direct effects to about 55 acres of soil in short term, 12.5 in long term. Any disturbance effects local soil productivity.	Direct effects to about 85 acres of soil in short term, 14.8 in long term. Any disturbance effects local soil productivity.

Resource Area	No Action	Alternative 2 Proposed Action	Alternative 3
Water Resources	Current activities and processes would continue	About 39 acre-feet water use. No measurable effects to surface and ground water quality/quantity-	Same as Alt 2
Wetlands/Riparian areas	Current activities and processes would continue	No project activities in jurisdictional wetlands. Minor effects to riparian areas. Design Criteria mitigate effects.	Same as Alt 2
Vegetation	Current activities and processes would continue	55 acres disturbed, temporary change in vegetation type after reclamation.	85.5 acres disturbed More ground disturbance subject to weed infestation. Same as Alternative 2.
Vegetation-aspen regeneration clearcuts	n/a	13 acres, regeneration expected.	Same as Alt. 2
Range	Current grazing levels continue	5.5 temporary reduction in AUMs, minor increase in forage after interim and final reclamation.	8.5 temporary reduction in AUMs, minor increase in forage after interim and final reclamation.
Fisheries & Wildlife	Colorado River Fish	May effect, likely to adversely affect Co river fish species. Fish species covered under Programmatic BO	Same as Alt. 2
	Federally listed species	Canada lynx-Not likely to adversely affect.	Same as Alt. 2
	Sensitive Species	May adversely impact individuals, but not likely to results in a loss of viability in the planning area, nor cause a trend to federal listing or a loss of species viability range-wide.	Same as Alt. 2
	MIS	All MIS species evaluated had no negative effects to population trends	Same as Alt. 2

Resource Area	No Action	Alternative 2 Proposed Action	Alternative 3
Cultural Resources	Current activities and processes would continue	Excavations may, but are unlikely to, uncover cultural resources. If cultural resources are discovered, operator must follow Design Criteria requirements.	Same as Alt 2
Recreation	Current activities and processes would continue	Short term disruption of hunting during construction/drilling. Short and long term effect on snowmobiling on NFSR 266	Same as Alt 2, but only a short term effect on snowmobiling on NFSR 266 during drilling/completion
Visual Resources	Current activities and processes would continue	Near field: Visible surface pipelines, 20-6 pad and compressor site Far field: visible pipeline corridors. Minor effects from Minor Forest Plan Amendment	Same as Alt.2, except more buried pipeline corridor would be visible.
Socioeconomics	n/a	Rents and royalties will be paid. Established industry not expected to increase work force. Production is unknown as this area is exploratory.	Same as Alt 2
Transportation: Pad and Access Construction One way trips[1]	n/a	17 average, 20 maximum	Same as Alt 2
Transportation: Pipeline Operations One way trips[1]	n/a	18 average, 32 maximum	Same as Alt 2
Transportation: Drilling Operations One way trips[1]	n/a	7 average, 30 maximum	Same as Alt 2
Transportation: Completion Operations One way trips[1]	n/a	43 average, 100 maximum	Same as Alt 2
Produced Water Hauling (access)	n/a	Daily travel on NFSRs 265 and 266 to each drill pad (approx. 4.7 miles of travel on NFSRs)	Reduces travel to 0.5 mile
Winter Access	n/a	Snowplowing 4.7 miles of NFSRs 265 and 266 to five drill pads and compressor site	Reduces snowplowing to 0.5 mile.

1. Transportation figures are the average number of additional vehicles/day that are anticipated for each phase of the project.

CHAPTER 3- AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section summarizes the physical, biological, social and economic environment of the affected project area and the potential changes to those environments due to implementation of the alternatives. It also presents the scientific and analytical basis for comparison of alternatives presented in the chart above.

3.0 Past, Present and Reasonably Foreseeable Future Actions

As defined in 40 CFR 1508.7 (regulations implementing NEPA), other past, present, and reasonably foreseeable future actions must be identified for the cumulative effects analysis. The analysis is dependent on identification of past, present, and future actions in the vicinity that could affect the same resources and overlap in the geographical and/or temporal manner with the anticipated effects from the Proposed Action. The geographical areas considered for these potentially interrelated actions vary among resources, since a remote activity may contribute to cumulative effects for one resource, while not contributing to cumulative effects for other resources. Past, present, and reasonably foreseeable future actions likely to contribute to cumulative effects for those resources affected by the Proposed Action are listed in Table 3.0. A description of the cumulative effects area for each resource is included at the beginning of each resource section in this chapter.

The Hightower area has been managed primarily for range and timber management to date. The DOW has used the area for moose re-location efforts, with good success. Recreational uses occur primarily during big game hunting season with associated dispersed camping and ATV travel. Nearby, gas well drilling on BLM and private land throughout the Plateau Valley has increased over the past five years as well as to the east on the White River National Forest in the Alkali Creek area. The proposed project would contribute to the effects already felt in the area from energy development. Cumulative effects associated with the two action alternatives are discussed in each resource section that follows.

Figure 3.0a shows some of the previous activity in the area that may apply to cumulative effects in the individual resource areas. See following individual resource sections for specific effects. Table 3.0 displays a list of past, present and reasonably foreseeable future actions in the project vicinity. Not all of the activities listed in the table fall within the cumulative effects analysis area for every resource area analyzed in this chapter. The cumulative effects analysis for each resource incorporates the applicable activities listed on the table that occur within the cumulative effects analysis area defined for the specific resource.

Table 3.0. Summary of Past, Present and Foreseeable Actions

Activity Type	Description	Specifics	Time Period	Location relative to project area
Livestock Grazing/use	Buzzard allotment	2188 cow/calf grazing	Mid June to Mid July & Mid September to Mid October	Within project area
	Porter allotment	Cattle trailed through project area en route to Porter allotment on NFSR 266	Mid May to early June & Mid October to Mid November	NFSR 266
	Sheep trailing	Sheep trailed from Collbran through project area on NFSR 266, stopping overnight at Hightower Guard Station on each trip	Around 6/24-25 & 9/24-25	NFSR 266
Misc Forest Service activities/facilities	Sheep Creek Soil and Watershed Rehabilitation Project 1946-1962	Contour trenches crossed by the project were constructed in 1961 for erosion control. Trenches are typically 8' wide x 1.5' deep, 50' spacing interval.	1961	North of NFSR 265, crossed by the gas sales line
	Hightower Guard Station	Pasture used for FS horses. Storage in buildings. Two fresh water wells and an irrigation ditch	Ongoing	Just north of NFSR 265/266 intersection
Timber management	Crooked Creek Timber Sale	Aspen timber sale, 121 acres	1998 and 2000	East of WAPA power line from Gunnison NF boundary north to 0.5 mile from Buzzard Cow Camp
	Hightower Timber Sale	Aspen timber sale, 174 acres	2003-2007	Units located along NFSR 265

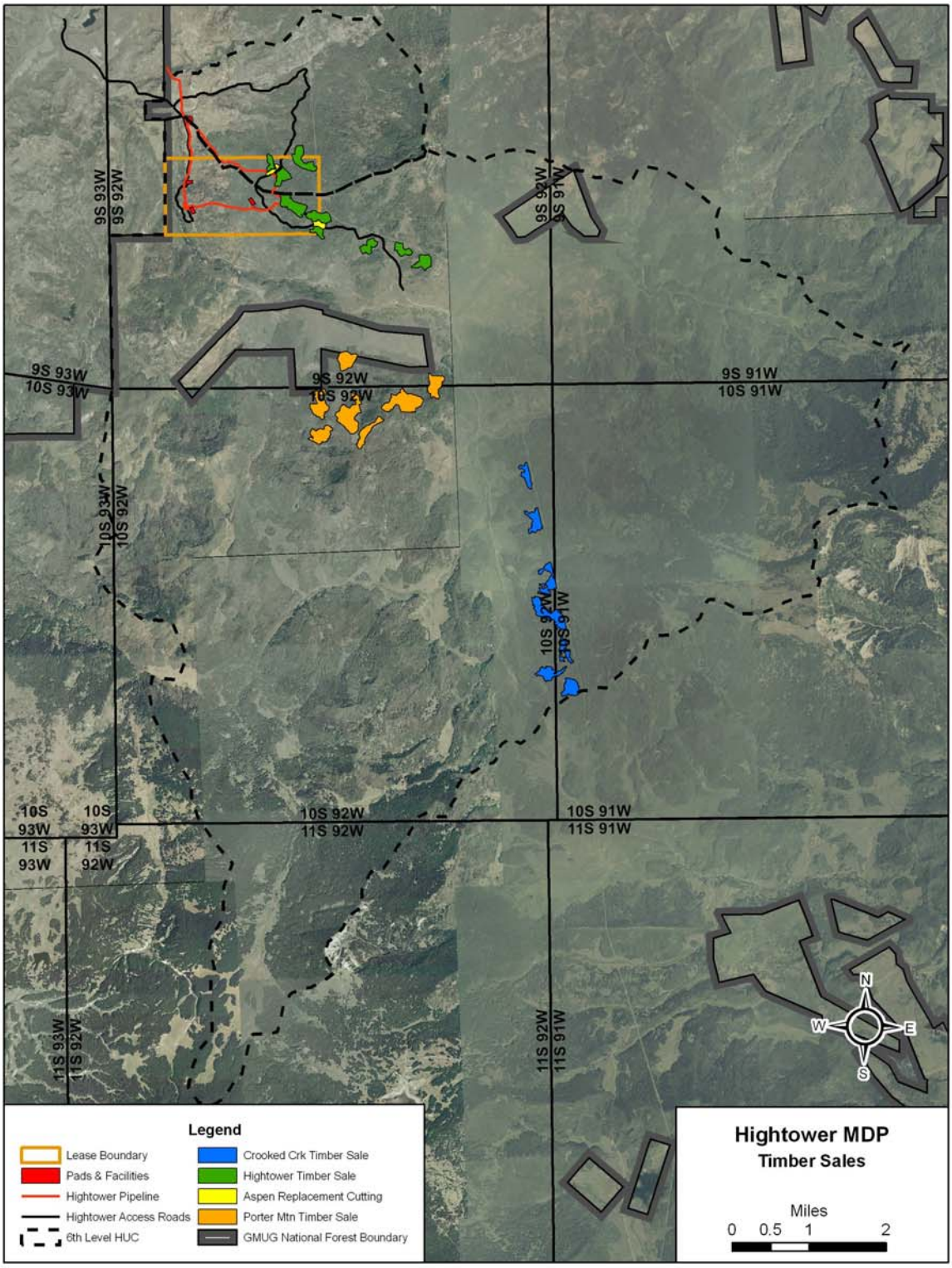
	Porter Mountain Timber Sale	Aspen timber sale, 262 acres. Summer hauling along NFSR 265; winter hauling along NFSRs 265 and 266. 6-8 loads/day.	2006-2011	Sale is 3 miles south of project area; haul route through project area.
	Personal use firewood collecting	Non-commercial use fuelwood gathering	Summer-fall	NFSR 265 and 266
Wildlife management	Moose relocation-DOW project	Ongoing project, moose released on private land on Harrison Creek , BLM land and in the Hightower project area.	Jan 2005-present	Within project area
	Moose exclosure fence	Buzzard Creek near Owens Creek	2008	2 miles south of project area
Recreation	Sunlight-Powderhorn trailhead	Snowmobile access to the S-P trail south on NFSR 266	Winter	NFSR 266
	Camping, fishing, big game hunting	Dispersed camping along Buzzard Creek, NFSR 265. Fishing in Buzzard Creek; hunting throughout area	May-November	Within project area
	Hiking/horseback riding/ATV riding	Trails primarily used by ATV's. ATV's permitted on NFSR 266, portion of NFSR 265, NFST 523 and 524	May-November	Within project area
	Outfitter-guides	a. Chuck Davies-drop camp 5miles east on Owens Creek. Summer and fall use b. TNT High Mountain-7 miles south accessed via NFSR 265. Fall use c. Hills Guide Service-Plateau Creek area, west of project area. Summer and fall use	June-November	Surrounding project area

Special Uses	WAPA power line	Electrical transmission powerline and maintenance ROW	1962-present	East of project area, accessed from NFSR 265
	Source Gas pipeline	Six inch diameter gas sales line	1961-present	1.5 miles north of project area
	Hells Gulch-Buzzard Creek interconnect pipeline	Sixteen inch diameter wet gas line and four inch waterline. Follows Source Gas pipeline alignment near project area	2007-present	1.5 miles north of project area
	Northwest pipeline	Transmission lines from Maralex Resources USA 1-16 and 1-17 wells, to Source Gas pipeline.	1982-present	1 mile north of project area, accessed along NFSR 265
	Delta Compressor station	3 compressers for Vega Gas Unit	Ongoing	Harrison Creek at CR330E, 4 miles east of project area
Oil and Gas	Maralex Resources USA 1-16SC and USA 1-17SC wells	Natural gas wells, Sheep Creek field Not currently producing	1981-present	1 mile north of project area, accessed along NFSR 265
	Delta Petroleum, Vega Gas Unit	7 wellpads located on BLM land	As of August 2007	4 miles west of project area
	Delta Petroleum, Vega Gas Unit	Vega Oil and Gas Unit Plan of Development, Phase One: approximately 27 wells directionally drilled from three pads, T9S, R93W, Sections 34 and 35; T10S R93W, Section 10. Decision signed by BLM December 2007	2008-2009	4 miles west of project area
	Delta Petroleum, Vega Gas Unit	Vega Oil and Gas Unit Plan of Development, Phase Two: Directional drilling from two pads, dependent upon results from Phase One	Analysis not yet begun	4 miles west of project area

	Delta Petroleum, Vega Gas Unit	Five additional pads planned on non-federal land/minerals	Future action	4 miles west of project area
	Hells Gulch South (formerly Hightower Mountain)	PXP, 10 wells, 2 pads, 1 compressor site Section 2, T9S, R92W	Ongoing	White River NF, Alkali Ck, four miles from project area
	Hells Gulch North Phase One	PXP, 36 wells, 3 pads and associated pipelines and road, Sections 23, 24, 25, 26, T8S, R92W	Ongoing	White River NF, Alkali Ck, six miles from project area
	Hells Gulch North Phase Two	PXP, 52 wells, 7 pads and associated pipelines and road, sections 23, 24, 25, 26, T8X, R92W (Note: of this, 45 wells and 6 pads are on NFS and remainder is on private land)	Analysis in progress	White River NF, Alkali Ck, six miles from project area
	Drilling on private lands	Throughout Plateau Valley , north and south of CR 330E	Ongoing	West of project area
	10 acre infill drilling at Hightower	COGCC has approved 10 acre downhole spacing in the area. Could entail construction of additional two wellpads.	Not known	Applies to lease area.
Minerals	Currier Gravel Pit	Active gravel pit located on private land along CR 71.4 approximately one mile from forest boundary	Ongoing	Approximately 2 miles north of project area.
Roads	NFSR 265	County Road Dept maintains, applies mag-chloride to portion of road accessing project area. Road used for access to Buzzard Creek grazing	Ongoing	In project area

		allotment, sightseeing, camping, hunting and ATV access, access to private land inholdings, and access to Hightower Mountain and Porter Mountain timber sales Forest seasonal road closure from Dec 1 to May 30 to protect soft roadbed.		
	NFSR 266	County Road Dept maintains. Road used for access to Buzzard Creek and Porter Mountain allotments, and sheep driveway. Also used for access to fishing, camping, ATVing, and S-P snowmobile trail, as well as access to private land inholdings and Porter Mountain timber sale.	Ongoing	In project area
	NFSR 270	AKA Silt-Collbran Road. County Road Depts maintain. Road used for access to Alkali Creek area on White River National Forest. Current traffic includes hunters, snowmobilers, grazing access. Will be traveled by service vehicles during drilling and operations in the Hightower and Hells Gulch areas	Ongoing	4 miles north of project area
	NFSR 281	Open to all vehicles from May 31-November 30.	Ongoing	Directly north of project area, intersects NFSR 265

Figure 3.0a Previous Timber Sales



3.1 Air Quality

Land management and development activities both on and off federally managed lands can potentially affect air quality on these lands. Air pollution is transient and can be transported over long distances, with a potential to contribute to effects over a large area. Air pollutants of concern include fine particulate matter, nitrogen oxides, sulfates, volatile organic compounds, and carbon monoxide. Elevated concentrations of these pollutants can adversely effect human health, reduce visibility, cause acidic deposition in sensitive, high-elevation lakes and contribute to the formation of ground level ozone.

Local emission sources of these pollutants on and off federally managed lands include highway vehicles, wildland fires, slash burning, wood burning stoves, and industrial facilities, including those associated with oil and gas exploration and development. It is these latter emission sources that currently dominate air quality concerns in the Western Slope Region of Colorado.

This section of the EA presents a summary of the air quality evaluation conducted to assess potential effects from the Proposed Action. The analysis area used for Air Quality modeling is shown in Figure 3.1.

3.1.1 Methodology

The following tasks were performed for the assessment of near-field and far-field air quality effects for Hightower MDP project:

1. Preparation of the air pollutant emission inventory for the Hightower project.
2. Used CALMET meterological data that was developed for a project analysis east of Hightower that is also applicable to the Hightower area in December 2006. The data was used to drive the CALPUFF atmospheric dispersion model, based on the Mesoscale Meteorological Model (MM5) developed by Pennsylvania State University and the National Center for Atmospheric Research.
3. Preparation of the cumulative emissions inventory.
4. Assessment of the far-field air quality effects of the Hightower project and cumulative sources using the CALPUFF dispersion model.
5. Assessment of potential visibility effects within mandatory federal Class I areas and sensitive Class II wilderness areas.
6. Assessment of the total sulfur and nitrogen deposition effects within mandatory federal Class I areas and sensitive Class II wilderness areas.

Criteria Pollutants

Significance criteria for potential criteria pollutant, effects include the Federal Prevention of Significant Deterioration (PSD) Class I increments, the Colorado Ambient Air Quality Standards (CAAQS) and National Ambient Air Quality Standards (NAAQS). For comparison, the CAAQS, NAAQS and PSD Class I increments are summarized in Table 3.1.2a. Note that PSD Class I increments do not exist for carbon monoxide and fine particulates (PM2.5). PM2.5 emissions were included in the analysis because of that pollutant's effect on visibility. Carbon Monoxide (CO) emissions will not be included because they do not have designated Class I increments and CO emissions have no effect on visibility or acid deposition.

For regulatory purposes, PSD increment consumptions are calculated from baseline dates and include adjustments for source emission increases and decreases that have occurred since the baseline dates. However, for purposes of this air quality assessment, PSD increment consumption comparisons were provided on an informational basis and do not constitute a regulatory increment consumption analysis.

Project Emission Calculations

A "most likely" emissions scenario was used for the air quality effect analysis. The "most likely" approach is designed to provide emission estimates typical for the industry and is not necessarily equivalent to the "worst case," or "potential to emit" methodologies used by air quality permitting agencies. On a regional basis, the traditional "worst case" methodology may yield unreasonably high effects that do not represent actual conditions. The "most likely" approach provides the USFS with the most useful information for assessing the potential environmental effects of the Hightower project.

The methodologies used for quantifying emissions were in accordance with EPA publication AP-42, Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, industry input, State of Colorado guidance, and good engineering practices. The emission inventories were derived based upon activity parameters indicative of the magnitude of the operational actions, combined with emission rate factors and process modeling to quantify emission rates.

The air quality modeling done for the Hightower Project assumed a load factor of 42 % to estimate the contribution of drill rig engine emissions. This number was derived from the air quality model which was run for the Jonah Infill Drilling Project EIS (USDI-BLM, January 2006) Data from drilling specifically in the Piceance Basin from 2007 showed load factors ranging from 22% for 18 day/well drilling, to 31% for 13 day/well drilling program (PXP, S. Rusch, 2/28/2008). The Hightower air quality model used the best available information, and took a conservative approach. Based on data and experience in the same gas-producing basin, it is expected that actual drill rig emissions would be less than that assumed in the model. The Hightower project includes Design Criteria (Table 2.2.15) for air quality designed to minimize air quality effects, including use of lower emission (Tier II) engines. Other BMPs to reduce emissions resulting from production, transmission and processing operations are listed on the EPA's Natural Gas STAR program website at www.epa.gov/gasstar/bmp.htm.

Far-field Modeling

The CALMET Model Version 5.53a Level 040716 was used to develop the meteorological files needed for the modeling. Dispersion modeling was conducted using CALPUFF Version 5.711a Level 040716. The post processing was completed using CALPOST Version 5.51 Level 030709.

Visibility Criteria

The visibility analysis followed the recommendations in the FLAG 2000 Guideline document referred to as Method 2. Specifically this analysis will compare both the project's potential visibility effect and cumulative visibility effects to "natural" background conditions to determine the change in extinction.. A 0.5 deciview (5% change in extinction) threshold is used as the threshold of concern for individual project effects. A 1.0 deciview (10 percent change in extinction) threshold is used as the threshold for adverse visibility effects. Projects or cumulative sources with predicted effects above these thresholds may be considered to have significant effects to visibility in a Class I (or sensitive Class II) area depending on the frequency and magnitude of the modeled effects and other relevant factors.

Visibility degradation at identified areas of concern were evaluated in terms of number of days greater than or equal to the deciview thresholds utilized by the U.S. Forest Service Federal Land Managers. There are no applicable federal, state, or local visibility standards.

Acid Deposition

Potential acid neutralizing capacity (ANC) effects were calculated manually by applying the screening methodology prescribed by the US Forest Service (USDA-FS, January 2000a). Total annual nitrogen (N) and sulfur (S) deposition fluxes as averaged by CALPOST were input to the following equations to calculate the potential change in ANC.

As indicated above, baseline alkalinity levels for the high elevation lakes of concern are required for the ANC effect calculations. Baseline ANC data was obtained from USFS (Jeff Sorkin, personal communication, January 11, 2006). The basis for the background ANC data is the 10th percentile of measurements observed at the lake outlet.

A full resistance model is provided in CALPUFF for the computation of dry deposition rates of gases and particulate matter as a function of geophysical parameters, meteorological conditions, and pollutant species. Terrestrial deposition effects were predicted for dry and wet nitrogen (N) and sulfur (S) chemical species using the CALPUFF multiple-resistance routine for predicting dry deposition and the empirical scavenging coefficient approach for predicting wet deposition. Further Technical discussion can be found in the Air Quality Technical Support Document (TSD) located in the project file and which is available upon request To provide ecological effect relevance, the effects to Acid Neutralization Capacity (ANC) was reported for selected sensitive lakes using the deposition data for the receptor at each lake.

Cumulative Sources Emissions

Four types of sources were included in the cumulative CALPUFF analysis:

- The first type is sources with emissions greater than 100 tons per year within the modeling domain.

- The second type of sources are those greater than 25 tons per year in areas defined as follows from the outer boundary of each Class I area: 35 km north, 35 km south, 10 km east, and 80 km west. These distances were used to ensure extensive inclusion of minor and area source emissions upwind from the potentially affected areas.
- Based on the emissions and location criteria, a listing of sources within the modeling domain was requested and received from the Colorado Air Pollution Control Division (CDPHE David Thayer via email).

- The third type of cumulative sources is the full development scenario envisioned for potential additional drilling that could occur in and immediately east of the Hightower project areas. An additional 208 wells could be drilled in the future, based on results of the current proposed projects.

- The fourth group of sources was NEPA projects that are approved such that the emissions can be categorized as reasonably foreseeable future actions (RFFA).

3.1.2 Regulatory Framework

The Clean Air Act (1963), as amended in 1977 and 1990, mandates the establishment of national ambient air quality standards to protect human health and welfare, and prevent significant deterioration of air-quality-related values (AQRVs), and protect natural visibility in Class I Areas. In Colorado, the primary responsibility for enforcing NAAQS rests with the Colorado Department of Health.

Ambient Air Quality Standards

Congress passed the Clean Air Act (CAA) in 1960 with subsequent amendments made in 1967, 1970, 1977, and 1990. The purpose of the Act is to protect the quality of the nation's air resources and along with human health and welfare.

Administration of the Clean Air Act (CAA), while a federal law, is a state responsibility. In Colorado, this task falls under the State's Department of Health and Environment, Air Pollution Control Division. The Act established National Ambient Air Quality Standards (NAAQS), which were generally adopted by the State of Colorado along with more stringent Colorado Ambient Air Quality Standard (CAAQS) for sulfur dioxide (SO2, 3-hour averaging time).

The NAAQS and CAAQS define the maximum legally allowable concentration of each criteria pollutant. Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), and particulate matter less than 10 microns (PM10) and less than 2.5 microns (PM2.5), sulfur dioxide (SO2) and lead (Pb). The NAAQS and CAAQS are displayed in the table below (Table 3.1.2a). The Project Area is located within an area designated as attainment for all these criteria pollutants.

Figure 3.1 Air Quality Analysis Project Area

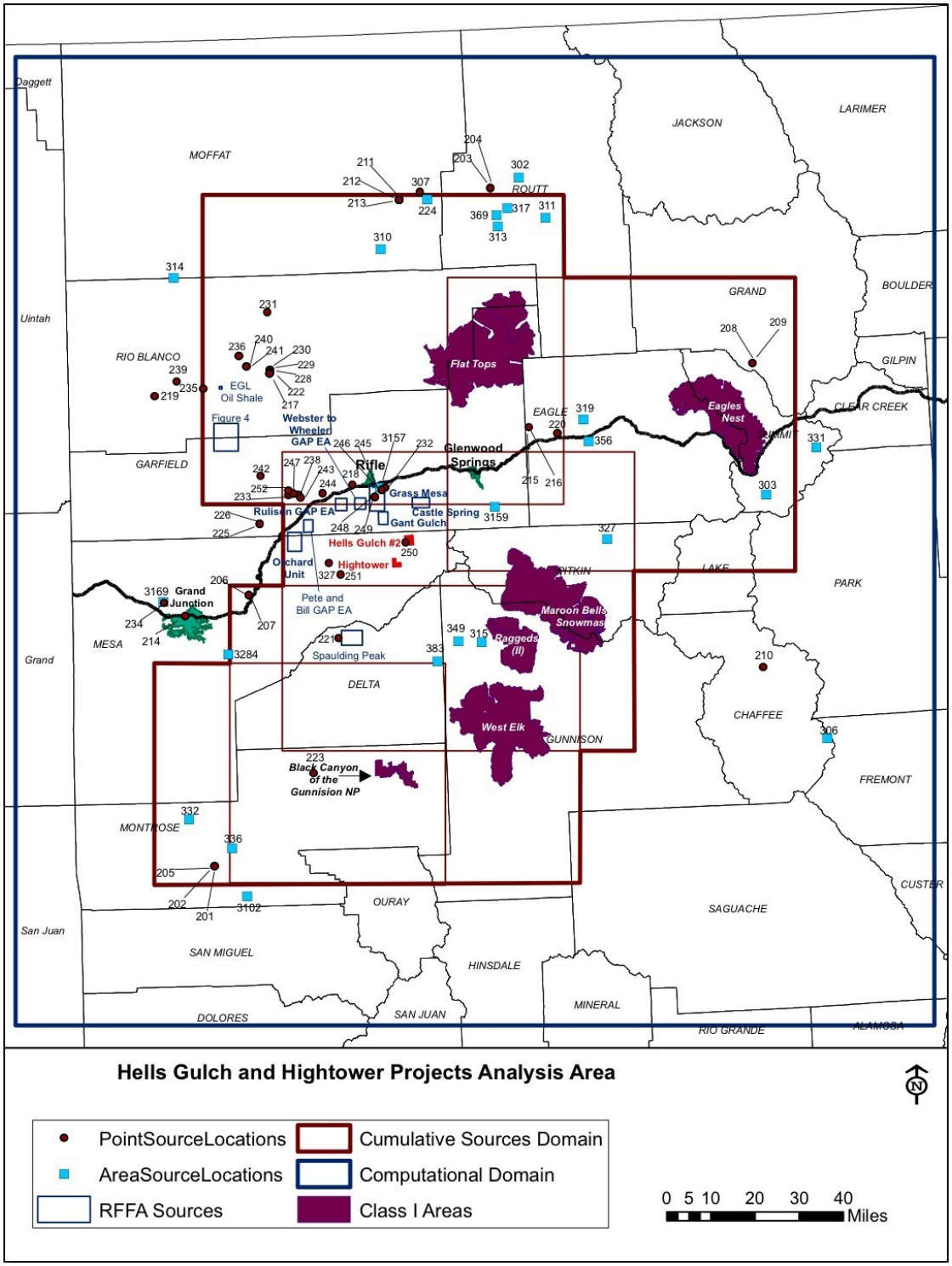


Table 3.1.2a. Applicable Ambient Air Quality Standards

Pollutant	Averaging Time	**NAAQS (µg/m3) 1**	**CAAQS (µg/m3) 2**	**PSD Class I Increment (µg/m3) 3**
NO_2	Annual	100	100	2.5
	24-hour	150	150	8
$PM_{2.5}$	Annual	15	15	NA
	24-hour	35	35	NA
PM_{10}	24-hour	150	150	30
SO_2	Annual	80	15	2
	24-hour	365	100	5
	3-hour	1300	700	25

1 National Ambient Air Quality Standards from 40 CFR Part 50
2 Colorado Department of Health and Environment, Air Pollution Control Division
3 SO2 expressed as allowable increases over an established baseline.

Class I Air Quality Protection

The Clean Air Act outlines different levels or classes of air quality protection. Class I areas include areas designated as wilderness as of August 7, 1977, that are 5,000 acres or greater in size. These areas have the most stringent degree of protection from current and future air quality degradation. Within the geographic scope of analysis there are five Class I areas and one Class II area as described in Table 3.1.2b below.

Table 3.1.2b. Class I and Sensitive Class II Areas

Sensitive Area	**Federal Land *Manager***	**PSD Designation**	**Distance from *Hightower Project Area (miles) [km]***
Black Canyon of the Gunnison NP	National Park Service	*I*	44.1[73.5]
Flat Tops WA	*U.S. Forest Service*	*I*	36.6 [61.0]
Eagles Nest WA	*U.S. Forest Service*	*I*	*69.4 [115.7]*
West Elk WA	U.S. Forest Service	*I*	*31.2 [52.0]*
Maroon Bells-Snowmass *WA*	*U.S. Forest Service*	*I*	24.1 [40.2]
Raggeds WA	*U.S. Forest Service*	*II*	22.5 [37.5]

Under the Clean Air Act's PSD provisions, the Forest Service has "…an affirmative responsibility to protect the air quality- related values (including visibility)…" within a Class I area it manages. As part of this responsibility, the Forest Service and National Park Service monitor air quality related values (AQRV's) in several Class I areas in the vicinity of the project area. The Wilderness Act (1964) directs the Forest Service to preserve and protect the natural condition of designated wilderness areas, including the intrinsic wilderness value of air quality in all Wilderness Areas. Class II wilderness areas in Colorado are given similar air quality protections under the Wilderness Act and Colorado Clean Air Act.

Table 3.1.2c identifies the levels of acceptable change for these areas (Federal Land Manager's Air Quality Related Values Workshop (FLAG) Phase I Report, December, 2000.

The Grand Canyon Visibility Transport Commission (GCVTC), created by Congress in 1991, advises the EPA on strategies for protecting visual air quality in national parks and wilderness areas on the Colorado Plateau.

The EPA's Regional Haze Regulation specifies that states must establish goals to improve visibility to natural background conditions in Class I areas.

Grand Mesa, Uncompahgre, and Gunnison National Forest's (GMUG) Land and Resource Management Plan, as amended 1991. Direction specific to air resource management states the following: "Comply with state and federal air quality standards."

Other resources can be found at FSM 2580.

Table 3.1.2c. Levels of Acceptable Change (LAC)*

AQRV	**Concern Threshold (LAC)**
Visibility	
	Effects greater than or equal to 0.5 deciview (5% change in extinction)
	Effects greater than or equal to 1.0 deciview (10% change in extinction)
Water	1 ueq/liter reduction in acid neutralizing capacity in lakes with ANC <= to 25
	10% reduction in acid neutralizing capacity in lakes with ANC>25
	No change for lakes with ANC <=0
*from: http://www.fs.fed.us/r6/aq/natarm/r2/class1r2.htm	

3.1.3 Affected Environment

The Hightower project is located approximately 19 miles south-southeast of Rifle, Colorado in Sections 8, 17, 20 and 21 of T8S R92W. For the purposes of modeling, the Hightower was modeled in conjunction with the Hells Gulch II project on the White River National Forest because they fall within the same cumulative sources modeling domain. The project locations as well as other cumulative sources are shown in Figure 3.1. The explanation and magnitude of emissions of the cumulative sources is in the Technical Support Document (TSD), located in the project file and available upon request. This will result in a comprehensive analysis for the project as well as a cumulative effects analysis.

The Hightower project (combination of alternatives) would include the following activities that affect air quality:

- Construction of five 5.5-acre drilling locations;
- Each pad could have five to seven wells (the first well a vertical well and then subsequent directional wells), two 2-phase 1.0 MMBtu/hr heaters, a 1,000 gallon glycol storage tank for glycol injection in the gas steam to prevent freezing, 1,000 gallon tank for scale inhibitor used to inject scale inhibitor down the wellbore to prevent scaling, and thirty-two 100-300 barrel blowdown tanks (one for each wellhead);
- Construction of 1.1 miles of new access roads;
- Construction of 5.5 miles of buried pipelines;
- Construction of 5.5 acre central facility with future operation of two Caterpillar 3516 Lean Burn 1,340 horsepower or Caterpillar 3506 1,340 hp compressor engine, one gas dehydration unit, one 3-phase separator, possible vapor recovery unit, electric-powered transfer pumps, electric generator, and three 2,000-barrel tanks (2 for water and 1 for condensate);
- Vehicle traffic (road dust and tailpipe emissions); and
- Three 2,150 horsepower diesel-fueled drill rig engines.

The following emissions sources from the above activities would consist of the criteria pollutants (nitrogen oxides [NOx], carbon monoxide [CO], particulates [PM10 and PM2.5], sulfur dioxide [SO2], volatile organic compounds [VOC]), and hazardous air pollutants (HAP). Emissions were calculated for the following activities and sources:

- Drilling location, pipelines and road construction: earth-moving equipment producing fugitive dust, and earth-moving equipment exhaust;
- Drilling: vehicles generating fugitive dust on access roads, mobile source emissions, and drill rig engine exhaust;
- Completion: vehicles generating fugitive dust on access roads and mobile source emissions;
- Mobile source emissions associated with all development phases;
- Gas drilling location operation: two-phase separator, flashing and breathing emissions from a condensate tank, dehydration unit;
- Compressor station: compressor engines.
- Mobile source and fugitive dust emissions associated with operations.
- Gas well pad operations: 2-phase separator, flashing and breathing emissions from condensate tank.

Cumulative effects area is based on a regional model including parts of eastern Utah and Western Colorado. For a full list of cumulative sources see the TSD .

Emissions

The representative activity parameters for the Proposed Action include the following:

- Weight for representative categories in the vehicle fleet;
- Expected vehicle miles traveled
- Road alignments in the project area;
- Drilling rig size and hours of operation per well;
- Size, fuel consumption rates and throughput rates for production equipment including separators, condensate tanks, and dehydrators;
- Operational parameters for production equipment including temperatures and pressures;
- Representative produced wet gas and condensate composition,
- Size and potential location of central compression facilities; and

Transportation of the produced natural gas will require additional compression horsepower. For compressor engines, emissions levels were assumed to be equal or less than 1.5 g/hp-hr Nitrogen Oxides (NOx). These emission rates are typical for a "Lean Burn" engine controlled with an oxidation catalyst or a "Rich Burn" engine controlled with a three-way catalyst.

Emissions of NOx and fine particulates less than 2.5 microns in diameter (PM2.5) would occur from the combustion of natural gas from the compressor engines, central amine and dehydration heater boilers, and dehydration heater boilers on the drilling locations. PM10, those particles less than 10 microns in diameter, and PM2.5 emissions would result from project vehicles driving on the access roads to service the wells. For equipment-specific project emissions calculations see the TSD. Emission inventories are compiled by the Colorado Air Pollution Control Division for each county in the State. These inventories indicate that within the general region where the proposed project is located there has been an increase of each of these air pollutants over time. *(http://www.epa.gov/air/data/geosel.html*.) This information is consistent with what one would expect as this region sees a growth in population, highway vehicle travel, and oil and gas development.

Table 3.1.3a contains the most recent (2004) reported pollutant totals for Delta, Garfield, Gunnison, Mesa, and Pitkin Counties. This table includes both mobile and stationary sources. All but volatile organic carbons (VOC) are criteria pollutants. Ozone is a secondary pollutant formed from VOC and NOx, and is not included in this table.

This data is summarized from the WRAPEDMS database (http://www.wrapair.org/forums/ef/docs.html) and maintained by the Western Regional Air Partnership (WRAP).

Table 3.1.3a. 2004 Reported Emissions (tons per year) per County in Western Colorado

Pollutant	Delta	Garfield	Gunnison	Mesa	Pitkin
NOx	1,461	8,006	1,131	6,554	714
CO	14,356	36,394	13,200	49,427	8,413
PM	1,914	29,891	1,065	1,771	218
PM10	2,577	3,326	1,966	7,056	1,016
VOC	18,421	42.617	22,152	37,414	11,623
SO2	81.7	139.6	43.2	3,124.3	20.5

NAAQS and CAAQS

No ambient air quality monitoring of NAAQS and CAAQS occurs within the project area. An estimate of background concentrations was obtained from the Draft Roan Plateau Resource Management Plan Amendment/Draft Environmental Impact Statement (BLM 2004). This data, derived from ambient air measurements collected by the Colorado Air Pollution Control Division (APCD), is considered representative of conditions in and near the project area.

The existing air quality in the five-county area appears good based on the regional monitoring data. For the most part, air pollution emission sources are limited to industrial facilities, transportation emissions along the I-70 corridor, and residential emissions in the small communities Table 3.1.3b lists background concentrations of pollutants that have National Ambient Air Quality Standards (NAAQS), and the Colorado Air Quality Standards (CAAQS).

Table 3.1.3b. Background Concentrations (ug/m3)

Pollutant	Annual	24-hour	8-hour	3-hour	1-hour	Monitoring Station Location
PM10	24	54	-	-	-	Rifle, Garfield Cnty. (1998-2000)
PM2.5	7	19	-	-	-	Grand Junction, Mesa Cnty (1999-2001)
NO2	34	-	-	-	-	Colorado Springs, El Paso Cnty (1998-2000)
CO	-	-	4,444	-	8,000	Grand Junction, Mesa Cnty (1999-2001)
SO2	11	39	-	110	-	Colorado Springs, El Paso Cnty (1998-2000)
*Values were recommended by Colorado Department of Public Health (CDPHE) based on the air quality measurements in the region.						

Visibility and Air Quality Related Value Monitoring

On the Grand Mesa, Uncompahgre and Gunnison N.F. and the White River N.F., current monitoring of air-quality-related values indicates that there is existing visibility impairment in the wilderness areas managed by the forest. Monitoring parameters include visibility through the Interagency Monitoring of Protected Visual Environments (IMPROVE) program, acid deposition through the National Acid Deposition Program (NADP), and lake chemistry.

Visibility is best characterized by the standard visual range (SVR) parameter, which represents the greatest distance at which a large, dark object can be seen by the human eye. Visibility-related background data are collected as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Visibility is monitored at two IMPROVE sites on the WRNF. They are located on Aspen Mountain on the Aspen Ranger District and near Ripple Creek Pass on the Blanco Ranger District.

SVR values (the latest available) are summarized in Table 3.1.3c for the Class I areas closest to the Project Area (also identified as areas with AQRV of concern for this project by the FS).

Table 3.1.3c. Measured Visibility at Class I Areas

Class I Area	Distance and Direction from Project [1] (miles)	SVR Values [2]		
		10th % (miles)	50th % (miles)	90th % (miles)
Maroon Bells – Snowmass Wilderness	23 miles E	56	96	163
Flat Tops Wilderness [3]	32 miles NNE	82	131	187
West Elk Wilderness	37 miles SSE	59	118	162
Black Canyon of the Gunnison National Park [4]	49 miles SSW	80	111	153
Eagle's Nest Wilderness	67 miles ENE	65	140	195

[1] *Distances estimated from Class I area boundary nearest the Project Area.*
[2] *SVR values from the U.S. Forest Service unless otherwise noted. Data can be found at: http://www.fs.fed.us/r6/aq/natarm/r2/class1r2.htm.*
[3] *Average SVR values from the IMPROVE data station (WHRI1) located in the White River National Forest (Average of 2001-2003 SVR values).*
[4] *Average SVR values from the IMPROVE data station (WEMI1) located in the Weminuche Wilderness Area (Average of 1991-2002 SVR values).*

SVR values presented in Table 3.1.3c represent the 10th, 50th and 90th percentiles of monitored visibility (for example, visibility is greater than or equal to 163 miles only 36.5 days per year [10% of the year] in the Maroon Bells - Snowmass Wilderness). Visibility effects resulting from the Proposed Action were assessed with respect to the deciview thresholds. A deciview is a index of visibility derived from SVR and light extinction measurements (b_{ext}), and was calculated to compare potential visibility effects at each Class I area with the 0.5 and 1.0 deciview thresholds of concern.

Some Class II areas have been designated as "sensitive" by the FS and were also included in the analysis. Visibility data is not available for these Class II areas to develop SVR values; however Raggeds Wilderness is approximately 26 miles from the project area.

Acid Deposition

The deposition of sulfate and nitrate species from air pollution sources may cause changes in water body chemistry and can effect the acid neutralizing capacity (ANC) of high elevation lakes.

Acid deposition monitoring occurs on the WRNF through two programs. The Environmental Protection Agency operates three sites under their National Acid Deposition Program (NADP) and lake chemistry (water sampling). These sites are located on Sunlight Peak and near the base of Sunlight Ski Resort on the Sopris Ranger District and near Ripple Creek Pass. Wilderness lakes are sampled each summer by the WRNF to determine baseline data and track trends in lake water chemistry.

Table 3.1.3d. Baseline ANC Levels for Lakes of Special Concern.

Location	Sensitive Lake	Background ANC (µeq/l)
Flat Tops WA	Ned Wilson	38.0
Flat Tops WA	Upper Ned Wilson	12.6
Maroon Bells WA	Moon	51.5
Raggeds WA	Deep Creek #1	44.3
West Elk WA	S. Golden	111.0

On the GMUG NF acid deposition and lake chemistry monitoring has been occurring at one site in the Raggeds Wilderness and one site in the West Elks Wilderness since 1990. E.P.A. operates a NADP monitoring site at the Rocky Mountain Biological Lab near Crested Butte Colorado. There are no IMPROVE sites within or nearby to the project analysis area on the GMUG NF

Results of these monitoring programs, displayed in Table 3.1.3d, indicate that background ANC levels on the WRNF and GMUG NF are low (<25 ueq/l) for one lake and approaching that level at others. Low ANC levels indicate a lake is sensitive to any additional deposition. Trend analyses of NADP data indicate an increase in nitrogen deposition in western Colorado since the program's inception in 1985 (http://nadp.sws.uiuc.edu/).

Climate

Climate related data is included, as it was needed for modeling analysis.

Temperature and precipitation profiles for the Project Area were estimated using long-term climate records from the Collbran, Colorado station (# 051741) located approximately 15 miles southwest at an elevation of 6,150 feet above mean sea level. Data collected from 1900 to 1999 (High Plains Regional Climate Center, 2005) indicates a maximum mean monthly temperature of 87 °F, a minimum mean monthly temperature of 9 °F, about 15 inches of average annual precipitation, and 65 inches of average annual snowfall. Table 3.1.3e provides a summary of this data on a monthly basis.

Table 3.1.3e. Hightower Project Area Climate

	Temperature (°F)		Precipitation (Inches)	
Month	Mean Maximum	Mean Minimum	Total	Snow
January	36	9	1.05	15.40
February	42	15	1.02	12.10
March	50	23	1.51	11.20
April	61	31	1.59	5.20
May	71	38	1.40	0.50
June	81	45	0.81	0.00
July	87	51	1.12	0.00
August	84	50	1.41	0.00
September	77	42	1.40	0.00
October	65	32	1.45	1.80
November	49	21	1.11	6.60
December	38	12	0.99	12.10
Annual	62	31	14.85	65.00
Data obtained from the High Plains Regional Climate Center, Collbran, CO (station #051741).				

Wind Direction
In mountainous terrain, such as in Western Colorado, winds are generally parallel to the major mountain ranges and can be greatly influenced by temperature gradients and complex terrain. This tendency is noted in the available wind data. The prevailing wind direction from each monitoring station is listed in Table 3.1.3f. Stations have different prevailing wind directions and there is generally no correlation amongst the monitoring stations on the east side or west side of the proposed project. However, the prevailing wind direction at each station is consistent throughout the year.
Winds in the stratosphere generally move weather and pollutants from west to east across the state.
At times of the year the winds swing from out of the northwest to the southwest. This is a significant consideration as it suggests the path air pollutants and effects, once aloft in the atmosphere, are likely to travel.

Table 3.1.3f. Prevailing Wind Direction from Airport Stations in Western Colorado. Data from 1992-2002. Source: Local Climatological Data Annual Summary.

Airport Station	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual Avg.
Rifle	S	S	W	W	W	W	W	W	W	W	S	S	West
Montrose	SE	SSE	SE	SE	SE	SE	SE	SE	SE	SE	SSE	SSE	South East
Eagle	E	E	E	W	W	WSW	E	E	E	E	E	E	East
Aspen	S	S	S	S	S	SSW	SSW	SSW	S	SSW	S	S	South
Gunnison	N	N	N	N	N	N	N	N	N	N	N	N	North
Wind direction is based on hourly data and is defined as the direction with the highest percentage of frequency. Wind direction denotes the direction from which the wind blows.													

3.1.4 Environmental Consequences

3.1.4.1 No Action Alternative

The No Action Alternative does not result in any additional pad, access road or pipeline construction activity or in any drilling, completion or production of wells. All activities currently acting on air resources in the project area would continue.

3.1.4.2 All Action Alternatives

Two Action Alternatives were developed for the project. The alternatives essentially involve different pipeline alignments and central facility placement, and longer construction periods due to the burying of pipeline in Alternative 3. Since the CALPUFF analysis focuses on the long-term conditions at the development level with drilling emissions included in the last year of development, the air quality effects would be similar for both action alternatives.

Emissions
Air quality effects from the Hightower MDP project would result from short term and long term pollutant emissions. Short term fugitive dust (PM 10 and PM 2.5) emissions and associated vehicle and equipment exhaust would be produced during construction of the five drilling locations, compressor facility, roads and pipelines, and from drilling and completion activities. Long term emissions would consist of drilling location and compressor facility emissions, and vehicle emissions from operations and maintenance activities. Drilling location emission sources include ten separator heater boilers (two on each drilling location); compressor facility sources include a gas dehydrator, two compressor engines, a three phase separator, a generator, and one 2,000 barrel condensate tank.

Emissions would consist of nitrogen oxides (NO_x), carbon monoxide (CO), Volatile Organic Compounds (VOC), fine particulates (PM10 and PM 2.5), sulfur dioxide (SO2) and hazardous air pollutants (HAP). Hydrogen sulfide, a candidate HAP) is not expected to be present in the gas.

Effects to Climate Change:
To address the project's effects to climate change, carbon dioxide and methane emissions associated with the project were estimated. Estimates for three drilling rigs are 4,749 tons per year of carbon dioxide and 0.96 tons/year of methane. The drilling phase is short term (12-16 months in duration).

Over the long term during the life of the wells, separator heaters and compressors will contribute to greenhouse gases. The ten wellsite separator heaters would contribute 5,151 tons/year of carbon dioxide and 0.061 tons/year of methane. The two compressor engines would contribute 3,284 tons/year of carbon dioxide and 8.26 tons/year of methane (Douglas, 2008).

Table 3.1.4.2a. Hightower Project Emissions (tons per year)

	Separator Units (1.0MMBtu/hr)	NOx Per Unit (tpy)	NOx Total (tpy)	CO Per Unit (tpy)	CO Total (tpy)	PM 2.5 Per Unit (tpy)	PM 2.5 Total (tpy)	PM10 (tpy)
Drill Location 20-6 (6 wells)	2	0.44	0.88	0.37	0.74	0.03	0.07	
Drill Location 20-11 (6 wells)	2	0.44	0.88	0.37	0.74	0.03	0.07	
Drill Location 21-2 (7 wells)	2	0.44	0.88	0.37	0.74	0.03	0.07	
Drill Location 21-10 (6 wells)	2	0.44	0.88	0.37	0.74	0.03	0.07	
Drill Location 21-12 (7 wells)	2	0.44	0.88	0.37	0.74	0.03	0.07	
Drill rig engine (3 rigs)		13.06	39.18	7.45	22.35	3.11	9.33	
Generator (one)		2.03	2.03	2.03	2.03	0.05	0.05	
Dehydration Unit (1.5 MMBtu)		0.66	0.66	0.24	0.24	0.05	0.05	
Two Cat 3516 1,340 hp compressor engines		19.39	38.78	22.8	45.4	0.46	0.93	
Truck Traffic			0.35				0.78	7.00
TOTAL PROJECT EMISSIONS (tons/year) WHILE DRILLING			85.4		73.72		11.47	7.00
TOTAL PROJECT EMISSIONS (tons/year) AFTER DRILLING			46.22		51.37		1.86	7.00

Table 3.1.4.2b. Hightower Analysis: Maximum Ambient Air Quality Effects in Class I/II Areas.

Class I Area	Pollutant[1]	Averaging Period	Ambient Air Concentration (µg/m^3)	PSD Class I/II Significance Level (µg/m^3)
Black Canyon of the Gunnison National Park	NO_x	Annual Avg.	7.04 E-04	0.1
	PM_{10}	Annual Avg	1.35 E-04	0.2
		24-hour Max	3.72 E-03	0.3
	PM 2.5	Annual Avg	5.62 E-051	None
		24-hour Max	1.68 E-03	None
Eagle's Nest Wilderness	NO_x	Annual Avg	1.38 E-03	0.1
	PM_{10}	Annual Avg	2.37 E-04	0.2
		24-hour Max	2.71 E-03	0.3
	PM 2.5	Annual Avg	9.74 E-05	None
		24-hour Max	1.14 E-03	None
Flat Tops Wilderness	NO_x	Annual Avg	4.95 E-03	0.1
	PM_{10}	Annual Avg	6.67 E-04	0.2
		24-hour Max	8.42 E-03	0.3
	PM 2.5	Annual Avg	2.67 E-04	None
		24-hour Max	2.68 E-03	None
Maroon-Bells/ Snowmass Wilderness	NO_x	Annual Avg	6.16 E-03	0.1
	PM_{10}	Annual Avg	9.00 E-04	0.2
		24-hour Max	1.74 E-02	0.3
	PM 2.5	Annual Avg	3.87 E-04	None
		24-hour Max	7.50 E-03	None
Raggeds Wilderness (Class II)	NO_x	Annual Avg	6.19 E-03	1.0
	PM_{10}	Annual Avg	7.26 E-04	1.0
		24-hour Max	1.89 E-02	5.0
	PM 2.5	Annual Avg	3.67 E-04	None
		24-hour Max	8.08 E-03	None
West Elk Wilderness	NO_x	Annual Avg	1.91 E-03	0.1
	PM_{10}	Annual Avg	3.08 E-04	0.2
		24-hour Max	7.07 E-03	0.3
	PM 2.5	Annual Avg	1.38 E-04	None
		24-hour Max	2.83 E-03	None

[1] *NO_2 is represented by NO_x for this analysis*

Potential ambient far-field effects resulting from the proposed project were calculated for the Class I and Class II areas identified in the geographic analysis area. Table 3.1.4.2b shows that the maximum ambient air concentrations of pollutants would be less than the Class I/II Significance Levels (i.e., the levels considered to cause or contribute to a NAAQS or PSD increment violation), indicating compliance with applicable air quality standards.

Visibility
Changes in visibility compared to the "natural condition" were below the U.S. Forest Service and National Park Service level of concern for individual projects (0.5 deciviews) at all locations except Maroon Bells Wilderness Area and Raggeds Wilderness Area. For the Hightower project, it is predicted that visibility effects greater than 0.5 deciviews would occur one time in three years at Maroon Bells and one time in three years at Raggeds Wilderness Area (not a Class I). See Table 3.1.4.2.c below for modeling results. Given the magnitude of the predicted effect (just over the 0.5 threshold), the frequency (1 day out of three years modeled), and the geographic extent (2 of 6 wilderness areas), the predicted effects do not constitute a significant contribution to visibility impairment in the Wilderness Areas.

Table 3.1.4.2c. Hightower Analysis: Maximum Visibility and Deposition Effects in Class 1 and Sensitive Class II Areas.

Class I or II Area	Max. Change in Deciview (Δdv)	Annual Number of days >0.5 dv	Annual Number of days >1.0 dv	Nitrogen Deposition (kg/ha/yr)
Black Canyon of the Gunnison National Park	0.088	0	0	2.97 E-04
Eagle's Nest Wilderness	0.069	0	0	5.71 E-04
Flat Tops Wilderness	0.244	0	0	1.73 E-03
Maroon-Bells/Snowmass Wilderness	0.522	1	0	2.00 E-03
West Elk Wilderness	0.107	0	0	6.12 E-04
Raggeds Wilderness	0.581	1	0	1.50 E-03

Acid Deposition
The deposition of nitrate and sulphate species from air pollution sources may cause changes in water body chemistry and can affect the acid neutralizing capacity (ANC) of high elevation lakes. Table 3.1.4.2e shows the effects of project emissions to ANC in Class I/II area lakes. ANC changes are below thresholds for all lakes analyzed indicating a neglible contribution to effects on ANC from the Hightower project.

Table 3.1.4.2e. Hightower Project Acid Neutralization Capacity Effects to High Elevation Lakes in Class I and II Areas.

Sensitive Lake	Location	LAC	Baseline ANC (ueq/l)	ANC Change (ueq/l)	Percent ANC Change
Ned Wilson	Flat Tops WA	10%	38.0	2.82 E-05	0.000049
Up. Ned Wilson	Flat Tops WA	1 ueq/liter	12.6	8.49 E-05	0.000401
Moon	Maroon Bells WA	10%	51.5	1.90 E-05	0.000001
Deep Creek #1	Raggeds WA	10%	44.3	2.01 E-05	0.000001
S.Golden	West Elk WA	10%	111.0	4.10 E-06	0.000001

Mitigation
To further understanding of levels of emissions from drill rigs in the Piceance Basin, the operator will be required to provide the FS with daily fuel consumption logs for the drill rigs throughout the entire drilling program.

3.1.5.1 Cumulative Effects

Cumulative air quality effects include effects from the proposed project as well as past, present and reasonably foreseeable emissions sources. The region surrounding the project area (including Delta, Garfield, Gunnison, Mesa and Pitkin Counties) has seen and will continue to see increased air pollution emissions concurrent with increases in air pollution sources such as oil and gas development and population growth.

The Colorado Department of Public Health and Environment identifies oil and gas exploration and development as the dominant air quality concern in the Western Slope region of the State. Other growing emission sources are directly related to population growth such as highway and recreation vehicles. As the industry and county populations continue to expand so, too, will emissions of air pollutants such as PM, NOx, CO, and VOC. The proposed project, by itself, is a nearly immeasurable contributor to air pollution emissions, while it adds to the cumulative effects associated with this regional growth the project does not make a significant contribution to the existing visibility impairment or to changes due to acid deposition.

Cumulatively in western Colorado, the analyses predict visibility effects greater than 1.0 deciview from 20 to 161 days in the six Class I areas (Table 3.1.5.1), due chiefly to existing emission sources. Table 3.1.4.2c shows that the contribution to visibility impairment from the Hightower project is negligible. The largest number of days was predicted at the Flat Tops Wilderness Area. The smallest number of days was predicted at the Black Canyon of the Gunnison National Park.

Effects to high elevation lakes from all cumulative sources evaluated are predicted to cause reductions in acid neutralization capacity ranging from 3 to 85 percent. The LAC for ANC would be exceeded at four of the five wilderness lakes analyzed (Table 3.1.5.2). Table 3.1.4.2e shows that the project does not measurably contribute to the LAC.

Table 3.1.5.3 shows that nitrogen and sulfur deposition rates are predicted to be highest in the Flat Tops Wilderness Area from cumulative sources, however, ambient air quality effects are predicted to be lower than allowable PSD increment thresholds. For regulatory purposes, PSD increment consumptions are calculated from baseline dates and include adjustments for source emission increases and decreases that have occurred since the baseline dates. However, for purposes of this air quality assessment, PSD increment consumption comparisons were provided on an informational basis and do not constitute a regulatory increment consumption analysis.

3.1.5.2 Summary
In summary, the Hightower MDP project would not result in exceeding NAAQS or wilderness lake water quality thresholds. Changes in visibility greater than 0.5 deciviews occurs one day in three years at Maroon Bells Wilderness Area and at Raggeds Wilderness Area.

Under the cumulative effects analysis, adverse air quality effects to Class I/II areas are predicted from current and future emissions sources in comparison to assumed natural visibility background and measured baseline ANC conditions. These effects are primarily due to emissions from power plants but also include emissions from oil and gas exploration and development as well as from a variety of mining and mineral-processing operations.

The results of this CEA underscore the importance of interagency cooperation in mitigating air quality effects from current and future emission sources. The Colorado State Air Pollution Control Division (APCD) has the authority and responsibility to manage and control existing air pollution sources. The Forest Service is working with the APCD through the Regional Haze State Implementation Process (SIP) (see http://www.cdphe.state.co.us/ap/regionalhaze.html) to manage and protect air quality in Class I areas.

Table 3.1.5.1 Maximum Cumulative Visibility & Deposition Effects in Class I and Sensitive Class II Areas[1]

Class I or II Area	Max. Change in Deciview (Δdv)	Annual Number of days >1.0 dv	Nitrogen Deposition (kg/ha/yr)	Sulfur Deposition (kg/ha/yr)
Black Canyon of the Gunnison National Park	6.03	26	0.0379	0.0559
Eagle's Nest Wilderness	6.05	78	0.0730	0.0493
Flat Tops Wilderness	10.21	156	0.1970	0.1210
Maroon-Bells/Snowmass Wilderness	11.59	98	0.0653	0.0464
West Elk Wilderness	5.74	37	0.0359	0.0365
Raggeds Wilderness	11.75	66	0.0522	0.0410

[1] Revised CALPUFF modeling run (Buys, 2008)

Table 3.1.5.2 Cumulative Acid Neutralization Effects in Class I and Class II Areas

Sensitive Lake	Location	Baseline ANC (ueq/l)	ANC Change (ueq/l)	Percent ANC Change
Ned Wilson	Flat Tops WA	38.0	16.438	28.30
Up. Ned Wilson	Flat Tops WA	12.6	18.038	85.14
Moon	Maroon Bells WA	51.5	160.812	9.37
Deep Creek #1	Raggeds WA	44.3	288.960	11.75
S.Golden	West Elk WA	111.0	26.474	3.46

Table 3.1.5.3 Maximum Cumulative Ambient Air Quality Effects in Class I/II Areas

Class I Area	Pollutant[1]	Averaging Period	Ambient Air Concentration ($\mu g/m^3$)	PSD Class I/II Allowable Increment ($\mu g/m^3$)
Black Canyon of the Gunnison National Park	NO_x	Annual Avg.	0.0807	2.5
	SO_2	Annual Avg.	0.0919	2.0
		24-hour Max	1.06	5.0
		3-hour Max	4.71	25
	PM_{10}	Annual Avg	0.139	4.0
		24-hour Max	2.19	8.0
	$PM_{2.5}$	Annual Avg	0.004	None
		24-hour Max	2.44	None
Eagle's Nest Wilderness	NO_x	Annual Avg.	0.193	2.5
	SO_2	Annual Avg.	0.0785	2.0
		24-hour Max	0.864	5.0
		3-hour Max	3.72	25
	PM_{10}	Annual Avg	0.364	4.0
		24-hour Max	3.65	8.0
	$PM_{2.5}$	Annual Avg	0.0132	None
		24-hour Max	0.128	None
Flat Tops Wilderness	NO_x	Annual Avg.	0.551	2.5
	SO_2	Annual Avg.	0.197	2.0
		24-hour Max	2.78	5.0
		3-hour Max	8.98	25
	PM_{10}	Annual Avg	0.458	4.0
		24-hour Max	4.82	8.0
	$PM_{2.5}$	Annual Avg	0.455	None
		24-hour Max	4.80	None
Maroon-Bells/ Snowmass Wilderness	NO_x	Annual Avg.	0.155	2.5
	SO_2	Annual Avg.	0.0690	2.0
		24-hour Max	0.899	5.0
		3-hour Max	3.10	25
	PM_{10}	Annual Avg	0.289	4.0
		24-hour Max	5.71	8.0
	$PM_{2.5}$	Annual Avg	0.286	None
		24-hour Max	5.65	None
Raggeds Wilderness	NO_x	Annual Avg.	0.115	25
	SO_2	Annual Avg.	0.0681	20

Table 3.1.5.3 Maximum Cumulative Ambient Air Quality Effects in Class I/II Areas

Class I Area	Pollutant[1]	Averaging Period	Ambient Air Concentration ($\mu g/m^3$)	PSD Class I/II Allowable Increment ($\mu g/m^3$)
		24-hour Max	0.824	91
		3-hour Max	2.51	512
	PM_{10}	Annual Avg	0.442	17
		24-hour Max	8.22	30
	$PM_{2.5}$	Annual Avg	0.439	None
		24-hour Max	8.16	None
West Elk Wilderness	NO_x	Annual Avg.	0.0683	2.5
	SO_2	Annual Avg.	0.0539	2.0
		24-hour Max	0.833	5.0
		3-hour Max	2.60	25
	PM_{10}	Annual Avg	0.272	4.0
		24-hour Max	2.88	8.0
	$PM_{2.5}$	Annual Avg	0.271	None
		24-hour Max	2.86	None

[1] NO_2 is represented by NO_x for this analysis

3.2 Geology and Geologic Hazards

The direct and indirect effects analysis area for geology and geologic hazards is defined by the locations of the proposed drill locations, compressor site, pipeline alignments and access roads. The cumulative effects analysis area is the four section area defined by sections 16, 17, 20 and 21, T 9S, R 92 W.

3.2.1 Affected Environment

Geology

The Hightower MDP is located on the northeast flank of the Grand Mesa (Figure 1.2-1). The area is regionally located within the Colorado Plateau Physiographic Province, which is generally characterized by dissected plateaus with strong relief. The project area also lies within the Piceance Basin, a known gas-producing basin.

Surficial geology in the project area consists of claystone, mudstone, sandstone, and conglomerate of the Wasatch and Ohio Creek formations (Tweto 1979) overlain by unconsolidated deposits derived from colluvial or glacial origins (Cole and Sexton 1981, Yeend 1969, and Ellis and Freeman 1984). Alluvial deposits are present along drainage courses in the area.

The formations exposed at the surface overlie Mesaverde Formation, which is a known gas-producing formation in the area, and is the target of the 32 Natural gas wells in the Hightower MDP. Target depths for the wells are about 8, 000 feet in the lower sandstones of the Mesaverde Formation.

The USA #1-16SC and USA #1-17SC wells operated by Maralex Resources, are located north of NFSR 265 in sections 16 and 17, T9S, R92W in the Sheep Creek field. These wells were drilled in the early 1980s and are currently shut-in.

Although not within a recognized gas field itself, the project area is also proximate to several named gas fields including the Buzzard Creek and Sheep Creek fields to the north, and the Vega field to the southwest (CGS, 2002). Each of these fields is noted for gas occurrence in the Mesaverde formation units known as the Cozette, Corcoran and Cameo zones.

Geologic Hazards

The Wasatch Formation and unconsolidated deposits exposed in the project area show varying degrees of instability and erodability. The Wasatch Formation has been the source of widespread mass wasting and slumping throughout the Grand Mesa National Forest (Yeend 1969). Surficial geology and landslides were mapped in 1988 (Soule). Most of the landforms in the project area are a collection of landslide or slumps of various ages and stabilities. Figures 3.2.1a and 3.2.1b show the surficial geology and landslide areas with respect to the alternatives. Soils derived from these formations are prone to slumping and sliding (see also Soils Section).

While it is recognized that land management activities can trigger landslides and slumps, the mass wasting activity in the project area and it's environs appears to be related more to ups and downs of the weather cycles, with slope movement being noted during times of above normal precipitation, and then in areas that show signs of previous movement (USDA-FS, 2001).

The drilling locations, access roads, and pipeline alignments included in the Hightower MDP are subject to specific stipulations set forward in the oil and gas lease related to geologic instability. These stipulations come from the GMUG Oil and Gas Leasing EIS. Portions of the lease have a No Surface Occupancy stipulation for high geologic hazards, and the entire lease is stipulated for controlled surface use for moderate geologic hazards (Figures 2.3 and 2.4). Areas of high geologic hazard are primarily in Section 20, the central portion of the project area. Areas of moderate geologic hazard are present throughout the lease and project area. The geologic hazard mapping done for the Oil and Gas Leasing EIS did not include extensive ground truthing for the hazards identified, and acknowledged that these issues would need to be verified at the time surface operations were proposed. The effects analysis will address site-specific conditions.

The compressor station and the aspen regeneration clearcut areas are not subject to the lease stipulations, however must be consistent with Forest Plan direction with respect to geologic hazard management. Geologic hazard mapping information for the project area is provided in Figures 2.3 and 2.4.

Figure 3.2.1a Surficial Geology, Alternative 2.

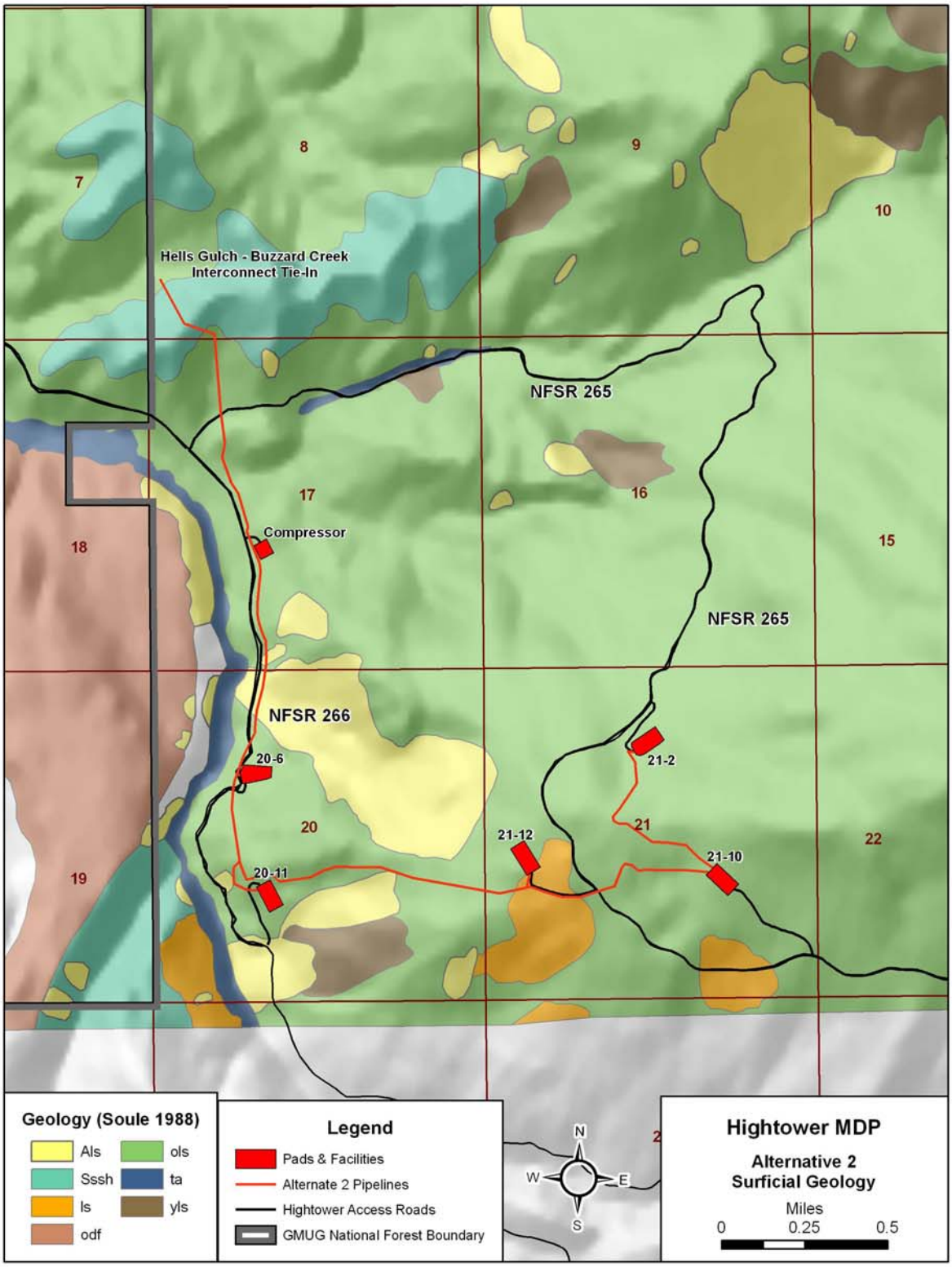


Figure 3.2.1b. Surficial Geology, Alternative 3.

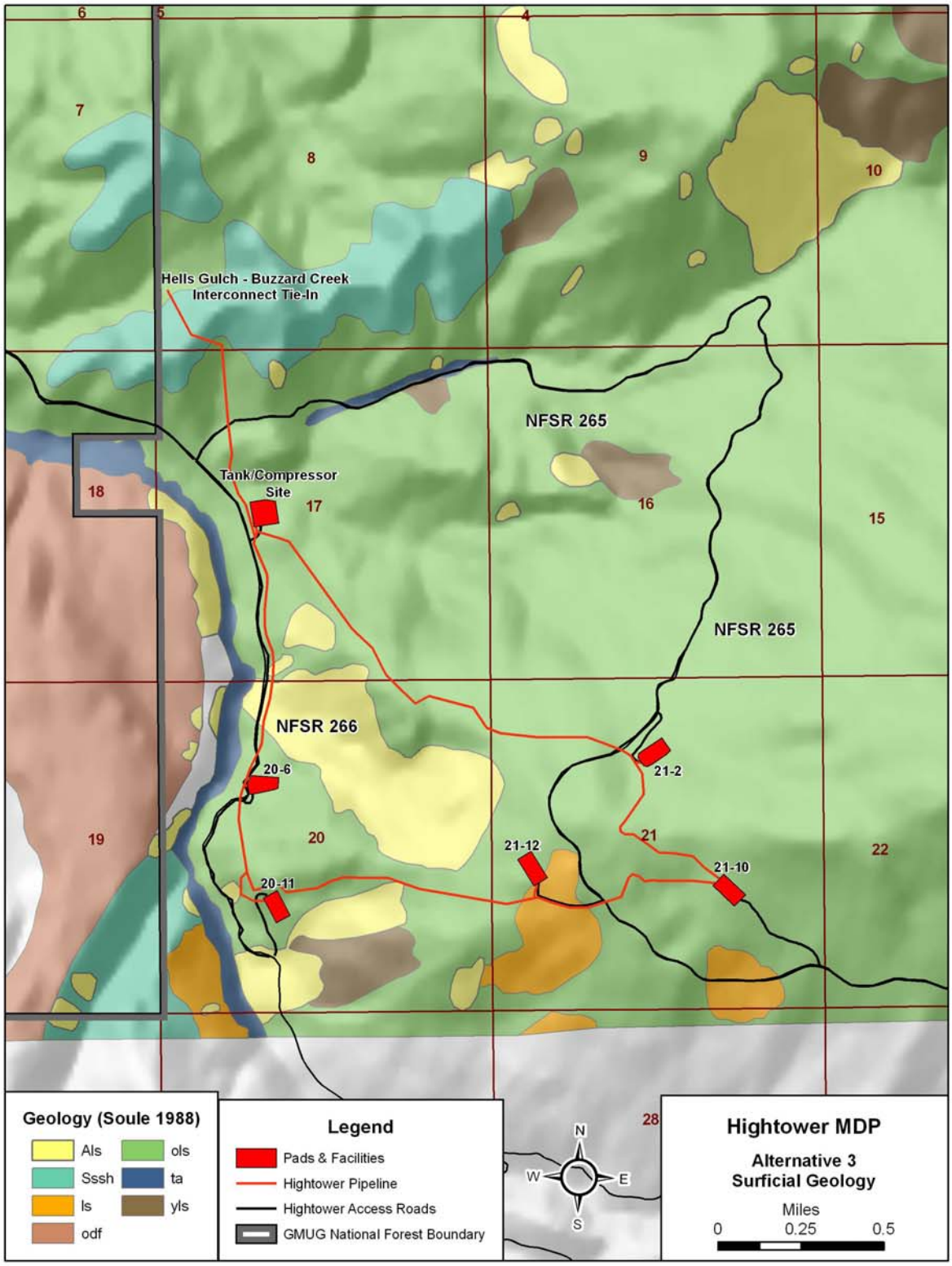


Table 3.2.1. Description of Surficial Geology in the Hightower MDP area (after Soule 1988) for Figures 3.2.1a and 3.2.1b.

Map Symbol	Landslides and/or surficial deposits name	Definition	Project Activities in Unit (Figures 2.3.1a and 2.3.1b)
Als	Modern Landslides	These features are simple to complex slope failures, usually no more than a few tens of feet thick, which are undoubtedly active at the present time. Movement of these varies seasonally and can range from feet per day to inches depending on local and seasonal moisture conditions and changes, oversteepening of slopes by erosion or other means, seasonal weather changes, and variation in bedrock types(s) beneath them. Virtually all landslides in the area are composed of materials derived from the Wasatch Formation.	Portions of NFSR 266 are currently on this unit. Buried gas gathering line between 20-6 drill location and compressor station/tank battery proposed to traverse it.
yls	Young Landslides	These features have all the attributes of modern landslides except present movement is unlikely or uncertain. In most instances they are in a state of metastable equilibrium and would likely move if ground moisture were to increase or slopes became oversteepened. In many places young landslides are contained with old landslides or ancient landslides suggesting that a continuous process occurs whereby one type grades to another.	Existing NFSR 265 skirts an area mapped as Yls. No other project activities proposed on it.
ls	Old Landslides	These are areas where surficial deposits are composed of landslide material that retains most of its landslide form and where recent or modern movement is clearly not taking place. These areas usually are composite of several individual landslides of different age. Evidence is primarily related to location of drainages, landforms of landslide origin, and steepness and composition of slopes.	Portions of gathering lines (both buried and surface) near 21-12 drilling location traverse this unit. Portions of existing NFSR 265 traverse this unit.
ols	Ancient Landslides	These are areas where the landsliding process took place long enough ago that erosion and other surface processes have considerably modified the form of the deposit. This implies that a major landslide event took place and ended thousands of years (maybe tens of thousands of years) ago and the areas has been in static equilibrium since.	The majority of the Hightower MDP proposed activities are on this unit.

Ta	Stream Alluvium of Terraces and Floodplains	These are modern and young alluvial deposits of the larger streams in the area. Mostly these deposits consist of erosional remains of sandstone and shale bedrock and make up a fine grained alluvium. In many places basalt boulders verified from old debris-flow deposits are also found in stream alluviums and terraces.	These areas are adjacent to Buzzard and Hightower Creeks. No project activities proposed in them, although a portion of existing NFSR 265 passes through this unit.
odf	Old Debris flow deposits	These deposits are the remains of formerly extensive landforms produced by massive large-scale debris flows that originated from the summits of Grand and Battlement Mesas tens of thousands of years ago. This unit mainly has weathered basalt boulders in a clay matrix. The surface of these deposits is usually strewn with basalt boulders that are left over from dissected and eroded debris flow deposits or have been left after fine materials eroded away.	Does not occur within analysis area.
sssh	Sandstone, Shale, and Marlstone	Interbedded sandstone and shale of the Wasatch Formation overlain by the Green River Formation which is comprised of sandstones, shales and marlstones.	Does not occur within analysis area.

3.2.2 Environmental Consequences

3.2.2.1 Alternative 1 – No Action

Section 2.2.1 describes the No Action Alternative. On-going natural processes including soil creep and mass wasting would continue as driven by natural forces. Currently approved activities would be implemented according to their applicable approvals.

3.2.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

On lease project Activities
Under Alternative 2, none of the project activities located on the lease would occur in areas stipulated as No Surface Occupancy (NSO) for high geologic hazards, except for about 200 feet of gas gathering pipeline between drilling locations 20-11 and 21-12. Placement of the pipeline in the NSO would require an exception to the lease stipulation in this area. This pipeline segment skirts the edge of a mapped landslide feature. Further site specific aerial photo interpretation indicates that a landslide feature is present at that location. It is not known how active this feature is, although the steepness of slope suggests that placing a pipeline in that location could subject the facility to potential for downslope movement that could compromise its structural integrity. Given the likelihood that a slide feature exists with currently unknown activity, it would be best to avoid this area with a pipeline to ensure that the line is placed in a stable location.

All the drill locations, proposed new access roads and gas gathering lines within the lease would fall in areas stipulated as controlled surface use (CSU) for moderate geologic hazards (see Figures 2.3 and 2.4). The CSU stipulation requires that placement of facilities in these areas have review by appropriate specialists, and that analysis of the specific locations occur. To that end, the following analysis and that brought forth in the Soil Section satisfy this requirement. To further address this requirement as well as address the need identified in the Oil and Gas Leasing EIS to look at site-specific conditions, this analysis uses detailed mapping done by Soule (1988, see Figure 3.2.1a and Table 3.2.1b), and on-the-ground site specific observations..

In this alternative, the majority of on-lease project facilities/activities (drill locations, surface gas gathering lines, and the buried segments of gathering lines and access roads) lie on ‘ancient landslides’ as mapped by Soule (1988), shown on Figure 3.2.1a and described in Table 3.2.1. This unit is described as one in which landslide activity took place long enough ago (thousands to tens of thousands of years) that the landform has been eroded by other surface processes (i.e. erosion) and the area is in static equilibrium. Placement of the drill locations, surface pipelines, and the buried segments of pipeline and access roads is not expected to affect the land stability in this unit given its inherent stability. Ground disturbance related to cut and fill operations to construct drill locations, or opening a trench to bury the segments of pipeline is not expected to destabilize the 'ancient landslide' areas. Site-specific field reviews identified areas where these overall conditions vary, and are described later in this section.

Drill location 20-6 is located on an abandoned drill pad used in the 1960s. The original pad was constructed on a landslide feature. Although the drill location falls within an area of ancient landslides, field reviews conducted by the FS in 2006 and 2007 noted that recent local movement had occurred. The 20-6 pad has been oriented to minimize the potential of reactiviating the slide, and

requirements for monitoring movement, and design and review by a geotechnical engineer will adequately address any potential land movement issues (see Table 2.2.15).

Similarly, the access road to the 20-11, the alignment crosses the toe of a historic landslide which has signs of recent movement. Disturbance from road construction could cause additional slide movement and create difficulties for construction and maintenance. The Design Criteria (Table 2.2.15) requiring design and mitigation for site-specific conditions on moderate geologic hazards will limit the effects of this disturbance.

A few hundred feet of the surface gathering line between drilling location 21-10 and 21-12, and the buried segment of gathering line between NFSR 265 and the 21-12 tie in lie on the unit named 'old landslides' by Soule. These features are defined as areas where surficial deposits are composed of landslide material that retains most of its landslide form and where recent or modern movement is clearly not taking place. Field review of this segment verifies that recent movements have not occurred. Review of aerial photos further supports this observation. The area is also on a shallow slope. Analysis of other management activities in the area (i.e. timber sales) has found that activities on older landslide deposits, that were on low slope angles, and showed no signs of modern movement posed little risk to reactivating the landslide feature (USDA-FS, 2001). Given these factors, there is little risk to reactivating mass movement in this landslide unit from the surface or buried pipeline segments crossing it.

A portion of the gas gathering line between the 20-6 tie in and the compressor lies within the oil and gas lease boundary. This segment would be buried. Several hundred feet of this run falls within a landslide unit described as a 'modern landslide' by Soule. This unit is generally considered an active landslide unit, in which movement is ocurring at the present time. Field investigation of the proposed gathering line crossing this unit shows that it crosses a portion which lies at a shallower slope, and is on what would be the toe slope of a larger feature. Excavation of a trench for a gathering line is not expected to destabilize the slope, although small sloughs could occur in the construction zone which may require careful construction techniques and local mitigation. Use of the Design Criteria in Table 2.2.15 will serve to lessen these effects.

Off Lease Project Activities

About one half mile of the gas gathering line between the 20-6 tie in and the compressor lies outside the lease boundary. This segment would be buried, and in general crosses the ancient land slide unit. Opening a trench to bury this segment of gathering line is not expected to destabilize this ancient landslide area.

The compressor station is located on 'ancient landslides' mapped by Soule. Given the overall stability of this map unit, cut and fill operations to construction the compressor location is not expected to destabilize this area.

Direct effects of proposed construction for all the project activities also include that surface disturbance could also create small local sluffs or slumps. These are projected to be minor, and will be manageable using standard construction techniques. The indirect effects of this alternative would be that there could be short-term potential for sediments to leave the construction areas and either become sediment in the stream network, or would be deposited as a sediment plume on the existing vegetation creating an indirect effect on wildlife habitat as well. Best management practices for sediment control listed in Table 2.2.15 would serve to reduce this effect.

The aspen regeneration clearcut areas are located in areas mapped as 'ancient landslides' by Soule. Previous analyses on the effects of aspen timber harvest in the area brought forward that given low slope angles and overall stability of the landforms, that timber harvest would present a small risk to stability. Cutting aspen for regeneration in the locations proposed is not expected to have noticeable effects on slope stability in the area (USDA-FS, 2001). Observations made from monitoring the Hightower timber sale has confirmed that no large scale movements have been triggered by these types of activities.

Road upgrade and maintenance operations on NFSRs 265 and 266 are not expected to cause land movement issues. Local effects may occur, however these are expected to be manageable with standard construction techniques.

The issue of slope stability can also be evaluated in relation to the size and amount of disturbance. The individual disturbances are small (< 5 acres) when compared the scale of the landforms in the project area (on the order of several hundred acres), and therefore the risk for causing accelerated slumping/mass wasting is expected to be small.

3.2.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

The direct and indirect effects of Alternative 3 are the same as that of Alternative 2 (the Proposed Action), except that all the gas gathering lines connecting between the drill locations would be buried their entire length rather than being placed on the surface. In addition, a gathering line between the 21-2 and the compressor site would also be constructed. All these additional buried segments lie on features mapped as 'ancient landslides'. Installing these lines in the subsurface would have similar effects as Alternative 2, and application of Design Criteria will also serve to reduce these affects.

For the segment of pipeline between drilling locations 20-11 and 21-12 that skirts the edge of the high geologic hazard area, the clearing and trenching involved with burying the pipeline could contribute to existing unstable conditions, with currently unknown effects. Therefore, avoiding this feature would ensure that destabilization would not occur.

For the gathering line run between the 21-2 and the compressor, aerial photo interpretation shows that mass movement landforms are present, however judging by the maturity of vegetation that these landforms appear stable. Trenching to install a gathering system is not expected to cause land movement issues.

Burying all the gas gathering lines is not expected to increase risk to destabilizing the overall area, however there would be more opportunity for some localized sluffs and slumps to occur in the immediate construction zone. These local events would depend on site-specific conditions including moisture, slope and predominant soil type. These potential effects are expected to be manageable using the Design Criteria listed in Table 2.

Under this alternative, the compressor site would designed to accommodate a centralized tank facility, therefore increasing the size of the locations, and the cut and fill. The location of the compressor site/tank battery in this alternative is also falls on an ancient landslide deposit. Construction of the compressor and tank facility is not expected stability at that site, and would have similar effects as those described in Alternative 2.

In the cumulative effects area for this resource, the GMUG Oil and Gas EIS notes the area as being stipulated for moderate geologic hazards. Mapping completed by Soule shows that ancient and old landslides are the predominant feature, and that these units are stable landforms that do not generally show modern movement.

Mapping done by the FS shows two individual slide masses in the NE ¼ of Section 17 and two small slides in the NW ¼ of section 17 (GMUG internal working map, undated). Aerial photo interpretation using 2005 photos did not show indication of recent movement on these areas. Small sluffs and slumps have been known to occur adjacent to roads in the cumulative effects area, especially after period of high precipitation or snow melt. NFSR 265 was closed for such reasons in 1984 (Geary, 2007), and later relocated to avoid slumpy areas. These effects have been mitigated by maintenance operations. The larger historic land movements have shaped the current landscape of the cumulative effects area, and are the reason why the landscape looks as it does today. The smaller scale movements known to have occurred as a result of human activities or natural events impart small modifications to the landscape. In general, the area is stable, and additional human generated activities may incur small scale land movements that can be mitigated by proper design and monitoring. The effects of the Hightower MDP project together with other known activities are not expected to affect the stability of the area as a whole.

Mitigation: Design Criteria provide adequate protection for geologic hazards, and no mitigations have been identified.

3.3 Soils

The direct, indirect and cumulative effects analysis area for soils is defined by the 6th level watershed as displayed by the dashed line in Figure 3.0a.

3.3.1 Affected Environment

Site and soil characteristics

The landforms within this analysis consist of dissected low mountain and foothill slopes, with mass wasting features. Specific landforms include residual slopes, ridges, landslides, mudflows, earth flows and landslide complexes.

The soils in this analysis area have developed and have been greatly influenced by the Wasatch Geologic Formation. This formation in this area, for the most part, is a mixture of fine textured shales, siltstones, mudstones, etc. This results in soils that exhibit fine textures, clay loams and clays on the surface and in their subsoils. The Wasatch formation has been observed to be highly susceptible to landsliding and frequently is veneered by landslide deposits. Within this analysis area landslide deposits have been identified by Tweto (USGS, 1979), and mapped by Soule (1988). The Colorado Geological Survey has mapped the geology on a number of quadrangles in the surrounding area, in similar terrain and has identified a number of landslide and mass wasting landforms (Center Mountain, Hunter Mesa, Cattle Creek). The description of the Wasatch Formation for the Hunter Mesa Quadrangle Geologic map, includes the following statement, “Although the Wasatch Formation does not appear to be prone to landsliding in the Hunter Mesa quadrangle, under present climatic conditions, human activities that, remove support (excavation), increase soil moisture, or add weight could trigger slope failure in the fine-grained strata of this unit.”

Soil information for this project area is found in the Grand Mesa – West Elk Soil Survey Area, Colorado (NRCS & Forest Service 1997). This is a level 3 inventory, with most of the mapping units identified as complexes of series or families. The soil map for this area is displayed, by alternative, in Figures 3.3.2.2 and 3.3.2.3. Characteristics of the various Soil map units are shown in Table 3.3.1, and brief soil descriptions follow.

In general, most of these soils tend to be fine textured throughout their profiles, clay loams, clays, silty clay loams and silty clays are the dominate textures. Due to these characteristics most of these soils have a rating of very limited or poor suitability for native surface road situations. Specific characteristics for this rating are low soil strength, excess fines, and high shrink swell. Not all soils received this rating, but a majority of the soils do have these characteristics. This is also true for the Soil Rutting Hazard. The majority of the soils involved have a severe rating for rutting when wet due mainly to low soil strength. This rating is an indication that with these characteristic the soil will rut easily if driven on by vehicles when wet. A majority of the soils in these landscapes can also be described as being "untrafficable" when wet, and due to the amount of silt could also be described as being very "slippery when wet" also.

The soil units above all, in general, have the potential for soil loss and mass land movement (landslides). Therefore, lease stipulations for moderate geologic hazard and areas of high geologic hazard occur throughout the entire lease. Figures 2.3 and 2.4 display the lease stipulations by alternative.

Past activities on this landscape

The cumulative effects area is displayed in Figure 3.0a as a dashed line (HUC 6 watershed). In the 1960's portions of the Hightower Watershed were involved in watershed restoration activities. The Sheep Creek Soil and Watershed Rehabilitation Project was conducted from 1946-1962 and included sections 8 and 9, the northwest corner of section 16, the north half of section 17. It had been observed that due to a lack of adequate vegetative cover over much of the area in combination with the rapid runoff characteristic of these fine textured soils that a gully network was developing and expanding. A solution to this was carried out that involved creating contour terraces across the slopes. The intent was to control the runoff that was occurring on these slopes, which would then allow the gully network to stabilize and heal. This has resulted in less runoff and the gully network appears to be stabilized. None of these terraces have been observed in the proposed disturbance areas of the project, but overall the watershed shows evidence of less accelerated runoff and gully activity. Grazing activities, at a lesser level than historic use, continues to occur in the area.

During the early to mid 1980's a 2-3 mile stretch of FSR 265 south of the Hightower FS Administrative site was relocated due to earthflows and landsliding activities that were accelerated by heavy snowmelt episodes. The 265 is now farther upslope and above most of the earth movement area.

Table 3.3.1. Soil Units in the Hightower MDP Area as shown in Figures 3.3.2.2 and 3.3.2.3.

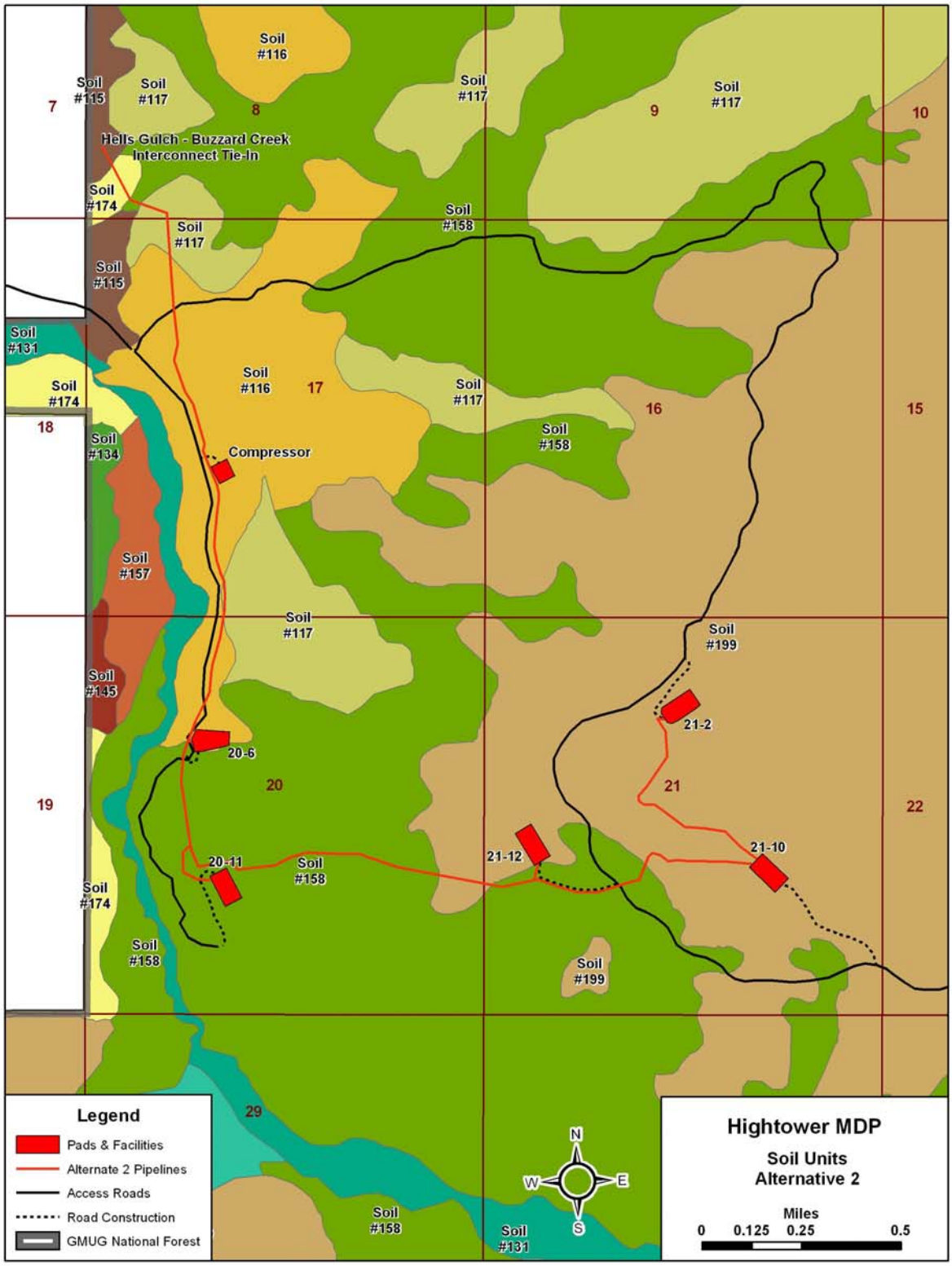
Soil Unit	Soil Unit Name	Alt. 2: Disturbed Area (ac)*	Alt. 3: Disturbed Area (ac)*	Runoff Rate	Mass Movement Potential	Shrink-Swell Potential	Soil Description
115	Cerro silty clay loam, 12 to 25% slopes	0.5	0.5	Very Rapid	Low to Moderate	High	The parent material for this unit is the residuum and colluvium from the Wasatch Shale (See Geology Section). This unit is present in the northwest portion of the Hightower MDP area. This is a cool deep, fine textured soil that has a high shrink-swell potential, slow permeability, and can be a moderate soil erosion hazard in steep areas (Table 3.2-1). This is a grassland soil.
116	Cerro – Herm complex, 0 to 15% slopes	14.4	19.5	Very Slow to Very Rapid	Low	High	The parent material for this unit is the residuum from various shales (see Geology Section).This unit is present in the northwest section of the project area where the compressor site and Drilling location 20-6 is located, as well as associated access roads. These soils are also cool, deep and fine textured soils. They have high shrink-swell potential, slow permeability, clayey surface and subsurface soils textures. The soils support grass and shrub vegetative communities.
117	Cerro – Herm complex, 15 to 40% slopes	2.5	3.2	Very Rapid	Low to Moderate	High	The parent material for this unit is the residuum and colluvium from various shales, and has the same characteristics as the Cerro-Herm complex above, except that it has a higher mass movement and soil erosion potential in steep areas. It occurs mostly in the northern portion of the area and the northern portion of the proposed pipeline resides on this soil unit.

Soil Unit	Soil Unit Name	Alt. 2: Disturbed Area (ac)*	Alt. 3: Disturbed Area (ac)*	Runoff Rate	Mass Movement Potential	Shrink-Swell Potential	Soil Description
158	Herm - Fughes - Kolob family complex, 25 to 40% slopes	11.8	25.4	Very Rapid	Moderate to High	High	The parent material for this unit is the alluvium and residuum from the interbedded sandstones and shales (see Geology). This unit consists mostly of cool,deep and fine textured soils. The Kolob portion of this unit may have more sandstone influence,and thus more coarse fragments as stone or cobble within the profile. It also supports a grass and shrub vegetative situation. This unit has a high shrink-swell potential, slow permeability, and is a high soil erosion hazard in steeper areas. It also has a modeate mass movement potential in steeper areas. This soil occurs throughout the area and exists beneath Drilling location 20-11 and the associated access roads and pipeline.
174	Pagoda - Hesperus complex, 12 to 40% slopes	0.9	0.9	Rapid to Very Rapid	Moderate	High	The parent material for this until is the alluvium and colluvium from shales (see Geology). These are cool, very dark, deep soils.The Hesperus portion contains slightly less clay in the subsoil. It occurs on steep slops, with a high shrink-swell potential and erosion hazard. It has moderate mass movement potential. These soils can be very productive and currently support grass and shrub plant communities. It occurs in the easter portion of the project area, and exists beneath the northern end of the gathering line from Drilling location 20-6.

Soil Unit	Soil Unit Name	Alt. 2: Disturbed Area (ac)*	Alt. 3: Disturbed Area (ac)*	Runoff Rate	Mass Movement Potential	Shrink-Swell Potential	Soil Description
199	Wetopa - Hayrack complex, 5 to 40% slopes	12.7	23.4	Medium to Very Rapid	Low to High	High	The parent material for this unit is the residuum and colluvium fromn interbedded sandstone and shale (see Geology Section). These soils are cold, deep and dark colored soils that are also fine textured. The Hayrack portion generally has gravelly or cobbly elements in the subsoil. This unit occurs at the upper elevations of the area and supports Aspen plant communities. This unit has a slow permeability, but a high soil erosion and mass movement potential in steep areas. This unit occurs in the western and central project area. Pads 21-2(21-2 in Alternative 3), 21-12, 21-10 and associated access roads and pipelines exist on this unit.
	Total Disturbance	42.8	72.9				

* Analysis used GIS shapefiles to calculate disturbed soil unit area unlike other acreage disturbances which were calculated manually to include cut and fill slopes of pads. Assumptions made were: 24' disturbance width for new access roads, 20'disturbance for surface pipelines (compaction, incidental vegetation removal, etc) and 75' disturbance width for buried pipelines

Figure 3.3.2.2. Alternative 2 – Soils Disturbance



3.3.2 Environmental Consequences

3.3.2.1 Alternative 1 – No Action

No additional environmental consequences on the soils resource are associated with the No Action Alternative. Natural erosion and erosion from other management activities such as timber harvest, road maintenance, and grazing would continue to occur.

3.3.2.2 Alternative 2 –Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

For direct effects, as summarized in Table 2.3.3, implementation of Alternative 2, the Proposed Action would initially disturb up to approximately 55 acres of surface soils on NFS lands (Figure 3.3.2.2). These areas consist of soil disturbed during the construction of the five drilling locations, compressor site, access roads, and gas-gathering pipelines. The disturbed area will be reclaimed and re-vegetated upon the completion of construction. This disturbance will be long-term (20- to 30-plus-year life of the project) if drilling efforts are successful. Of these acres disturbed, approximately 18 acres will be related to the buried pipeline construction area of 75 ft. This area will be driven on, compacted, and possibly rutted by the construction equipment. Within this disturbance there will roughly be 1 acre that will be bladed, trenched, with a pipeline placed in the trench, and then back filled. This action will alter physical characteristic of these soils, so that infiltration, waterholding capacity, runoff, and productivity will be different than undisturbed soil situations. These effects will be long term in nature. For areas that will have the pipeline placed on the surface there will be 6 acres of on the surface disturbance. This will consist of being driven on by heavy equipment, resulting in compaction, displacement and possible rutting of the soils.

Soils stability is generally low in the area, with most units having a relatively high shrink-swell and mass land movement (landslide) potential. Construction activities on steeper areas may trigger landslides and soil erosion. Alternative 2 uses surface placement of pipelines above a landslide feature that would prevent some mass movement potential.

Non-surfaced roads may become slippery and impassable when wet due to the high clay content in most of the soil units. This will be mitigated through design surfacing of roads as proposed in Design Criteria.

Direct affects to soils will include removal of vegetation and disturbance of topsoil and subsoil through the construction of drilling locations, pipelines, and access roads. In general the soil will be bladed, scraped, piled, excavated, displaced, backfilled, and compacted. In most cases this will alter the soils' natural horizonation, densities, infiltration rates, aeration and percolation characteristics. The soil will be treated as a construction medium. In construction of the drilling pad the landscape involved will be excavated into and leveled to provide a stable working area. Excavation depths of 20-30 ft may be necessary, depending on local topographic conditions. In certain instances, this excavation may destabilize the slopes above this activity. This potential is greatest with the drilling location 20-6 and the access road leading to pad site 20-11. Slope movement characteristics have been observed in the field at both these locations. Segregation and reapplication of surface soils could cause mixing of shallow soil horizons, resulting in a blending of soil characteristics. This blending will modify physical characteristics including structure, texture, and fertility characteristics and could lead to a reduction of soil productivity in these areas. Soil productivity will be lost for the life of the project on approximately 12.5 acres associated with long-term disturbance.
Compaction due to construction activities at the drilling locations, pipelines and access roads will reduce aeration, permeability, and water-holding capacity of the soils. An increase in surface erosion

could be expected, potentially causing increased sheet, rill and gully erosion. However, proposed project features are located in areas with existing vegetation cover which will act as a buffer against erosion. In addition compaction effects will be minimized through the proposed reclamation techniques described in Table 2.2.15, Design Criteria. Accordingly, the potential for adverse effects to soils from increased compaction is considered to be negligible.

Soil disturbance from construction activities and traffic use could result in increased short-term erosion from disturbed areas. The potential for water erosion ranges from "low" to "high" for the soil types in the project area. Erosion potential will be reduced for drilling locations by placing, inspecting and maintaining storm water BMPs in accordance with the Stormwater Management Plan (SWMP) as well as FS guidelines. The proposed access roads will be constructed at averages grades of 10 percent or less based on Forest Service standards. All access roads will be gravel-surfaced which will further reduce erosion potential. Access roads and pipelines will require a SWMP for BMP installation, inspection and maintenance.

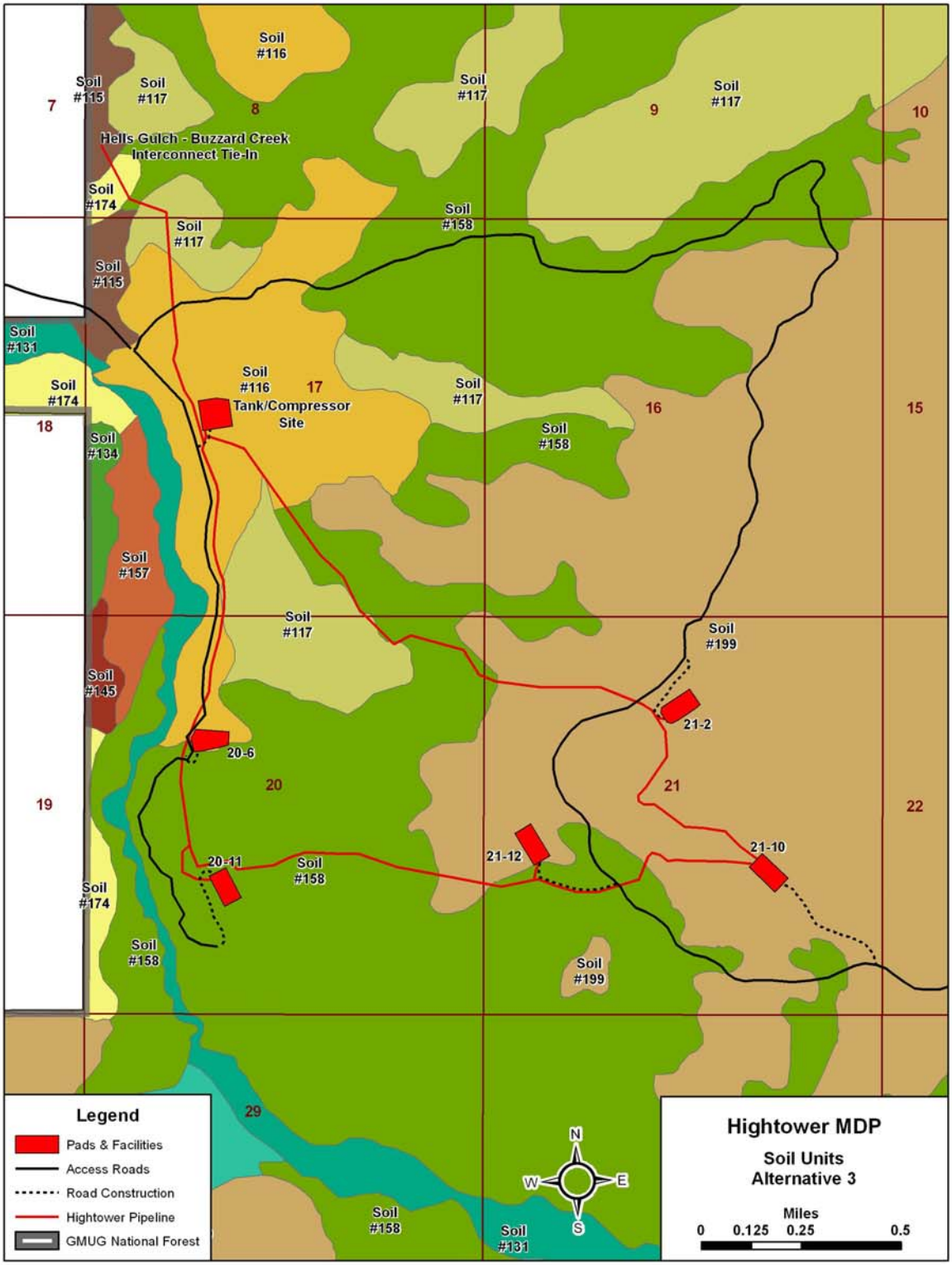
Following drilling location construction, drilling and completion of all wells, and installation of permanent facilities, each drilling location will undergo interim reclamation. Each drilling location will be reclaimed from the approximately 5.5 acre drilling size to about 1 acre needed to contain anchors and surface facilities.

Contamination of surface and subsurface soils near gas facilities is a risk that may occur in any gas field. Sources of potential contamination include spills or leaks of produced water or condensate from well heads, pipelines, and storage tanks. Petroleum released to surface soils infiltrates the soil and can migrate downward. To reduce the potential for hydrocarbon contamination of soils, pipelines and associated collection piping will be designed and constructed to minimize the potential for spills and leaks. Storage tanks will be set within secondary containments capable of holding at least 150% of the largest single tank volume. Leaks or spills of saline water, hydro-fracturing chemicals, fuels, and lubricants could also result in soil contamination. Depending on the size and type of spill, the effect on soils primarily will consist of the potential loss of soil productivity. However, implementation of SPCC plans in accordance with EPA requirements will minimize the risk of such spills by providing safeguards against spills, and detail control and recovery measures to be taken in the event of a spill. Thus, potential effects to soils from spills are considered to be minor.

Field review of the project area has verified that moderate to high geologic hazards occur on the southern portions of the 20-6 pad and along the access 20-11 access road (Hughes 2007) and that these areas may be more susceptible to increased movement due to the presence of very fine texture soils. Please refer to Design Criteria for treatment of these areas.

The indirect effects of this alternative are a short-term potential for soil material to get outside the construction areas and either become sediment in the stream network, or be deposited as a sediment plume on the existing vegetation. Additional indirect effects include compaction of soils and increased erosion potential associated with approximately 13 acres of timber harvest for aspen regeneration which could be minimized by harvesting aspen when soils are very dry or frozen or through the use of Design Criteria/Best Management Practices as identified in the *Hightower-Porter Mountain Timber Sales EA*.

Figure 3.3.2.3. Alternative 3 – Soils Disturbance



The use of Design Criteria and best management practices has proven to be effective in the prevention of erosion and sedimentation. However, the use of silt fence and strawbales for erosion control has often been found ineffective in National Forest habitats due to improper installation or destruction by livestock/wildlife. It is, therefore, recommended that erosion control measures be bio-engineered with native materials (i.e. rock, aspen, other woody vegetation) wherever possible. Monitoring by the operator and diligent adherence to the SWMP will provide quick identification, rectification, and prevention of any deficiencies in the design of devices.

Cumulative Effects **:** Past, present, and future actions with the potential for cumulative effects to soil resources in the project area including existing and future natural gas development, timber sales, road construction, livestock grazing, public use of trails and roads, and wildfires. Erosion control measures and reclamation is required for most of these activities to reduce direct, indirect, and cumulative soils effects. The cumulative effects to soils will vary depending on the location and amount of disturbance and the sensitivity of specific soil types to erosion.

Future oil and gas projects could be proposed for GMUG lands in the area. Construction of access roads, pipelines, and drilling locations for these projects will increase the acreage of soil disturbance in the region. Increased public use of unsurfaced roads along with project-related traffic will contribute to compaction of soils comprising native surface roads. The increased area of disturbed soils and increased runoff from soil compaction could increase the amount of sedimentation to water courses and ponds, including Buzzard and Plateau Creeks.

3.3.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

The same basic direct effects described in Alternative 2 apply to the Alternative 3. Because Alternative 3 proposes to bury all pipelines, approximately 30.5 more acres of soil will be effected than in the Proposed Action scenario (Figure 3.3.2.3 and Table 2.4.3). These disturbances will be in the form of a 75 ft wide overall disturbance area needed to properly construct a pipeline. Within that area there will be 3 acres that will be bladed trenched, with a pipeline placed in the trench, then backfilled. These actions will alter physical characteristic of these soils, so that infiltration, waterholding capacity, runoff, and productivity will be different than undisturbed soil situations. These effects will be long term in nature. Most of the additional disturbance resides in Soil Units 158 and 199, where the buried pipeline will disturb soils from the 21-10 pad down to the central facility resulting in a larger potential for mass movement. This disturbance, however, will be offset by the positive effect of the decrease in traffic from hauling water from the central facility one every day, versus a truck visiting each pad every day.

The indirect effects of this alternative will be the same as Alternative 2.

Cumulative Effects**:** Cumulative effects for Alternative 3 are expected to be similar to those described above for Alternative 2 except with a slightly larger disturbance area.

3.4 Water Resources

3.4.1 Affected Environment

The direct and indirect effects analysis area for surface water resources are Buzzard Creek through Sections 17 and 20, Hightower Creek where it is paralleled by NFSR 265, Road Gulch where it is paralleled by NFSR 270, and five ephemeral ponds in section 21. The cumulative effects analysis area for surface water resources is the 7th level hydrologic unit for the Upper Buzzard Composite watershed (Figure 3.4.1a), and Hightower Creek where it is paralleled by NFSR 265, Road Gulch where it is paralleled by NFSR 270. The direct, indirect and cumulative effects areas for wetlands and water influence zones (WIZ) are defined as those zones along Buzzard and Hightower Creeks, Road Gulch and other areas as mapped along ephemeral drainages and ponds in the project area. The direct, indirect and cumulative effects analysis area for ground water resources is defined by the boundaries of Oil and Gas Lease 68792.

Surface-water
Surface-water resources in the project area include Buzzard Creek, which flows generally to the northwest to join Plateau Creek, which is a tributary to the Colorado River; Hightower Creek a tributary to Buzzard Creek, and Road Gulch also a tributary of Buzzard Creek. Several ephemeral ponds occur in Section 21.

Buzzard Creek flows year-round, with high flows occurring in spring and summer months that are generated by melting of the winter snow pack. Historic flow records collected by the USGS are available for the years from 1955 to 1970. Table 3.4.1 summarizes the data collected at a location on Buzzard Creek upstream of the project area.

Table 3.4.1. USGS Stream Gage Data in the Project Area.

	Monthly Average Flow (cfs)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Min	0.4	0.8	1.5	18.0	33.3	4.4	0.8	0.03	0.00	0.22	0.7	0.4
Max	4.4	5.5	15.5	131	279	297	41.8	5.8	5.7	7.2	7.2	5.9
Avg	1.9	2.2	5.2	46	152	75	7.7	2.0	2.4	2.8	2.4	2.0
Data Source: USGS 2007. USGS 09096800 Buzzard Creek below Owens Creek. Abbreviations: Min – minimum flow, Max – maximum flow, and Avg – average flow												

An instantaneous stream discharge measurement of about 6.5 ft^3/second (Cordilleran 2007) was collected during in June 2007.

Hightower Creek is an intermittent drainage that carries water during runoff and storm events. No discharge data is available for Hightower Creek. Road Gulch within the GMUG boundary is an ephemeral/intermittent drainage that functions similar to Hightower Creek.

According to the CDPHE, all surface-waters on NFS lands in the project area lie with in Segment 5 of the Lower Colorado River basin (CDPHE – WQCC 2006a) and are assigned the following beneficial uses:

- **Aquatic Life Cold Water Class 1:** These waters currently support or are capable of supporting cold-water biota with no impairment to the abundance and diversity of species.

- **Recreation Class 1b:** Waters are suitable for recreation use in or on the water, but where primary contact (i.e., swimming) has not been documented.
- **Agriculture:** Waters are suitable for irrigation of crops or livestock use.
- **Domestic Water Supply:** These surface-waters are suitable for potable water supplies following standard treatment.

There are no public drinking water supplies on Buzzard Creek in the project area, and none of the surface water courses are on the State of Colorado 303(d) list, which suggests that the designated uses are currently being supported (project file).

The USGS evaluated water quality as a function of rock type in a study published in 2002 (Miller, 2002). Samples were collected from Buzzard Creek upstream of the project area along with 6 other streams draining watersheds with exposures of sedimentary rocks in the Green River and Wasatch Formations. The study showed that the streams carry calcium-carbonate type water, have alkaline pH and moderately high conductivity values. The values of trace elements and metals were interpreted to pose no water quality problem. The study further concluded that the water quality in these watersheds underlain by the Green River and Wasatch Formations were moderately high in dissolved solids, however the water quality did not pose a human health risk.

Specific to Buzzard Creek, the study noted some sediments in Buzzard Creek with signs of cattle use. The pH was measured at 8.7 and conductivity at 652 microSiemens per cm. Total dissolved solids were measured at 330. A water sample was also collected from Buzzard Creek near the Hightower Guard station in June 2007 (Cordilleran Compliances Services, 2007). This sample showed the pH to be 8.7, and conductivity at 340 umhos/cm. Total dissolved solids were measured at 220. Overall the water quality in Buzzard creek was assessed to be good.

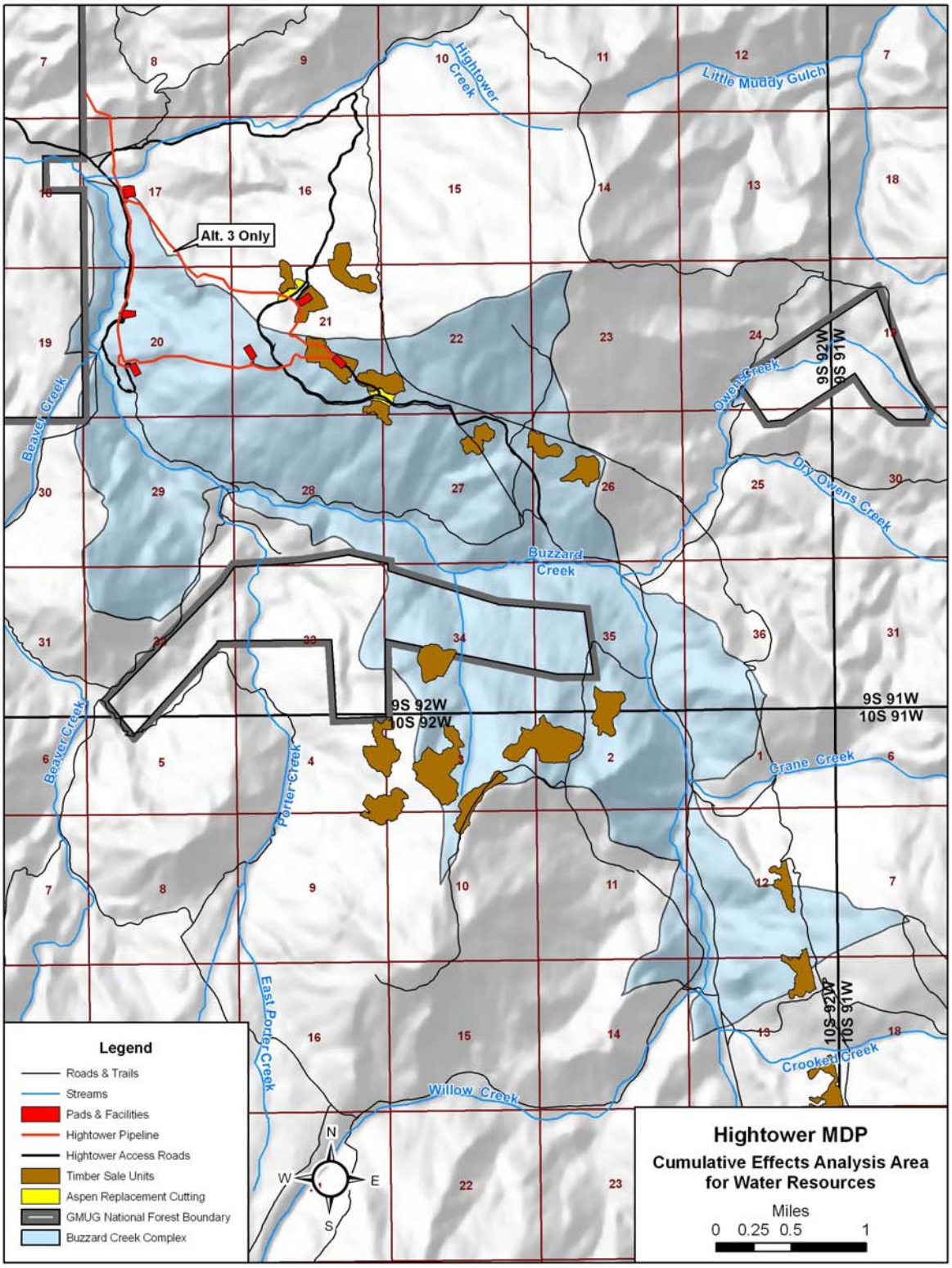
Specific data on Hightower Creek and Road Gulch are not available, however given their location in similar geologic and geomorphic terrain as Buzzard Creek, and their non-perennial nature, it is assumed for this analysis that water quality (when water is present) is similar.

Buzzard and Hightower Creeks incise into an alluvial/colluvial terrace, and alternate between low gradient reaches punctuated by steep, confined reaches (USDA-FS, 2001). An abbreviated Rosgen Level II analysis was undertaken in June 2007 to describe channel geometry of Buzzard Creek (WestWater 2007). Based on measurements taken in the field, Buzzard Creek's channel is classified as a B3 channel, dominated by runs, with few riffles or pools. Although the channel has steep banks in places, the channel is stable and appears unaffected by current levels of activity. The channel bottom was mostly cobbles with smaller sediments. Some large woody debris was present. The channel has been scoured by historic high water and flash flood events.

Sedimentation is the principal concern for water quality in the surface water courses. Fine sediment production is related hillslope erosion, landslides and streambank erosion (USDA-FS, 2001). Fine textured hillslope soils derived principally from the Wasatch Formation have high water holding capacity and low strength with slow, constant downhill creep of materials. Livestock use contributes to channel sediment where trailing and trampling of the streambank retards growth of riparian vegetation and physically breaks down the channel banks (USDA, 2001).

Five ephemeral ponds are located in Section 21 (see Figure 3.4.1d). These ponds are shown on the USGS topographic maps of the area, and are further delineated on the lease stipulation map as no surface occupancy for riparian areas or wetlands (see Figures 2.3 and 2.4). These ponds hold water for a period of time after snowmelt, and may hold water after storm events. A water quality

Figure 3.4.1a. Upper Buzzard Composite Watershed



sample was collected from the pond southwest of drilling location 21-10 in June 2007 (Cordilleran Compliance Services, 2007). Water quality appeared to be good, and no adverse conditions were made during sampling.

Water Influence Zones

The WIZ is defined as a riparian buffer zone located adjacent to creeks that includes the floodplain, riparian vegetation, inner gorge, unstable areas, or highly erodible soils. The FS describes the minimum width of the buffer on each side of a stream as the greater of 100 ft, or the mean height of mature dominant late-seral vegetation (FSH 2509.25, zero code). Neither the Forest Plan nor the WCP handbook has a numeric standard for the amount of disturbance allowed in the WIZ. Instead, the Forest Plan restricts any action in the WIZ that may damage stream health and specifies reclamation standards for disturbance in WIZ areas (see Table 3.4.1c).

The areas of WIZ in the project area generally correlate with the riparian areas on the lease stipulation map (Figures 2.3, 2.4 and 3.4.1c*). The stipulation map reflects areas where riparian areas and floodplains have been mapped based on vegetation interpretation or field surveys. Where those data are not available, the WIZ is simply defined by the 100-foot buffer defined in the R2 Watershed Conservation Practices Handbook and recommendation in the GMUG Forest Plan. Project activities proposed within potential WIZ areas include:

•21-12 to 20-11 gathering line: crosses one drainage.
•20-6 to lease boundary: gathering line crosses three drainages.
•21-2 access road: crosses one drainage located in the center of the N1/2 of Section 21.

*Note: Figure 3.4.1c only shows the WIZ for larger drainages in the project area to preserve map clarify at that particular scale.

Ground Water

The occurrence and distribution of ground-water resources in the ground-water analysis area is dependent on the geologic units present. The area has several geologic units, each of which have varying capabilities to store and transmit ground water. For the purposes of this analysis, these units will be referred to as water-bearing units to describe the hydrogeologic setting.

The hydrogeologic setting in the project area includes near-surface ground water contained in unconsolidated deposits derived from colluvial (i.e. landslide deposits), and glacial/alluvial deposits (alluvial fan and terrace deposits) along the perennial stream courses (i.e Buzzard Creek) in the area (see Section 3.4.1), and in layers of claystone, mudstone, sandstone, and conglomerate of the Wasatch Formation where they are exposed on the land surface (generally in the northern portion of the ground-water analysis area), and deeper ground water in the rock layers of the Mesaverde Formation. Recharge to the ground-water occurs principally through infiltration of precipitation (primarily snowmelt) into the subsurface. Ground-water discharge from shallow water-bearing units provides baseflow for streams in the project area, and to springs. The Hightower project area lies within the greater Colorado River basin alluvial aquifer system as defined by Topper, et al (2003). They identify unconsolidated Quaternary-aged alluvial aquifers associated with major river systems as one of the principal types of aquifers in the state. In the Colorado River Basin, it is acknowledged that surface water is the principal water resource in the basin, suggesting that ground-water resources do not provide substantial water for beneficial uses. Additional details on the various components of the hydrogeologic setting are provided below.

Figure 3.4.1c. Surface Water Resources, North

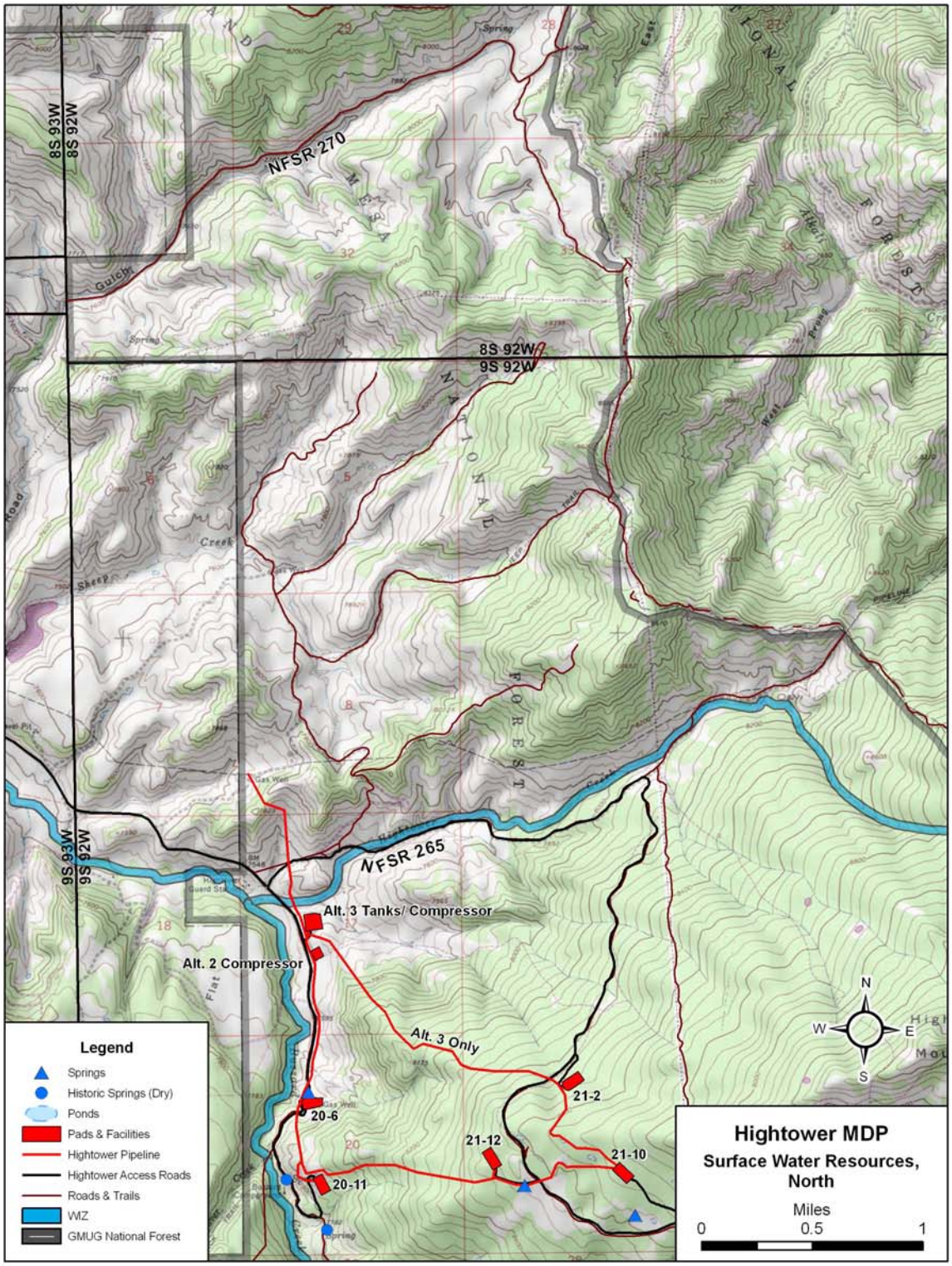
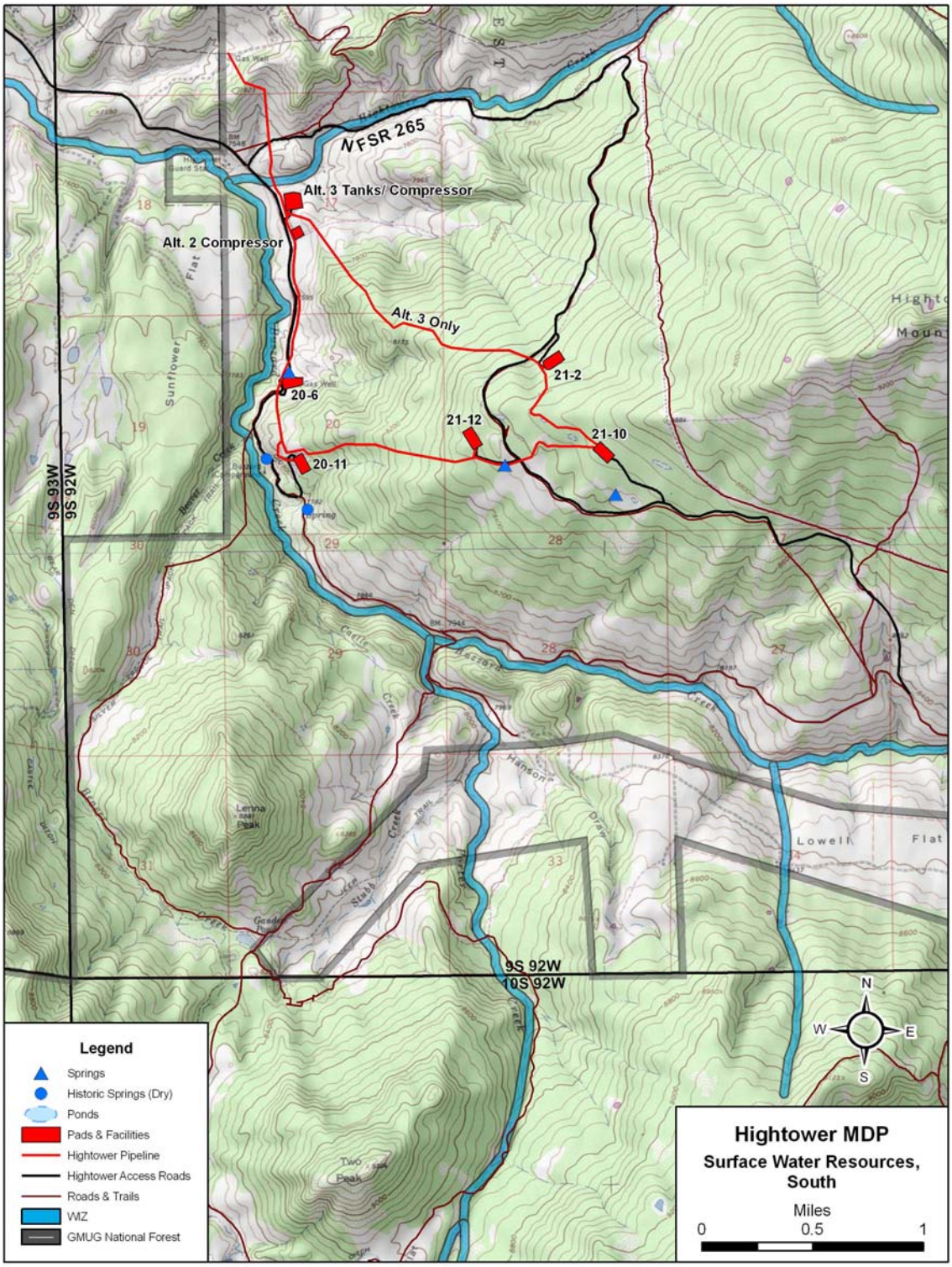


Figure 3.4.1d. Surface Water Resources, South



Unconsolidated Deposits

The unconsolidated deposits have hydraulic properties sufficient to store and transmit ground water, however the limited areal extent of these deposits in the project area do not make them sources of substantial ground-water resources. Ground-water discharge from this unit supports the seasonal seeps and springs, or supports perennial and intermittent stream flow.

Ground-water occurring in the unconsolidated unit exists under unconfined or 'water table' conditions. Under these conditions, the local water table fluctuates in response to recharge events and atmospheric changes. It is estimated that the water table can vary seasonally (dependent on topographic location) from between several feet of the surface to ten or more feet of the surface. Ground-water levels measured in wells on the Grand Mesa is 'perched', that is not in hydraulic communication with the underlying water table (Noblis, 2008).

A field inventory conducted by Cordilleran Compliances Service in June 2007 identified three springs near the proposed 21-10, 21-12, and 20-6 sites (see Figure 2.4.1d). The spring near the 21-10 site was supporting a pond which is discussed in the Surface Water section. Review of USGS maps also indicate springs occurring near the location of the former Buzzard Campground, along with two mapped springs in the S ½ Section 21, all in T9S, R92W. These springs were field checked in summer 2007, and were dry at the time of observation.

Wasatch Formation

Based on the primary rock types being fine-grained, the Wasatch Formation is generally not considered to be an aquifer, although it can locally support low volume wells (Ackerman and Brooks, 1986 and Brooks, 1983). A study done in Garfield County by the COGCC indicates that porosity and hydraulic conductivity are low in the Wasatch and much of the ground water produced from Wasatch wells is likely from flow through open fractures (Papadopolous & Associates, 2007). Seasonal seeps and springs may occur in areas where the Wasatch has been subject to mass wasting (i.e. landslide) events.

Mesaverde Formation

Ground-water also occurs in the rock layers of the Mesaverde Formation which lies below the Wasatch Formation. The Mesaverde Formation in the ground-water analysis area likely contains ground water in the sandstone and coal layers at depths beneath the land surface such that it is unavailable for use. The Mesaverde in the project area has low hydraulic conductivity, between 0.01 and 0.001 feet per day[2] (CGS, 2003). Deep ground water in the Mesaverde likely occurs under confined, or pressurized conditions. The Colorado Geological Survey reports that the level at which ground-water would stand in a tightly cased well in the project area would be about 6, 000 feet of elevation, equating to about 1,500 to 1,800 feet below the land surface. There is no known hydrologic connection (structurally or stratigraphically) between deep ground water in the Mesaverde Formation and the shallow ground water in the unconsolidated deposits in the project area.

An EPA report from 2004 acknowledges that in the Piceance Basin, the permeabilities of the gas producing formations is so low, that gas is over-pressured such that it has forced ground water out of those zones.

[2] This would be equivalent to 0.000035 to 0.0000035 cm/s

Recharge

Principle recharge to the ground-water system is from direct infiltration of precipitation into the subsurface. In the project area, precipitation is estimated to range between 20 and 35 inches/year (Colorado Climate Center, 1984). In other places on the Grand Mesa and environs at similar elevation, it was estimated that about seventy-five percent of precipitation falls as snow in the winter months (Gill, 2006). In areas of similar elevation and geology, about 2 % of precipitation is estimated to infiltrate the subsurface and recharge the shallow ground-water system (Colorado School of Mines, 2003). A minor amount of this recharge goes to deeper underlying water-bearing units. A review of soil types in the area indicates that most the soils have very rapid runoff rates (Table 3.2-1), suggesting that available recharge runs off overland rather than infiltrating the subsurface. The hydric soils associated with wetlands in the project area indicative of shallow water tables and are generally associated with surface drainages.

EPA (2004) notes that that in the Piceance Basin, the low permeability of gas-bearing strata (the Measverde Formation) and hydrocarbon over-pressure limits the circulation of meteoric (i.e. precipitation) recharge into this formation.

Ground water use and development

Ground water in the project area where it issues as springs is used for wildlife and ecosystem support, or supports riparian or wetland vegetation.

A review of Colorado Division of Water Resources (CDWR 2007) files on permitted wells revealed 4 registered wells in the Project Area (two in T9S, R92W, Section 17 and two in T9S, R93W, Section 13).

The closest wells to the project area are at the former Hightower Guard Station in section 17. These wells are registered for domestic and stock uses. Data for one well list a yield of 10 gpm and no information on total depth or water level. Information available in Forest Services files for one of the Hightower Guard Station wells shows it being drilled to a depth of 152 feet, with first mention of water at 132 feet below land surface. The well yield was reported to be 0.5 gpm. A water quality sample taken from one of the Hightower wells in 1939 indicated it contained fluorine at 6 parts per million (ppm) that rendered in unuseable for human consumption. Cordilleran Compliance Services collected a water sample from each of the Hightower wells in June 2007. The wells were reported to be flowing at the land surface at about 0.1 gpm. The water is being used for stock watering. The water quality shows fluoride present at just over 6 ppm, TDS at 620 and 680, pH at 9.5 and 8.7. One well showed concentrations of sulfate reducing bacteria.

Another registered well in Section 13, 9S, 93W over one mile north-west of the project area, is listed for domestic use, has a yield of 6 gpm, total depth of 90 feet, water level of 5 feet. This well is presumed to be completed in unconsolidated deposits. The second well in Section 13 is about one mile west of the project area, is listed for stock use, has a yield of 3 gpm, total depth of 310 feet, and a water level of 111 feet.

In Mesa County, it is estimated that 1.8 percent of the total water usage comes from ground water sources (Aiken, etal 2000).

EPAs 2004 report acknowledges that water wells in the greater Piceance Basin are generally less than 200 feet deep, and goes on to report that based on water quality from water collected at depths of 4,600 feet to 5,400 feet below surface had a total dissolved solid content of 15,500 mg/l. This exceeds the standard of 10,000 mg/l for Underground Sources of Drinking Water.

3.4.2 Environmental Consequences

3.4.2.1. Alternative 1 – No Action

Under the No Action Alternative no project-related effects to water resources would occur. Natural variations would continue to affect water resources and wetlands/WIZ based on climatic patterns and other physical changes. Effects to surface water quality from existing uses including livestock use in drainages are expected to continue. Ground-water withdrawals from existing permitted wells are expected to continue, and would continue to impart small scale depletions to the water-bearing zone principally in the unconsolidated deposits.

3.4.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

Surface-Water

Potential effects of concern to surface water resources from the Proposed Action include increased and sedimentation in surface water features, and contamination of surface water features by spills of produced water, fuels and other chemicals.

Increased short-term delivery of sediment to Buzzard Creek, Hightower Creek and Road Gulch from surface disturbance could potentially occur during the construction of drilling locations, access roads, and pipeline corridors due to increased availability of exposed sediment to mobilize during snowmelt and precipitation events. Generally, effects from increased sedimentation are largest during construction of project facilities and decrease to negligible levels within three years (BLM 1994). The potential for adverse effects would be greatest shortly after the start of construction activities and would likely decrease in time due to natural stabilization, reclamation, and revegetation efforts. The magnitude of these potential effects to surface water resources depends on several factors, including the proximity of the disturbance to the water influence zones (WIZ) of surface water drainages or ponds, the duration and timing of the construction activity, and the implementation, success or failure of reclamation and BMPs (see Table 2.2.15).

Construction of drilling locations is not expected to contribute sediment to any of the creeks because all the locations are situated at large distances from them such that sediment transport to a drainage is unlikely (see Figure 3.4.1d), except for location 20-6 and Buzzard Creek which is further discussed below. Use of BMPs for sediment control and timely interim reclamation (see Table 2.2.15) will limit the amount of sediment leaving the immediate area of the drill location disturbance area. For all sites, the exact design of the BMPs would be submitted with the individual APDs for each drilling location and the access roads to each site.

The 20-6 pad lies in closest proximity to Buzzard Creek and its associated WIZ, and adjacent to an ephemeral drainage that directly joins Buzzard Creek. Since ground-disturbing activities within close proximity to streams have the greatest potential for affecting water resources, rapid and successful reclamation/re-vegetation of temporarily disturbed areas and implementation of Best Management Practices (BMPs) to reduce erosion are particularly important in minimizing water quality effects and to assure maintenance of long-term stream health. By reason of it's proximity to surface water

features, construction of this location has a greater chance to introduce sediment into Buzzard Creek. However, diligent use of BMPs for sediment control is expected to reduce this risk to a very low level. Should BMPs not be effective, or should BMP failure occur, some sediment may migrate from the location into surface water features. This is anticipated to have little measurable effect on the water quality because of background levels of sediment already existing in Buzzard Creek. The potential for this effect to occur would be greatest during and immediately after construction which is expected to last a few weeks until site stabilization occurs.

Maintenance of existing NFSRs holds the most potential to increase sedimentation to surface water features, and also provide ways to reduce overall sediment. Specifically, road work needed along NFSRs 265 along Hightower Creek, 266 along Buzzard Creek and 270 along the upper portion of Road Gulch have the potential to expose sediments that could mobilize into stream courses because of road proximity to the surface water feature. This risk is short term, as road maintenance would be performed over the course of a few days to a few weeks. Use of BMPs for sediment control will mitigate sediment moving away from the road corridor. The roads will also require placement and compaction of gravel surfacing that will reduce the amount of exposed soil and hence reduce the erosion risk and rutting of roads. This provides a beneficial effect in that it will reduce the potential for sedimentation off roads to occur by armouring existing native surface roads. Effective crowning and ditching on the roads will further serve to reduce adverse water quality effects. New access road construction to the drilling locations are not located near surface water features, therefore the risk for sediment contribution from them is negligible.

Construction of the new access route to drilling location 21-10 passes adjacent to one of the ephemeral ponds in Section 21 (see Figure 3.4.1d). Soil disturbance associated with construction could cause sediment to wash into the pond, and could damage it's existing ecosystem function. However field placement of the access road to avoid the pond and it's WIZ, along with use of BMPs for sediment control will decrease this risk to low levels.

Under the proposed action, the gas gathering pipeline between the 20- 6 drilling location and the existing Hells Gulch – Buzzard Interconnect pipeline would be buried, as would a portion of the pipeline segment between the 21-10 and 21-12 locations (see Figure 2.3). Burying these pipelines will disturb soils that would then be available to mobilize sediment to surface water features. Of particular concern is the segment between the 20-6 location and the compressor station because of the proximity to Buzzard Creek, and the pipeline crossing at Hightower Creek north of the compressor site. All other buried pipeline segments are not in close enough proximity to surface water features to pose risk for sedimentation.

Construction of pipeline in these areas could result in some additional sedimentation to Buzzard and Hightower Creeks. In order to reduce these effects, BMPs would be employed to reduce the amount of sediment that is delivered (see Table 2.2.15). The exact design of the BMPs would be submitted with individual APDs or pipeline Plan of Development (POD) prior to construction.

The pipeline crossing at Hightower Creek would involve excavation of a 75-foot wide construction zone through the WIZ and across the channel of the drainage. The crossing would be done using the open cut method. This activity would expose soils and make them available to erode. Direct effects to water quality and stream channel stability would generally result from the activity occurring in the drainage channel. Most of these effects would be small scale, occurring in the immediate area of disturbance and would be short term, lasting only for the time soils were exposed (likely on the orders of days) and would continually reduce while vegetative cover re-establishes (2 to 3 years). Use of appropriate construction practices for drainage crossing and BMPs for sediment control in this area will help limit these effects (see Table 2.2.15). Season of construction is also key for the drainage

crossing. The crossing would be done in the summer or fall when flow is lowest to reduce effects to water quality.

Diligent use of BMPs for sediment control is expected to reduce these risks to very low level. Should BMPs not be effective, or should BMP failure occur, some sediment may migrate from the pipeline construction area into surface water features. This is anticipated to have little measurable effect on the water quality because of background levels of sediment already existing in Buzzard and Hightower Creeks.

Clearcutting aspen in the in the regeneration cutting units are not expected to cause noticeable effects on water quality in the area because of their distance to surface water features, and small size. Observations at existing clearcut areas in the vicinity have not shown noticeable effects on water quality.

Surface water sources may contaminated by potential spills including those occurring from vehicle accidents, leaks from storage containers, leakage from produced water and condensate storage tanks. A list of chemicals used in drilling and completion operations is provided in Appendix B. Appendix B summarizes the composition of drilling fluids, and MSDS sheets for these chemicals reside in project file.

Trucks and other vehicles will make regular daily trips to each drilling location during drilling operations to transport motor fuels, water for drilling, drilling mud, and other compounds to be used in well drilling and completion. Although from a percentage of truck trips perspective, the likelihood of a spill related to a vehicle accident to occur is low, accidents such as this have occurred. A spill of any kind would present a risk to surface water quality if it occurred on a road adjacent to a surface water resource. The operator will have a Spill Prevention and Countermeasure and Control (SPCC) Plan to minimize potential effects to surface water resources that might result from spills. As a result, any effect to surface water resources would be temporary and localized in nature.

Chemical use and storage (including vehicle fuels) could potentially result in a leak or spill at the drilling site. The use of containment devices (such as spill palettes), berms and BMPs for using chemicals would reduce the risk of a spill or leak migrating. If a spill is occurs on a drill site, the SPCC Plan would be implemented to minimize, control, and cleanup the affected area. In addition, any spills occurring on a drill location would be inside the boundaries of the pad which are designed and constructed to contain fluids on the pad, therefore the likelihood of a spill migrating outside the pad boundary is low. These measures would ensure that spilled material does not enter a surface water feature. Experience on other drilling projects suggests that spills on drill sites are generally small, and low volume and can be easily and quickly mitigated.

Under Alternative 2, storage tanks for production fluids (either produced water or condensate) would be located at the wellheads. According to standard industry practice and BMPs, tanks on the drilling locations will be placed inside containment structures, and these would be designed to hold 150% of the largest tank on site. This would prevent fluids from migrating offsite and contaminating surface waters. Continued monitoring of tank volumes via telemetry and physical observation will also serve to manage reduce the potential for leaks to occur. Should a leak occur that escapes the berm, clean up efforts will be handled according to the SPCC.

The potential for contamination of surface water resources by produced water, condensate, or other chemicals that would be used under the Proposed Action is considered to be minor.

In summary, through aggressive reclamation and re-vegetation of disturbed areas, the implementation of BMPs to reduce sedimentation of surface- water resources, and implementation of plans and practices intended to prevent the release of chemicals and contaminants from project facilities, the Proposed Action would have minimal effect on surface-water resources in the Hightower MDP project area.

WIZ

The gas gathering pipeline crossings of WIZ areas between the 20-11 and 21-12 and from the 20-6 to the compressor, along with the access road to the 21-2 are not expected to have effects on the WIZ or the functions of them at these locations. Although mapped as potential WIZ, field verification of these areas indicates that these drainages are dry, vegetated with grass and sagebrush, or other non-hydric species. Design Criteria further include protections specific to WIZ.

Disturbance (both short-term and long-term) in the WIZ of Buzzard and Hightower Creeks, and Road Gulch would occur as a result of road maintenance operations and pipeline installation. Construction activities near or in riparian areas/wetlands/WIZ can result in several types of effects, including increased sediment deposition, removal of riparian vegetation, water quality degradation, and loss of wildlife habitat.

BMPs would be employed in the disturbed areas during construction to reduce the amount of sediment migrating through a WIZ or riparian area. In addition, all disturbance would be reclaimed following the completion of construction. To enhance the probability of successful re-vegetation, the seedbed would be prepared by disking or similar implement. Seeding would be performed in the fall following the end of construction and well completion activities. A surface mulch of certified weed-free straw would be applied to seeded areas where necessary. Vegetative ground cover would likely re-establish within one to two years following reclamation. This re-vegetation of riparian or WIZ disturbance areas would substantially reduce the potential for erosion and subsequent water quality effects for the long-term.

Construction of the pipeline crossing at Hightower Creek would remove approximately 0.25 acres of vegetation depending on where the corridor would cross (see Vegetation section). Loss of vegetation is of concern because it would increase sediment availability, however use of BMPs and timely reclamation would reduce these effects to low levels. The GMUG Forest Plan calls for special handling of soils disturbed in riparian areas and timely reclamation requirements (see Table 2.2.15) that would be used during project implementation.

Groundwater

Potential effects to ground-water resources from the Proposed Action include changes to the quantity and quality of ground water in the various water-bearing units underlying the project area. The concern for ground-water quality centers on drilling operations intercepting ground-water, and if recovery of produced water from the gas-bearing zones will deplete usable ground-water resources. A linked concern is that ground-water quality may be affected by drilling mud, or petroleum constituents or other compounds used during the drilling or completion process.

Under the Proposed Action, up to 32 new gas wells would be drilled in the project area. All of the proposed wells would target hydrocarbon reservoirs within the Mesaverde Formation that lie about 8,500 feet below the land surface. During drilling, the wellbore will pass through the unconsolidated deposits, the Wasatch Formation and the upper portion of the Mesaverde Formation.

Drilling operations at the 20-6, 20-11 and 21-12 will begin (or spud) in mapped unconsolidated deposits, and will likely encounter shallow ground-water in them. The drilling and casing program must comply with State and BLM requirements to protect fresh water (see Table 2.2.15), and therefore no measurable effects to water quality or quantity from drilling are expected. The drilling locations are within 250 to 1,000 feet of various springs in the project area (see Figure 3.4.1d). These springs issue from the unconsolidated deposits that are of limited lateral extent, and are likely hydraulically connected. Because of the protections for fresh water required in the drilling and casing program, effects to the springs are not expected.

Drilling operations at the 21-2 and 21-10 locations will spud in the Wasatch Formation, and all wells will drill through it. Due to the general non-water-bearing qualities of the Wasatch Formation, drilling operations are not expected to encounter ground-water in this unit, therefore no effects are expected.

All the gas wells will drill through and be completed in the Mesaverde Formation. In general, hydrocarbon reservoirs in the Piceance Basin have exhibited low porosity and permeability (Seccombe and Decker 1986) and do not produce much ground water. Produced water records available from PXP and COGCC for gas wells producing from the Mesaverde Formation in the Hells Gulch area to the east of the project area, and from the Plateau Valley to the west support low water production from the Mesaverde Formation.

Recent information on water production for PXP wells in Plateau Valley and Hells Gulch showed cumulative production of 3900 bbls[3] for the month of November 2007. Wells in the Hells Gulch area (about 5 airmiles northeast of the Hightower project area) accounted for around 9% of this total production, or about 350 bbl. The average daily water production in PXPs existing wells is about 30 bbl/day/well. Some older wells in Hells Gulch produce 5 bbl/day/well or less. In general a gas well will produce more water after initial completion and early production, and decline through time. In the area, newer wells have produced 80 bbl/day in early phases of production, followed by a decline to around 5 to 10 bbl/day. It is expected that the Hightower wells will produce water in similar quantities. If all 32 wells are drilled and have similar production characteristics, up to 320 bbl of water/day could be produced after initial start up.

A report prepared by the EPA (2004), notes that in Piceance Basin, gas wells completed in the sandstones and coal of the Mesaverde Formation have little water due to the tight and poorly permeable nature of the rock. Further, it has been observed that the formation is generally saturated with respect to gas, rather than a mixture of water and gas.

Groundwater intercepted during production of the 32 gas wells (produced water) would be pumped into storage tanks on the drilling locations. This water would be periodically pumped from the tanks and taken offsite to an approved disposal facility, as discussed in Section 2.3.6 or 2.4.6. No produced water would be discharged into surface water drainages or allowed to flow onto the ground surface. There is a slight chance that produced water could be spilled during the loading operations. However, given the BMPs that would be employed to control storm water runoff at each drilling location, there is little chance that produced water would enter and contaminate shallow ground-water. Accordingly, the potential for contamination of groundwater resources by produced water is considered to be negligible.

[3] Bbl is the abbreviation for barrel, a commonly used petroleum industry term. One bbl is 42 gallons.

Spills of fuels or other compounds from project vehicles or leaks from the reserve pit could potentially introduce compounds used in drilling and completion into shallow groundwater. However, because of the isolated nature of shallow groundwater and that the reserve pit would be lined, the potential effects to shallow groundwater resources from infiltration of drilling fluids or spills is considered to be negligible.

Hydraulic fracturing (or fracing) of the Mesaverde Formation is proposed for these wells and would be used to enhance the overall permeability of the formation and enhance the flow of gas into the well bore after drilling is completed. A description of the fracing process for this project is given in Section 2.2.4), and a more general description is part of EPA's publication listed in Chapter 5 (EPA 2004).

If effective, fracing would permanently increase the hydraulic conductivity and overall transmissivity of the Mesaverde Formation zones in which it is done. These effects would only occur in the immediate vicinity of the individual wellbore. Based on information from the EPA (2004), it is not expected that fracing effects would extend beyond about 500 to 1,000 feet from an individual wellbore. While the fracing process would enhance the existing hydraulic properties, the Mesaverde Formation has inherently low permeability and low transmissivity (which creates conditions for very slow fluid movement), the enhanced conditions would still fall in the range of low permeability and transmissivity. This along with the fact that these effects would occur only in the immediate vicinity of an individual well, supports that fracing is not expected to have measurable effects on the formation as a whole.

The fracing process would introduce chemicals into the wellbore and surrounding fractured zones that could affect ground-water quality. Chemicals to be used in this project are listed in Appendix B. The planned procedure will be that fracing fluids will be flowed back from the wells a kept in tanks on the surface so that recovery can be measured (see Section 2.2.4).. Since no fracing chemicals will be directed to the reserve pit, no sampling of pit residue would be needed. Based on PXPs experience in nearby gas fields, a large percentage of frac fluids are not recovered in the flowback process. However, additional volume of fracing fluids is recovered once the well begins production. It is expected that minimal residual amounts of chemicals used in fracing would remain in the formation (see Appendix B).

Fracing would occur at depths over 8,000 feet below the land surface. Because fracing would be conducted at these considerable depths, effects to ground-water resources in the unconsolidated deposits that support local ground-water wells and springs are considered very unlikely to occur. EPA (2004) acknowledges that the thousands of feet of streata separating the fracing zone and the surface would prevent hydraulic fractures from reaching the shallow water-bearing zone.

While there would be local effects to the Mesaverde Formation in the immediate vicinity of each wellbore, the low transmissivity and hydraulic conductivity of the formation would prevent migration of residual fracing fluids outside the zone of fracturing. The low volumes of produced water measured in adjoining wells suggest that there is limited ground water in the Mesaverde Formation. Given these circumstances, along with the target depths being deep, and that ground-water in the Mesaverde is considered unusable (Noblis 2008), there is negligible risk to ground-water supplies.

Trenching for pipeline construction could encounter shallow ground-water resources and cause temporary alterations to the existing flow system. The scope of these alterations depends on season of use and specific location.

Trenching through the unconsolidated deposits could encounter ground-water, and if so, would temporarily alter the flow regime by creating an artificial discharge point into the trench. This affect is considered to be temporary as the trench would be backfilled with native materials between 2 to about 14 days of initial disturbance. Within the trenched area itself, the hydraulic conductivity of the materials may be temporarily increased creating conditions where ground water would travel more rapidly, however this is forecasted to be a temporary effect, and is not expected to impart a noticeable or measurable change. The existing unconsolidated materials are estimated to have transmissivity in the range of 100 to 200 square feet per day (ft^2/day). The magnitude of a temporary increase within the trench is not expected to be measurable on this scale.

It is considered most likely that shallow ground water would be encountered in the trench where it crosses Hightower Creek, particularly in the period of time directly following snowmelt and seasonal runoff, estimated to be May to June when local water tables are expected to be higher than other times of year. Performing the drainage crossing during times of year when the shallow ground water table is lower will reduce the amount of shallow ground water encountered and reduce the effects to the flow system. This is what is planned for the project (see Section 2.2.5). Observations made during installation of the Hells Gulch - Buzzard Interconnect pipeline (located a few miles north of the Hightower project area) during construction in 2007 noted only minor ground-water inflows where the pipeline trench crossed low areas. These effects only lasted a few days, because the trench was backfilled quickly after the pipe was installed.

Vegetation removal along the gathering line and pipeline corridors will alter the existing recharge regime by reducing the amount of transpiration. However given the local nature of the project, small scale disturbance, revegetation requirements, this effect is not expected to be measurable.

Cumulative Effects on Water Resources

Implementing the Proposed Action or Alternative 3 could result in minor cumulative effects on the Buzzard Creek watershed, however would not change the watershed risk of adverse effects related to roads or drill pad construction. The current watershed risk is low, and would not change with this proposal. Cumulative effects primarily would consist of the small, but incremental increase in erosion and sediment yield that could occur due to surface disturbance associated with preparation/construction of the proposed well pad and pipelines, maintenance on existing roads and construction of the access roads. These effects would incrementally add to water quality effects of other activities that have occurred in the past for the short term, and to those that are reasonably certain to occur within the cumulative effects area over the next three to five years. Proper storm water management and BMPs used throughout the industry should help to prevent any negative cumulative effects.

Any changes to water yield or sedimentation are not expected to be measurable against background sediment loads. Further, effects to watersheds are generally only measurable when disturbance exceeds 25% of the watershed area (USDA-FS, 2001). The Buzzard Creek composite watershed covers about 6,779 acres. Alternative 2 would disturb about 55 acres in the short term, and 12 acres in the long term, where Alternative 3 would disturb 85 acres in the short term and also 12 acres in the long term. These values, along with other known activities are well below the 25% area (1,694 acres) of the watershed at which level effects might be measurable.

Road management and livestock grazing are the current primary human influences in Buzzard Creek subwatershed. Aspen clearcuts (both past and planned for this project) are also present. Adverse effects from the timber clearing have not been noted. Grazing and the existing road and trail system would continue to affect localized areas along Buzzard Creek and other drainages in the project area.

Opportunities to improve NFSR 266 would be realized. Sediment level in Buzzard Creek, Hightower Creek and Road Gulch would have minimal effect on Plateau Creek or the Colorado River since both have large flow volumes compared to Buzzard Creek, and hence high sediments loads due to background elevation, geology and land use.

Portions of the northern part of the Water Resources cumulative effects area were involved in watershed restoration activities. These were intended to control runoff and reduce gullying in the fine grained soils. These efforts have been successful at reducing sediment loading to the local drainages (see also Soils Section).

If the Hightower MDP area proves to be productive for natural gas, additional wells could be drilled. Reasonably foreseeable future actions could include two additional drill pads and 96 more wells (the wells could have downhole targets of 10 acres). In terms of surface water, changes to the sediment yield are not expected to be measurable, as BMPs would be used to prevent sedimentation from occurring, and the overall watershed disturbance would not be within range where effects would be measurable.

Activities contributing to cumulative effects on ground water resources in the study area include existing ground-water use from shallow wells, and additional oil and gas development. The minimal existing uses of ground water for ecosystem support and stock watering impart small depletions from the shallow ground-water system. Drilling the Proposed Wells and the potential for future gas well drilling are not expected to deplete shallow ground-water resources. The potential for contamination due to spill or leaks is low, and would be ameliorated by spill control measures, therefore measurable cumulative effects are not expected. The project would withdraw deep ground water from the Mesaverde Formation during the course of production. As this water is at great depth below the land surface (8,000 feet), and is hydrologically separated from the near surface water, no measureable cumulative effects are expected.

Mitigation

The project design, including Design Criteria listed in Table 2.2.15 provides protection for water resources. No mitigation measures have been identified

3.4.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

Direct, indirect and cumulative effects are the same as the Proposed Action except with the additional disturbance of all buried pipelines. There may be additional interception of shallow ground water in the pipeline trenches. These effects are estimated to be most likely where trenches cross low areas or surface drainages. These effects are expected to be temporary, and will not measurable effect the ground-water system. Alternative 3 has a slightly higher risk of cumulative effects due to burying pipelines in the project area. However the short term nature of these activities when additional sediment sources would be available presents a minor risk since reclamation occurs immediately after construction.

3.5 Wetlands/Riparian Areas

The direct and indirect effects analysis area for wetlands and riparian areas are the specific locations of project activities. The cumulative effects area is the four section project area (sections 16, 17, 20 and 21).

3.5.1 Affected Environment

Wetlands, as defined by the US Army Corps of Engineers (ACOE), are found throughout the project area. Most are fringe wetlands along Hightower and Buzzard Creeks. Some ponds, seeps, wet depressions, and potholes are also found, particularly in the vicinity of the higher elevation pads (HT 21-2, 21-10 and 21-12).

Riparian areas are generally found along the perennial and intermittent drainages of Buzzards and Hightower Creeks. Species generally associated with these riparian areas are cottonwoods, willow and sedge/forbs. The incised nature of the drainages, and steep stream banks generally confine the riparian vegetation to areas immediately adjacent to the channel.

Field surveys completed for placement of project activities in proximity to wetlands was conducted by WestWater Engineering (2007). The project was designed so that wetlands would not be affected. There are no COE jurisdictional wetlands within 100 feet of any project facility.

Although not required under COE rules, a wetland delineation was completed for the ephemeral drainage adjacent to the 20-6 pad location because the edge of the pad is within 100 feet of the drainage. The survey showed that the area had wetland characteristics, however the area had been heavily disturbed by cattle, and severe plugging and areas of bare soil were evident.

The 20-6 to lease boundary gathering line crossed three apparent stream/riparian areas per the lease stipulation map. Field surveys during 2007 indicate that each of these drainages are shallow (1 inch to 6 inch deep) swales, vegetated with sagebrush and grasses and lacking wetland characteristics (Renner, 6/27/07 field notes). None of these would classify as Waters of the U.S.

Outside of the lease boundary and north of the central facility location, the sales pipeline will cross Hightower Creek. The channel crossing here is 6 inches deep by 60 inches width. During the field survey, the creek was dry and not vegetated. The riparian condition at Hightower Creek where the pipeline would cross is described as lacking hydric soils and hydrophytic vegetation, however, cottonwoods and willows are common along the drainage. Hightower Creek is an intermittent stream, and would be classified as Waters of the U.S. but not a jurisdictional wetland (Renner, 6/27/07 field notes).

The federal oil and gas lease shows NSO for riparian/wetlands/floodplains along drainages in thep. The coverage used to generate this map reflects where riparian areas and floodplains have been mapped based on vegetation interpretation or field surveys. Where those data are not available, the area is simply defined by the 100-foot buffer defined in the R2 Watershed Conservation Practices Handbook and recommendation in the GMUG Forest Plan.

Project activities proposed within potential NSO riparian areas include (see Figure 2.3) :
•21-12 to 20-11: gathering line will cross one drainage
•20-6 to lease boundary: gathering line crosses three drainages
•21-2 access road: crosses one drainage located in the center of the N1/2 of Section 21.

3.5.2 Environmental Consequences

3.5.2.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative. Section 2.2.1 describes the No Action Alternative.

3.5.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

No project activities are located in wetlands, therefore there would be no direct effects to them. The wetland on the north side of the 20-6 location and on the south side of the 21-10 locations would not be directly affected by construction. However, they may be affected by soils from the fill slopes washing into the wetland (siltation), however use of BMPs listed in Table 2.2.15 would minimize these effects from occurring. Wetlands and vegetation may also be affected by accidental spills of hazardous substances. These effects are discussed further in Water Resources, Section 3.4.

The following project activities are proposed in potential riparian areas that would fall under the NSO for Wetlands/Riparian/Floodplains as shown on the lease stipulation map: 21-12 to 20-11 gathering line, 20-6 to lease boundary gathering line, and 21-2 access road. Relief from the lease stipulation is needed for these activities.

Field investigation during 2007 showed that riparian vegetation or conditions were not present where the 21-12 to 20-11 gathering line, the 21-2 access road, and the pipeline between the 20-6 drilling location and the compressor would cross the NSO areas. Therefore, there would no effects to riparian conditions. Further, use of Design Criteria and Best Management Practices will effectively reduce any effects to riparian areas. Granting an exception to the lease stipulation would not affect riparian conditions.

The sales pipeline will cross Hightower Creek and an ephemeral channel north of NFSR 265. See Section 2.2.5 Pipeline Construction for construction techniques that will be used for these drainage crossings, and Table 2.2.15 for Design Criteria. The results of field surveys indicate that typical riparian vegetation was not present where the line would cross Hightower Creek, therefore the effects to riparian conditions are not expected. Use of BMPs and revegetation standards from the WCP and Forest Plan will restore the disturbed area to reduce the effects.

The various pipeline crossings of drainages would occur over a short period of time (on the order of days). Reclamation activities would occur very quickly, thus restoration would begin shortly after disturbance. Revegetation is expected to occur over a 2 to 3 year timeframe in these areas.

Cumulative Effects **:** For cumulative effects, the following activities that could affect wetlands or riparian areas for both alternatives: Livestock grazing is permitted over the entire project area and would continue to occur.. Livestock grazing and trampling may retard efforts to re-vegetate areas disturbed by construction. In the project area, the Hightower aspen timber sale was completed in 2007 and the Porter Mountain aspen timber sale is ongoing. Past and present timber sales have had effects on wetland areas due to temporary roads. There may be further oil and gas development in the in the Hightower Creek area, however, these activities would be designed to avoid wetland and riparian areas to be consistent with lease stipulations. Noxious weed infestation could affect wetlands (Canada thistle is abundant in the project area and will establish easily in newly disturbed soils near wetlands).

3.5.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

Direct and indirect effects would be similar to those of the Proposed Action. There is no change in location of the drilling locations or pipeline locations between the two alternatives. Burying the additional pipeline segments will not have additional effects on wetlands or riparian areas. Burying the segments across areas mapped on the lease stipulation map will not affects riparian areas, as field investigation indicated those conditions do not exist at those locations. Therefore, granting an exception to the lease stipulation will not adversely affect riparian areas. Alternative 3 has an additional pipeline segment from the 21-2 location to the central facility, but it does not affect wetlands or riparian areas. Alternative 3 has a greater area of disturbance, so the likelihood of siltation and erosion would be greater.

Cumulative effects would be similar to those for the Proposed Action.

3.6 Vegetation (includes Special Status Species)

The direct, indirect and cumulative effects analysis area for vegetation is the 6th level watershed boundary as shown by the dashed line in Figure 3.0a.

3.6.1 Affected Environment

The vegetation patterns of the project area are related primarily to moisture gradients. Vegetation types found along Hightower and Buzzard Creeks are the sagebrush community, sagebrush/grass mix, sagebrush/mesic, mountain shrub mix, Gambel oak, mesic mountain shrub mix, pinyon/juniper/sagebrush mix, pinyon/juniper/mountain shrub mix, aspen, Douglas-fir and willow.

Hightower Mountain and Porter Mountain aspen timber sale units are displayed in Figure 3.0a. The Hightower Timber Sale was completed in 2007; and the Porter Mountain timber sale harvest began in 2006 and ends in 2011.

Special Status Species

The FWS identifies 13 plant species in Colorado as either threatened or endangered. Those species that are known to occur in or near the Grand Valley Ranger District are shown in Table 3.6.1. No special status plant species have habitat in the project area and, therefore, will not be discussed further here.

Table 3.6.1. Species listed by FWS to be potentially present on the Grand Valley Ranger District.

Common Name	Scientific Name	Status*	Habitat Affected
Plants			
Uinta Basin hookless cactus	*Sclerocactus glaucus*	T	No
DeBeque phacelia	*Phacelia submutica*	C	No

Invasive/Non-native Species

Noxious weed species were noted during the 2007 biosurvey. During the 2007 biosurveys the following species were noted: Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*), musk thistle (*Carduus acanthoides*), bull thistle (*Cirsium vulgare*), and scentless chamomile (*Matricaria perforata*). These weeds occur in patches, especially in areas of soil disturbance.

3.6.2 Environmental Consequences

3.6.2.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative. Section 2.1 describes the No Action Alternative.

3.6.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

The direct effects for implementation of the Proposed Action would result in the removal of existing vegetation during construction of the pads and associated roads, pipelines and facilities. A summary of the approximate acreage by vegetation type that would be affected is given in Table 3.6.2.2.

Vegetation will be removed from approximately 55 acres for drilling locations, roads, gas gathering lines, and a pipeline. The removal of the vegetative types listed below is long-term; however, successful reclamation will replace all but 12.5 acres of the existing vegetation with a mixture of species compatible with existing conditions. Drilling locations 21-2, 21-10 and 21-12 are located within aspen forest that is classified as suitable for timber production in the 1991 LRMP. A commercial timber sale would be required for the removal of merchantable aspen from two aspen regeneration clearcuts (see Figure3.0a for location of clearcut units) and a timber purchase contract for merchantable timber on the 21-12 pad and access road, timber along pipeline corridors for the 21-2 to 21-10 pipeline, 21-10 access road, 21-10 to NFSR 265 pipeline, and pipeline from the 21-12 to 20-11. Non-merchantable timber and brush would be removed and stockpiled for use during reclamation.

Reclamation activities are unlikely to restore the three wellpads to aspen forest capable of current timber production levels. During interim reclamation these three sites will be revegetated to grass/forb communities to quickly establish ground cover to prevent erosion and sedimentation. During final reclamation these revegetated sites will be composed of mesic mountain shrub plant communities at a minimum and possibly restored to aspen forests depending on the viability of surrounding aspen clones and maintenance of soil productivity/fertility.

Saline produced water, if removed by truck from on-site storage tanks, may have a deleterious effect on vegetation if spilled. However, due to tanks being placed inside berms, the incidence of this occurring is extremely low.

Additionally, effects as previously described in the *Hightower-Porter Mountain Timber Sales EA*, will occur on approximately 13 acres of aspen regeneration clearcuts immediately adjacent to the project area. These clearcuts are needed to replace approximately 13 acres of regenerating aspen in two harvest units of the Hightower Timber Sale. The Hightower Timber Sale was for the purposes of increasing structural/age class diversity and improving resistance to insect/disease infestations. The HT 21-2 and HT 21-10 pads, portions of their access roads and gas gathering lines will be constructed in two of these clearcut units.

Figure 3.6.1. Vegetation Communities

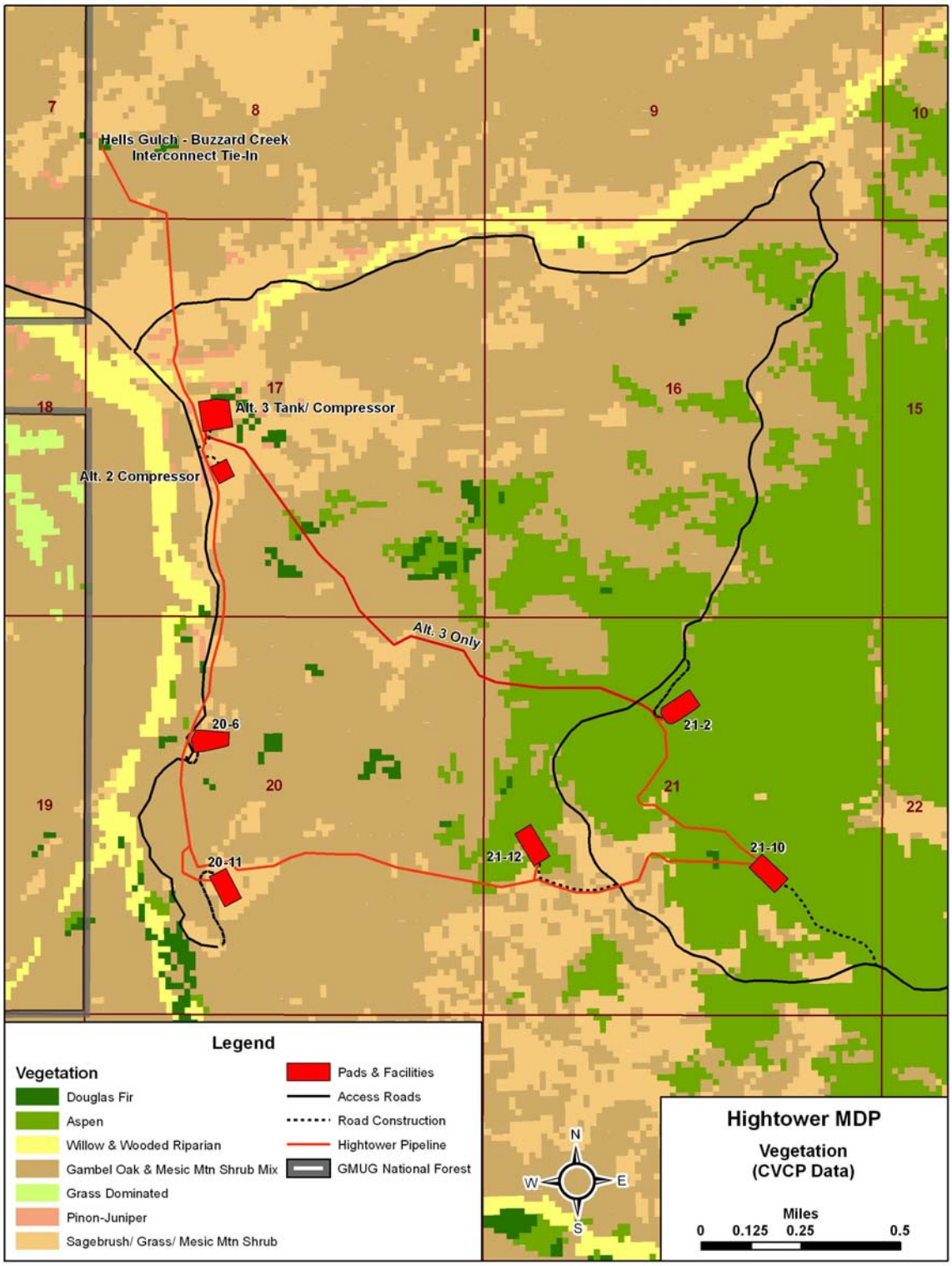


Table 3.6.2.2.Vegetation Types Affected by Alternative 2.

Vegetation Type	Acres
Sagebrush community	1.8
Sagebrush/grass mix	0.2
Sagebrush/mesic mountain shrub mix	12.6
Gambel oak	8.8
Mesic mountain shrub mix	7.5
Pinyon/juniper/sagebrush mix	0.8
Pinyon/juniper/mountain shrub mix	0.1
Aspen	12.3
Douglas-fir	0.1
Total	**44.2***

- Analysis used GIS shapefiles to calculate disturbed vegetation area using small vegetation unit blocks (pixilated appearance of Figure 3.4.1.) which unlike other acreage disturbances which were calculated manually to include cut and fill slopes of pads. Aspen regeneration clearcuts were not included on maps. Assumptions made were: 24' width for new access roads, 20'disturbance for surface pipelines (compaction, incidental vegetation removal, etc) and 75' disturbance for buried pipelines.

The most common indirect effect is the invasion of noxious weeds in disturbed areas. In particular, Canada thistle occurs in patches in the project area and will establish easily in newly disturbed areas. However, compliance with the *Noxious and Invasive Weed Management Plan for Oil and Gas Operators*, Glenwood Springs Energy Office, March 2007, as adopted by Grand Valley Ranger District, will direct control of existing populations and effectively prevent the spread of noxious weeds on lands disturbed during oil and gas exploration and development, including drilling locations, facilities, pipelines, roads and any other disturbed areas including timber harvest areas.

Cumulative Effects

For cumulative effects, the following activities will continue to effect species composition/diversity and density of vegetation: grazing throughout the entire project area which may retard efforts to revegetate areas disturbed by construction; moose re-introduction; on-going recreation activities such as hunter camps; on-going and completed timber sales (Porter Mountain and Hightower respectively); firewood collection; potential additional oil and gas development with vegetation disturbing activities and related infrastructure such as pipeline construction.

3.6.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

Additional acres of vegetation would be removed under this alternative due to a) larger size of the central facility as compared to the compressor site, b) addition of 7,819 feet of pipeline from the 21-2 to the central facility, c) widening of the pipeline corridor to 75' for buried pipeline. A summary of the approximate acreage by vegetation type that would be affected is given in Table 3.6.2.3.

The removal of the above-listed vegetative types is long-term; however, successful reclamation will replace all but 14.8 acres of the existing vegetation with a mixture of species compatible with existing conditions.

Indirect effects would be similar to those for the Proposed Action, although total disturbance would be greater, resulting in more acres prone to weed infestation. This would be offset by the reduction in traffic through burial of water lines in Alternative 3 (see Transportation Section 3.12) as traffic is a continuous source of weed introduction.

Cumulative Effects: Cumulative effects would be similar to those for the Proposed Action.

Table 3.6.2.3. Vegetation Types Affected by Alternative 3.

Vegetation Type	Acres
Sagebrush	0.6
Sagebrush/grass mix	0.2
Sagebrush/mesic mountain shrub mix	19.8
Gambel oak	15.1
Mesic mountain shrub	13.5
Pinyon/juniper/sagebrush mix	0.7
Pinyon/juniper/ mountain shrub mix	0.1
Aspen	22.0
Douglas-fir	0.4
Total	**72.4***

* Analysis used GIS shapefiles to calculate disturbed vegetation area using small vegetation unit blocks (pixilated appearance of Figure 3.4.1) which unlike other acreage disturbances which were calculated manually to include cut and fill slopes of pads. Aspen regeneration clearcuts were not included on maps. Assumptions made were: 24' width for new access roads, 20'disturbance for surface pipelines (compaction, incidental vegetation removal, etc) and 75' disturbance for buried pipelines.

3.7 Rangeland Resources

The direct, indirect and cumulative effects analysis area for rangeland resources is the Buzzard grazing allotment.

3.7.1 Affected Environment

The project area is grazed by livestock (cattle) permitted by the FS (Figure 3.7.1). Management of livestock includes controlling location and numbers of the animals and systematically grazing different pasture areas to allow forage to recover. Livestock movement is generally limited through the use of fences and gates, and by access to water sources and salt licks.

The project is located in the Buzzard Allotment. Cattle are turned into the Sheep Creek Pasture of the Buzzard Allotment, located directly north of the project area, in mid-June (beginning June 13). Depending on rotation, the cattle are moved through the Hightower Pasture, located within the project area, beginning July 1. If the cattle stay in the Hightower Pasture, they will remain in the pasture for approximately one month. If the cattle graze other pastures, the expected time spent in the Hightower Pasture is approximately 10 days. The cattle will return to the Hightower Pasture for 10 days to two weeks, from mid-October to mid-November, as the cattle are moved off of the grazing allotments for the season. There are 2,188 pairs of cattle permitted on the Buzzard Allotment, which equates to roughly 11,116 animal unit months (AUMs) on the whole allotment. The Sheep Creek Pasture supports 1,425 to 1,900 AUMs.

The project area is bounded by two main travel ways through the Hightower Pasture, NFSR 265 and 266. NSFR 266 is utilized by Porter Allotment cattle in mid-May/early-June, and again in mid-October/mid-November to access their private inholding in Porter Creek. In addition, NFSR 266 is also utilized to trail sheep in mid-June and late-September.

Range projects present on federal allotments include fences, watershed stabilization terraces and water facilities, such as springs and stock ponds. Vegetation in the project area is described in the Section 3.6 of this document.

3.7.2 Environmental Consequences

3.7.2.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative. Section 2.1 describes the No Action Alternative.

3.7.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

The direct effect of the Proposed Action is likely to result in short-term losses of AUMs due to vegetation disturbance, which would be replaced by assumed successful reclamation. If it is assumed that the affected federal grazing allotments have a carrying capacity of 10 acres per AUM, the total estimated, short-term disturbed area of 55 acres would result in temporary loss of 5.5 AUMs. This effect on grazing would occur during the construction period, if the construction took place between June 13 and July 1, and would potentially last until the project area is successfully re-vegetated. It is estimated that the time to re-establish vegetation in the project area would be about one to two years following project development and reclamation.

The long-term disturbance due to the Proposed Action is calculated at 12.5 acres. This corresponds to a grazing resource of about 1.2 AUMs, which would continue for the 30 plus year life of the project.

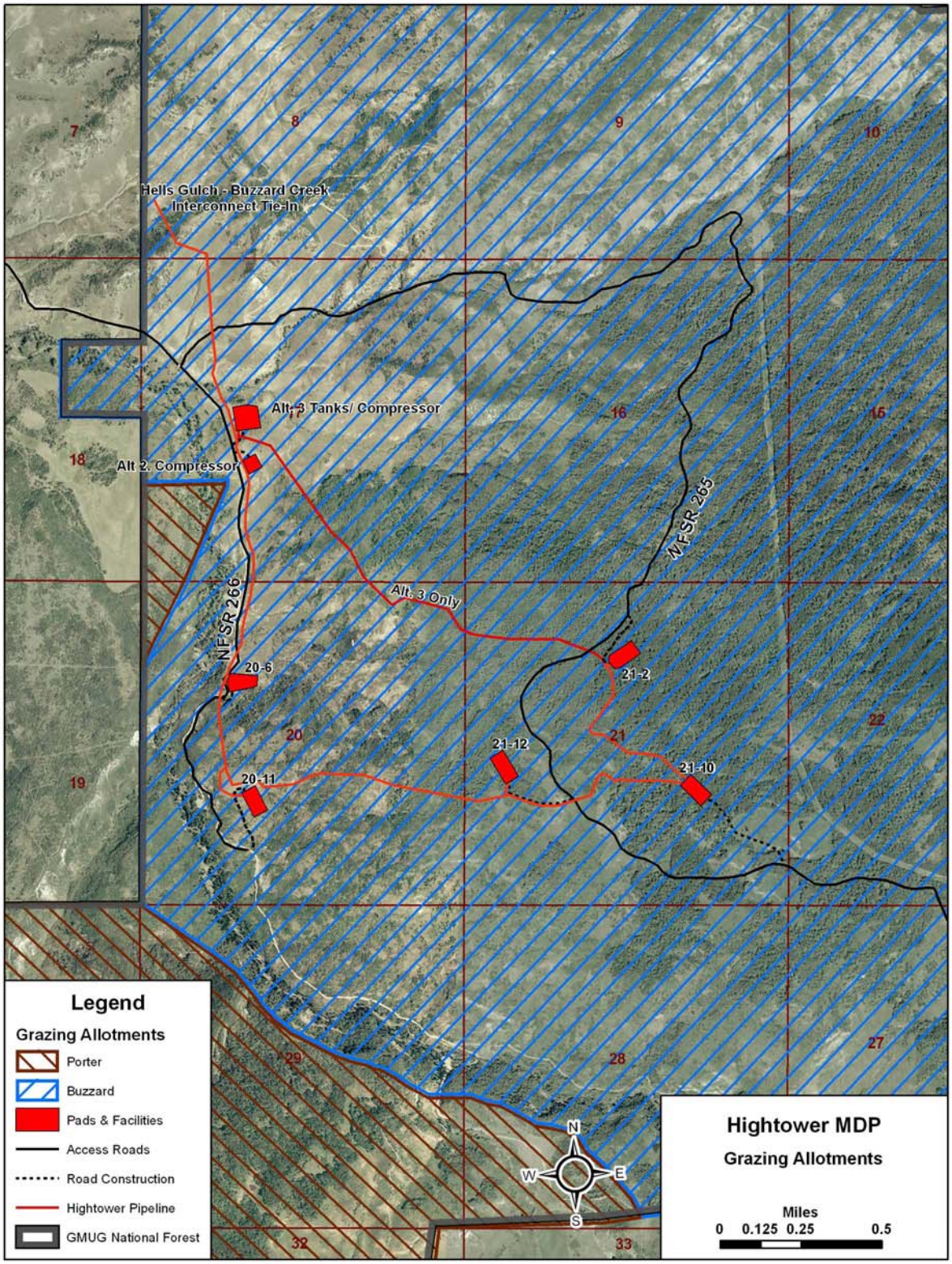
The primary indirect effect of the proposed Action is the potential for traffic and livestock congestion along NFSR 265 and 266. This could occur if mobilization or demobilization for a major project development activity (i.e., rig move or frac job) were concurrent with livestock turn-out or gathering. Design Criteria call for the company to communicate with the range permittees and the FS Range Conservationist for mob/de-mob activities occurring near on and off dates therefore minimizing this effect.

Cumulative Effects : Effects of the Proposed Action are not considered significant in the effects analysis and do not act in conjunction with other past, present, or future actions to create significant cumulative effects. Past, present and foreseeable future actions are not known to have, or potentially have, any significant effects on rangeland resources.

3.7.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads will All Buried Pipelines (including produced water lines)

The direct effects of Alternative 3 are expected to be very similar to the effects discussed under Alternative 2, with the exception of the total estimated, short-term disturbance area increasing from 55 to 85.5 acres, which corresponds to a temporary loss of 8.5 AUMs. The long-term disturbance due to Alternative 3 is calculated at 14.8 acres. This corresponds to a grazing resource of about 1.5 AUMs, which would continue for the 30 plus year life of the project.
Indirect and cumulative effects of Alternative 3 are expected to be the same as the indirect effects discussed under Alternative 2.

Figure 3.7.1. Hightower MDP Grazing Allotments



3.8 Aquatic Wildlife (Includes Special Status Species)

3.8.1 Affected Environment Aquatic Wildlife, Amphibians and Reptiles

There is no fishery in Hightower Creek, but a variety of aquatic organisms are found, including worms, mites, insects, mollusks, and amphibians such as tiger salamander and chorus frog. There is a fishery in Buzzard Creek, its tributary streams, and associated wetlands provide habitat for a wide variety of aquatic wildlife, amphibians and reptiles as well as macroinvertebrates. In upper Hightower Creek, water appears to be present year round, although the lower portion is dry by late summer in most years. There are two beaver ponds located in upper Hightower Creek and one located on a tributary of Hightower Creek. Of the three ponds, only one of the ponds on Hightower Creek was active in 2007.

No formal sampling for aquatic macroinvertebrates was done during fieldwork, but the relatively poor condition Buzzard Creek and its tributary streams would indicate the presence of macroinvertebrate populations consistent with a degraded water system. Mayflies, for example, are usually abundant in high quality water systems but are likely not as abundant in the project area reach of Buzzard Creek as they would be much higher in the watershed.

The Buzzard Creek watershed provides habitat for aquatic vertebrates that include several fish species. The analysis area includes GMUG NF **Management Indicator Species**: Colorado River cutthroat trout (*Oncorhynchus clarkia pleuriticus) and* brook trout (*Salvelinus fontinalis*); the area also includes **USFS Region 2 sensitive species**: bluehead sucker (*Catostomus discobulis*) and mountain sucker (*Catostomus platyrhynchus*); and also includes native non-game species such as mottled sculpin (*Cottus bairdi*), speckled dace (*Rhinichthys osculus*),and long-nosed dace (*Rhinichthys cataractae*). Stream sampling by the Colorado Division of Wildlife in 2006 turned up bluehead sucker, mottled sculpin, and speckled dace, but no salmonids (trout) near the confluence with Cheney Creek downstream from the project area (Anita Martinez, CDOW, pers. comm.). USFS sampling in 2005 showed that salmonids occurred only in Bird Creek and Willow Creek. Buzzard Creek from Uhl Creek to the headwaters is listed as Colorado River cutthroat trout habitat (Chapter O, Appendix C, CDOW Regulations). It is speculated that the absence of salmonids in the latest sampling effort is due to the drought of 2002 when Buzzard Creek was completely dry from Crane Creek to well below the Forest boundary. It is possible that fish populations have yet to recover from that event. For further discussion of Colorado River Cutthroat Trout as a sensitive species see Section 3.8.8 below.

The beaver ponds and small potholes scattered throughout the Project Area provide suitable breeding habitat (Hammerson 1999) for tiger salamander (*Ambystoma tigrinum*), striped chorus frog (*Pseudacris triseriata*), northern leopard frog (*Rana pipiens*) and boreal toad (*Bufo boreas boreas*), but only the chorus frog is known to be present in the project vicinity. However, a boreal toad population is known to exist on Buzzard Creek beginning about one half mile above the confluence with Owens Creek south of the Project Area. The only reptile species known to be present is the western terrestrial garter snake (*Thamnophis elegans*).

3.8.2 Environmental Consequences Aquatic MIS species All Action Alternatives

3.8.2.1 No Action

No effects to Aquatic MIS species are expected. On-going processes are expected to continue.

3.8.2.2 Alternatives 2 and 3

No direct effects to MIS aquatic species are expected since no activities would occur directly on Buzzard Creek.

Short term disturbances for road, pad, and pipeline construction will release suspended sediment even though implementation of best management practices for erosion and stormwater control will keep those releases to a minimum. Effects to MIS species are expected to be minimal since the majority of CRCT and brook trout distribution is upstream of the project area.

There will be no direct effects to habitat from either of the action alternatives, but indirect effects through siltation or pollution of Buzzard Creek are possible, so the action alternatives may adversely impact individuals, but are not likely to result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability range wide

Numerous land use actions (e.g., oil and gas activity, recreational activity, livestock grazing, road building, housing development, etc.) on State and private lands surrounding the GMUG are reasonably certain to occur over the next several years. These land uses have the potential to affect trout through sedimentation of the streams and lakes, which affects the water quality needed by trout. Road use and maintenance associated with increased oil and gas, recreation, and timber management activities would continue to cause sources of sediment to be delivered to Buzzard Creek.

For further discussion of Colorado River Cutthroat Trout as a sensitive species see Section 3.8.8 below.

Determination:
This project would not affect the viability of trout species on the Forest given the size and scale of the project. Indirect effects are anticipated to be minimal and discountable and would not result in a measurable change in downstream habitat due to the projects proximity to fish-bearing streams, and relative small disturbance area when compared to the total subwatershed acres. Since the indirect effects of the project are minimal, and the stream comprises such a small percent of the total habitat for trout Forest-wide, the viability of cutthroat and brook trout would not be threatened by this project. Therefore, this project may temporarily displace individuals or alter how individuals use affected habitat through habitat alteration and/or disturbance, but these effects will not result in a change in population numbers or trends at the project or Forest level scales.

3.8.3 Affected Environment Colorado Pikeminnow (Ptychocheilus lucius), Humpback Chub (Gila cypha), Bonytail Chub (Gila elegans), and Razorback Sucker (Xyrauchen texanus)

Federally threatened (FT), endangered (FE), or candidate wildlife, that were initially considered for this project include those identified by the FWS, in a list that was received on 10-30-07, as potentially occurring on the GVRD or potentially affected by management activities on the GVRD. This list includes:

- Colorado Pikeminnow-FE
- Bonytail Chub-FE
- Razorback Sucker-FE
- Humpback Chub-FE

Information on species status, distribution, and ecology was derived from FWS recovery plans, Colorado Natural Heritage Program (CNHP) data base maps and reports, Colorado Division of Wildlife (CDOW) data, various scientific studies and reports, and correspondence with FWS biologists.

These species, collectively known as "**Colorado River Fish",** are all federally endangered and are not found within the boundaries of the Project Area, but do have the potential of being affected by activities that deplete or degrade the flow of downstream waters into the Colorado River (FWS 1990a, b, 1991). Any FS action that would result in the depletion of water or degradation of water quality to tributaries of the Colorado River requires formal consultation with the FWS. Water use associated with this project is described below.

Colorado pikeminnow
Status: Federally Endangered, Colorado State Endangered

The historic range of the Colorado pikeminnow included the main channels and major tributaries of the entire Colorado River basin. Present distribution of this species is restricted to the upper Colorado River system above Glen Canyon Dam. In general, Colorado pikeminnow use a variety of riverine habitats with varying depths and velocities. Shoreline, eddy, and main channel areas are extensively used by adult pikeminnow year-round with pool and backwater habitats seasonally important. As water temperatures decline in the fall, adult pikeminnow use of fast water habitats decreases and shifts to slow water areas. Diet consists primarily of zooplankton and insect larvae in young of year, switching mainly to fish as juveniles. Adult pikeminnow are almost exclusively piscivorous. Spawning occurs in late June and July when water temperatures have reached 20 degrees C for a few days.

Bonytail chub
Status: Federally Endangered, Colorado State Endangered

Historic distribution of the bonytail included the main channels and larger tributaries of the Colorado River system. The upper limit of present distribution on the Colorado River is the Black Rocks area of Ruby Canyon. Habitat requirements and general ecology of the bonytail is largely unknown due to the low population level remaining in the wild. The few captures of bonytails in the wild (excluding the lower basin reservoirs) in the past two decades have been in canyons with deep, fast currents. However, the general consensus among researchers is that adult bonytails primarily use pool and eddy habitat types with slow currents. Bonytail diet consists of primarily aquatic and terrestrial invertebrates. Spawning occurs when river temperatures reach about 18 degrees C.

Razorback sucker
Status: Federally Endangered, Colorado State Endangered

Historic range of the razorback sucker in the Upper Colorado River basin is similar to that of the bonytail and pikeminnow but razorbacks were more common in the lower basin. At present, razorbacks have been documented in the Green River (below its confluence with the Yampa River), and the mainstem Colorado River upstream from the confluence of the Green River to DeBeque, Colorado. Unique morphological characteristics of the razorback sucker suggest it is adapted to large riverine systems with turbulent flows. However, in the upper Colorado River basin the majority of razorback captures have been in low velocity, off-channel areas in low gradient reaches. Food consists primarily of small invertebrates and organic debris on the bottom. Spawning occurs within

low velocity backwaters over gravel substrate where predation by non-native fish species may contribute to low survival. Spawning occurs when river temperatures range from 12-16 degrees C.

Humpback chub
Status: Federally Endangered, Colorado State Endangered

Little is known of the humpback chub's historic distribution within the Colorado River system. At present, humpback chubs occur in the upper Colorado River. The highest known concentrations are located in the Black Rocks area of Ruby Canyon and Westwater Canyon reaches near the Colorado/Utah State line. Humpback chubs are found in a variety of habitats but have primarily been documented in areas associated with fast currents, deep pools, and boulders. Humpbacks are primarily bottom feeders but will feed on both aquatic and terrestrial invertebrates, which occur throughout the water column. Spawning is thought to occur over gravel-cobble substrate in backwaters, which are associated with preferred deep canyon habitats when water temperatures approach 16 degrees C.

3.8.4 Environmental Consequences Endangered Colorado River Fish

3.8.4.1 Alternative 1 – No Action

Under this Alternative there will be no change in existing conditions.

3.8.4.2 *All Action Alternatives*

Water use associated with the Plan of Operations would result in an estimated 39 acre-feet depletion being depleted from the Colorado River basin. Water depletions, depending on the timing, could reduce spawning success, reduce the availability of rearing habitat, and increase overwinter mortality.

Water for use during drilling would be purchased from an adjudicated water source. Approximately 1.2 acre-feet (10,000 barrels) of water would be needed for the drilling process for each well. A total of 32 wells are expected to be used for drilling. Drilling water would be reused on subsequent wells as much as possible. Total acre-feet depletion for the project is 39 acre-feet.

There are no direct effects to this species with the implementation of the Proposed Action. Indirect effect to these species would occur associated with the annual 38.4 acre-feet depletion associated with water use. Water depletion would occur in the Colorado River sub-basin, and is associated with mineral extraction.

There are no known cumulative effects associated with future State, tribal, local or private actions that are reasonably certain to occur in the action area.

Determination:
Alternatives 2 and 3 **"may affect"** and are **"likely to adversely affect"** the **Colorado pikeminnow, razorback sucker, humpback chub, bonytail chub**, and is also **"likely to adversely affect"** the designated critical habitat located downstream of the action, due to water depletions.

This project is consistent with ES/GJ-6-CO-99-F-033-CP062 (TAILS 65413-2007-F-0119) programmatic consultation for *depletions (< 100 acre-feet per year; no single project > 50 acre-feet per year) associated with numerous mineral development and other projects located on the GMUG NF* (USFWS April 27, 2007).

Since this project is within the Colorado River Basin and also under the current programmatic biological opinion (PBO) for the BOR (PBO USFWS 1999), the applicant is required to sign a Recovery Agreement provided by USFWS as stated in the 1999 PBO. The applicant must sign and return the Recovery Agreement form to the GMUG NF before Section 7 requirements can be met.

3.8.3 Sensitive Fish Species Affected Environment

The FS provided a list of Region 2 sensitive species that may occur within the GMUG. From this list, a sub-list of species that may occur on the Grand Mesa was identified by the Grand Valley Ranger District wildlife biologist and the FS botanist. Sensitive species on this list were then evaluated for their potential to occur in the analysis area. Table B-3 lists each of the species on this sub-list, gives a brief description of their habitats, and makes a determination of their potential to occur within the analysis area. Habitat descriptions and distribution information are from several sources. See further discussion of Sensitive Species in Section 3.9.5.

3.8.4 Bluehead sucker (Catostomus discobolus) Affected Environment

Natural History

The bluehead sucker is native to the Colorado River Basin in Colorado, New Mexico, Arizona, Utah and Wyoming. Within Region 2, populations exist in western Colorado and south-central Wyoming. This species can occur in larger streams up to 8,500 ft. and requires moderate to fast velocities of water. Bluehead suckers and mountain suckers (*C. platyrhynchus*) may occur sympatrically on the periphery of their distributions in smaller tributary streams (Ptacek 2005). Detailed information concerning the distribution, life history, population trends and community ecology of this species is relatively limited (Ptacek 2005).

Environmental Baseline

Bluehead suckers have been documented in lower elevation streams on the Grand Mesa National Forest. CDOW biologists have collected bluehead suckers upstream nearly to Crooked Creek at the upper end of the elevation range (CDOW 2007). Bluehead suckers and mountain suckers (*C. platyrhynchus*) may occur sympatrically on the periphery of their distributions in smaller tributary streams and this may be true in Buzzard Creek (Ptacek 2005).

3.8.5 Bluehead sucker Environmental Consequences

3.8.5.1 Alternative 1 – No Action

As there would be no change in conditions, there would be **No Impact** to bluehead suckers

3.8.5.1 All Action Alternatives

There will be no direct effects as a result of the action alternatives, but indirect effects due to siltation or pollution of creeks are possible. Other cumulative impacts include diversion of water, construction of barriers that don't allow fish passage (culverts, dams, etc) and introduction of non-native species (Ptacek 2005).

Determination:

The action alternatives may **adversely impact individuals, but are not likely to result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability range wide.**

3.8.6 Mountain Sucker (Catostomus platyrhynchus) Affected Environment

Distribution
Mountain suckers are native to Western North America and are widely distributed in the Great Basin and upper Missouri River, upper Colorado River, Saskatchewan River, Fraser River (British Columbia), and Columbia River (Wydoski and Wydoski 2002). Mountain suckers are considered imperiled in Colorado (NatureServe 2005). There is limited literature on mountain suckers therefore their status in most of their range is unknown (Wydoski and Wydoski 2002).

Natural History
Mountain suckers are found in reservoirs and clear, cold creeks and rivers. They apparently prefer pool-like habitats and cobble to sand substrates. Young inhabit slower moving water in side channels, weedy backwaters and near shore areas in reservoirs (NatureServe 2005). Males mature between age 2 and 3, while females mature between age 2 and 5. Females attain larger sizes than males and both genders can live over 8 years.

Throughout their range, mountain suckers may spawn from May until early August, but most populations spawn in May and June when water temperatures are between 11 and 19C (Wydoski and Wydoski 2002). The spawning season in different waters is influenced by both latitude and altitude, generally being later in more northern latitudes or higher elevations. Females may produce between 900 and 4000 eggs dependent upon their size (Brown 1971). Mountain suckers broadcast spawn over gravel substrates in riffles of clear mountain streams (Wydoski and Wydoski 2002). Young of the year usually hatch in 7-8 days at about 18C (Snyder and Muth 1990).

Mountain suckers feed primarily on algae and diatoms; although they are known to eat some invertebrates (Wydoski and Wydoski 2002). Mountain suckers are predated upon by salmonids, as well as by mammals and birds; since, mountain suckers are generally less than 200 mm in length they are vulnerable to large piscivores throughout their lives (Wydoski and Wydoski 2002).

Important factors for healthy mountain sucker populations include good water quality and habitat. Population declines have been associated with the loss of essential spawning habitat, land management and irrigation practices that increase sediment, alterations of riparian areas, predation and competition from nonnative fishes, or a combination of these factors (Wydoski and Wydoski 2002). Reservoir construction has also had detrimental affects on mountain sucker populations as they can result not only in habitat loss but also fragment populations and make them more vulnerable to extirpation (Moyle et al. 1989). Many populations may initially thrive in impoundments but later decline below pre-impoundment levels due to the establishment of predatory salmonid populations (Wydoski and Wydoski 2002; NatureServe2005).

Environmental Baseline
Mountain suckers have been reported within the Project area or in close proximity downstream. FS biologists have documented mountain sucker distribution in Buzzard Creek upstream nearly to Bird Creek, an elevation of 8,640 feet in 2005 (FS 2007). This is the upper end of their elevational distribution. The streams within the project Area are suitable mountain sucker habitat.

3.8.7 Mountain Sucker Environmental Consequences

3.8.7.1 Alternative 1 – No Action

As there would be no change in conditions, there would be **No Impact** to mountain suckers

3.8.7.1 All Action Alternatives

Gas development activities can decrease vegetative cover, may increase bank erosion and can increase stream temperatures as well as change the aquatic invertebrate composition and channel morphology. Sucker populations may be effected by increased sediment runoff from the Project Area, and changes to the thermal regime from lack of riparian cover. Cumulatively effects of historical water diversion, dam construction, introductions of non-native fish have most likely affected mountain suckers populations.

Determination: Gas development activities may result in the above impacts and therefore, the action alternatives **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning Area**, **nor cause a trend to federal listing or a loss of species viability range wide.**

3.8.8 Colorado River cutthroat trout (Oncorhynchus clarki pleuriticus) Affected Environment

Distribution

Historically Colorado River cutthroat trout (CRCT) occupied portions of the Colorado River in Wyoming, Colorado, Utah, Arizona, and New Mexico. They were once present in portions of the Green, Yampa, White, Colorado, and San Juan Rivers. Their current distribution is likely constrained to headwater streams and lakes by diversions, summer thermal barriers, and nonnative species. Most of the lotic populations are in isolated headwater reaches with less than 30 cubic feet per second (cfs). Gradients are usually greater than 4% and the majority of populations are located above 7,500 ft above mean sea level (CRCT 2001).

Natural History

Habitat requirements for the Colorado River cutthroat appear to be similar with other cutthroat subspecies, and other North American trout (Joseph and Sinning 1977). CRCT live in clean, cool mountain streams, preferably of moderate (6 % or less) gradient. Colorado River cutthroats typically require water with high dissolved oxygen content, cool water temperatures in the summer, and clean gravel for spawning. Cutthroat streams in Wyoming, for example, generally have gradients ranging from two to above 11 percent, with most over four percent. Most are cold, fed by springs of 42 degrees to 52 degrees F (Binns 1977). Since these figures are based on the present range of the species, however, they probably only represent a portion of the range of stream gradients and temperatures necessary to sustain the native Colorado River cutthroat trout. In addition, they require riffle areas for food production, complex habitats for juveniles, pools for overwintering, and summer rest. The pool to riffle ratio should be roughly equal for maximum population and biomass, and to provide adequate habitat for juveniles and adult fish. In headwater streams, over-wintering can occasionally be problematic for the trout, due to lack of pools of sufficient size and the formation of anchor ice. Vegetation in the riparian zone needs to be abundant enough to provide shade and cover (Wesche et al. 1987; Bozek and Rahel 1991). Colorado River cutthroat trout require year round stream flows to survive. Since most of the flow of regional streams comes as a springtime "pulse" from snowmelt, some streams provide good early-season but very poor late-season habitat. A base flow in late summer/fall/winter that is above 50% of the average annual flow is considered excellent, 25-50 % fair and below 25% poor (Binns and Eiserman 1979). The pH levels of cutthroat habitats should be 5 to 9, with a slightly basic optimal range of 6.5 to 8.0 (Hickman and Raleigh, 1982).

A recent assessment of CRCT populations states that CRCT occupy approximately 14% of historical range (Hirsch et al. 2006). Literature has identified the strongest cause of CRCT population decline comes from interactions with non-native trout (Young 1995, Behnke 1992). This interaction has lead

to competition, as well as hybridization of CRCT with other trout species, and local populations of "conservation", or genetically pure CRCT, are rare in the GMUG (USFS 2005a). In addition to competition and hybridization, land management practices such as road construction, mining, recreation, and water use have all been shown to have adverse effects on CRCT habitat conditions and abundance (Meehan 1994).

Environmental Baseline

Currently there are 32 conservation populations of Colorado River cutthroat trout (CRCT) known to occur in 22 7th field watersheds on the GMUG. Two additional populations occur on BLM land adjacent to the GMUG Forest. Conservation Populations are restricted to approximately 96 miles of stream, with most populations occurring in tributaries of the North Fork of the Gunnison River. Streams on the GMUG support 27% of the known CRCT Conservation Populations in the Colorado, Dolores and Gunnison Geographic Management Units (GMUs). Existing populations are located in isolated headwater streams of generally 2-4 miles in length, and remain at risk for localized extirpations. Two CRCT Conservation Populations have been established in lakes totaling approximately 75 surface acres on the Grand Mesa; however, severe drought and dam reconstruction have likely affected the abundance of these populations. The total miles of stream occupied by CRCT on the Forest have increased 29% since 2001. However, this increase was largely due to the discovery of new CRCT Conservation Populations, and not from increases in abundance or dispersal of individual populations.

Buzzard Creek is listed by CDOW as Colorado River cutthroat trout water. Brush Creek, tributary to Buzzard Creek has a population of 90 to 99% pure CRCT ("conservation population") but it is much farther downstream (Hirsch et al. 2005). The Buzzard Creek designation is for historic habitat. Only two reports of cutthroat collections by CDOW or FS occur in the watershed. FS reports collecting "CRN", notation for native cutthroat of unknown genetic purity at Bird Creek near the upper end of the Buzzard Creek drainage.

Suitable habitat for CRCT and other trout species occur throughout the Project Area. Competition with non-native trout is considered to be the biggest threat to CRCT, and impacts to the distribution, abundance, and genetic integrity of CRCT are well documented (CRCT Task Force 2001; Young 1995). Cutthroat and brook trout share similar habitat requirements, though spawning times differ. Brook trout are fall spawners and have been shown to have competitive advantages over CRCT (spring spawners), particularly at the juvenile life-history stage (Peterson et al 2004; Peterson and Fausch 2003).

3.8.9 Colorado River cutthroat trout Environmental Consequences

3.8.7.1 Alternative 1 – No Action

There would be no impact to Colorado River cutthroat trout.

3.8.7.1 All Action Alternatives

Due to their restrictive habitat, CRCT have short home ranges and therefore, even a small impact to available habitat could have an effect on local populations (Heggenes et al. 1991, Quinlan 1980). Gas development activities could increase sediment load into surrounding streams, creeks, thereby degrading available habitat and impacting existing populations or potential habitat. However, by maintaining riparian and aquatic habitats as required by the Forest Plan, Watershed Conservation Plan (See Appendix A), and the design criteria, the potential for negative effects to riparian and aquatic habitat is reduced.
The actions alternatives may have short-term indirect effects on CRCT due to the potential for temporary increased sedimentation, but it will not negatively affect CRCT population trends at the local or Forest-wide scale.

Determination: The Action Alternatives **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability range wide** for the cutthroat trout.

3.9 Terrestrial Wildlife (Includes Special Status Species)

3.9.1 Terrestrial Wildlife Affected Habitats

Ten of the vegetative types recognized by GMUG are found in the Hightower Master Development Plan (MDP) Area. The area of each type affected under each action alternative is summarized in Tables 3.9.2.2 and 3.9.2.3. Acreages were calculated by overlaying the proposed project features over a vegetation map obtained from GMUG.

The proposed Project Area is located on the east side of Buzzard Creek just inside the Forest boundary in the Grand Valley Ranger District (GVRD) of the GMUG. Two of the well pads and the compressor facility would be located along NFSR 266, and three well pad locations would occur along NFSR 265. Vegetation is primarily sagebrush and mountain shrub habitats, but some juniper, blue spruce, and cottonwood are also present at the lower elevations along NFSR 266. Aspen dominates at the sites along NFSR 265.

3.9.2 Terrestrial Wildlife Habitat Consequences

3.9.2.1 Alternative 1 – No Action

3.9.2.2 Alternative 2 – Proposed Action

Implementation of the proposed action would result in the removal of existing vegetation in the action areas. See Table 3.9.2.2.

The removal of the vegetative types listed should be considered short term for the brush species and long term for the tree species. Successful reclamation will replace all but 13.0 acres of the existing vegetation with a mixture of species compatible with existing conditions.

Table 3.9.2.2. Vegetation Types Affected by Alternative 2.

Vegetation Type	Acres
Sagebrush community	1.6
Sagebrush/grass mix	0.2
Sagebrush/mesic mountain shrub mix	9.2
Gambel oak	6.1
Mesic mountain shrub mix	5.2
Pinyon/juniper/sagebrush mix	0.6
Pinyon/juniper/mountain shrub mix	0.1
Aspen	11.9
Douglas-fir	0.1
Willow	0.2
Aspen regeneration	13
TOTAL	**48.2**

3.9.2.3 Alternative 3

A summary of the approximate acreage by vegetation type that would be affected is given in Table 3.9.2.3. Reclamation would replace all but 16 acres with appropriate vegetation.

Table 3.9.2.3. Vegetation Types Affected by Alternative 3.

Vegetation Type	Acres
Sagebrush	2.0
Sagebrush/grass mix	0.2
Sagebrush/mesic mountain shrub mix	15.0
Gambel oak	12.1
Mesic mountain shrub	9.4
Pinyon/juniper/sagebrush mix	0.5
Pinyon/juniper/ mountain shrub mix	0.1
Aspen	20.6
Douglas-fir	0.2
Aspen regeneration	13
TOTAL	**73.1**

3.9.3 Threatened and Endangered Species

Those threatened or endangered species that are known to occur in or near the Grand Valley Ranger District are shown in Table 3.9.3. A complete description of the habitat requirements of each species and the findings of the field inventory for threatened, endangered and candidate species can be found in the Biological Assessment prepared for this project.

Most of the potential species were dropped from further consideration because their range distributions are outside the Project Area, or habitats necessary for their life requirements are not found within the Project Area. From the list below, only the Canada lynx will be analyzed further.

Table 3.9.3. Terrestrial species listed by FWS that are potentially present on the Grand Valley Ranger District.

Common Name	Scientific Name	Status*	Habitat or species Affected by proposed activities
Birds			
Mexican spotted owl	*Strix occidentalis lucida*	T	No
Yellow-billed cuckoo	*Coccyzus americanus*	C	No
Mammals			
Black-footed ferret	*Mustela nigripes*	E	No
Canada lynx	*Lynx canadensis*	T	Yes

* T = Threatened E = Endangered C = Candidate

3.9.3.1 Affected Environment

Canada lynx

Information on Canada lynx status, distribution, and ecology was derived from Forest-wide GIS lynx mapping coverage developed in collaboration with FWS, and information compiled in the Canada Lynx Conservation Assessment and Strategy (Ruediger et al. 2000) and the lynx science report (Ruggiero et al. 2000). This species is evaluated in greater detail in the Biological Assessment.

Lynx are federally threatened and occur in mesic coniferous forests that have cold, snowy winters and provide a prey base of snowshoe hare (Ruggiero et al. 2000). Lynx occupy boreal, sub-boreal, and western montane forests (Ruediger et al. 2000). In the western United States, they are associated with lodgepole pine, subalpine fir, Engelmann spruce, and aspen cover types on subalpine fir habitat types. Snowshoe hare are the primary prey of lynx (Koehler and Aubrey 1994), but red squirrels are an important alternative prey species (Koehler 1990, Ruediger et al. 2000).

Primary lynx habitat in the Southern Rocky Mountain region is found in the subalpine and upper montane forest zone, roughly between 8,000 and 12,000 feet elevation (Ruediger et al. 2000). Lower montane forests are likely to be important for movement and dispersal.

Foraging habitat for lynx in the Southern Rocky Mountain region include subalpine fir, lodgepole pine, and Engelmann spruce cover types with abundant prey species. Densely regenerating conifer forests typically produce the highest densities of snowshoe hares (Koehler 1990, Koehler et al. 1979, Weaver 1993, Koehler and Aubry 1994). Conifer-aspen forests with dense regeneration or with an extensive shrub and woody debris understory may be important for snowshoe hare or other prey species (Ruediger et al. 2000). Extensive stands of pure aspen likely are poor lynx foraging habitat, unless intermixed with spruce-fir or young lodgepole pine stands. Regenerating burns are often quite productive for prey species due to the mixed deciduous/conifer forests, multiple age classes, shrub layer, dense herbaceous layer, and extensive downed woody debris. Sagebrush communities at higher elevations and in proximity to subalpine and upper montane forests may be important foraging areas for lynx due to high prey abundance (Squires and Laurion 2000). Other habitats that may be important for foraging include large and medium willow carrs, beaver pond complexes, and shrub dominated riparian communities (Ruediger et al. 2000).

The common component of den sites appears to be large woody debris, either downed logs or root wads (Koehler 1990, Mowat et al. 2000, Squires and Laurion 2000). Stand structure appears to be more important than forest cover type (Mowat et al. 2000). Denning habitat in the southern Rockies is likely to occur in late-successional spruce-fir forests with substantial amounts of large woody

debris, primarily on north aspects (Ruediger et al. 2000). For denning habitat to be functional, it must be in close proximity to large acres of foraging habitat.

The average home range for male lynx in southern boreal forests is 58 square miles and 28 square miles for females (Aubrey et al. 2000). The large home ranges in the southern boreal forests are probably in response to the low density of snowshoe hare populations and the fragmentation of habitat. Travel corridors are thought to be an important factor in lynx habitat because of their large home ranges (Brittell et al. 1989). The mosaic of natural and artificial barriers to lynx movement in Colorado indicates the need to maintain undisturbed corridors to link primary lynx habitat. Landscape connectivity for lynx movement may include forested mountain ridges, wooded riparian drainages, and lower elevation forests and shrub habitat. Travel corridors are usually forested and include contiguous vegetation cover over 2 m (6 feet) in height (Brittell et al. 1989). Lynx travel along the edges of meadows, but generally do not cross openings wider than 90 m (300 ft) (Koehler 1990). However, there are records of lynx using open habitat and riparian areas surrounded by open habitat in travel corridors (Shenk 2006) and large open expanses of mountain grasslands (Thompson and Halfpenny 1989).

Ruediger et al (2000) suggest that shrub habitats found in the project area must provide food as well as cover as lynx travel from one area of suitable denning habitat to another. Lynx may utilize birds, ground squirrels, cottontails, and jackrabbits while searching for areas providing more suitable prey. For this reason, degradation of tree and shrub habitats within linkage corridors should be avoided whenever practicable.

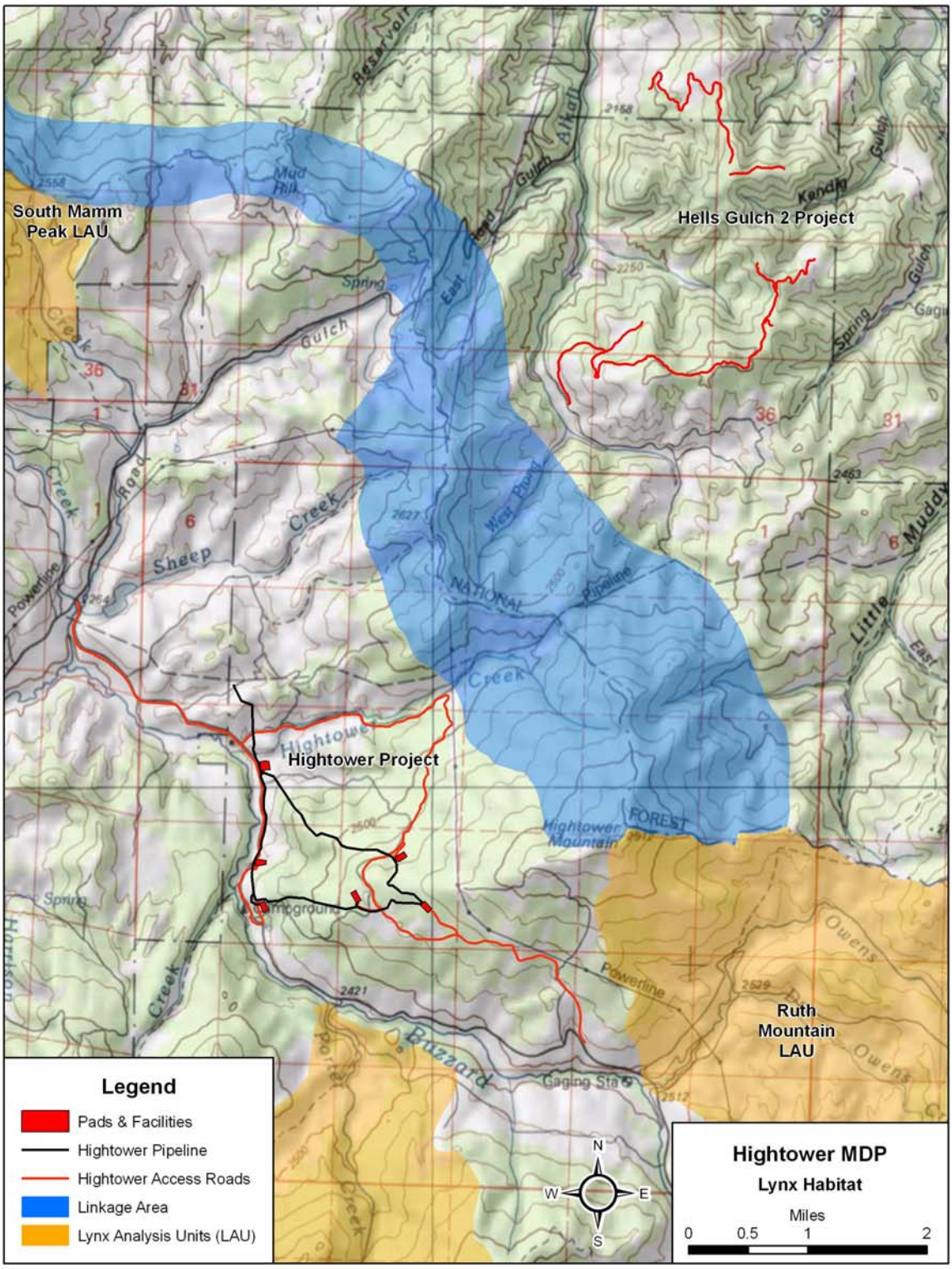
A portion of the Battlement Mesa lynx linkage area occurs in the area, although none of the facilities would be located within the actual boundaries of the linkage area. Truck traffic associated with the Proposed Action would bisect the linkage area on NFSR 270. (See Figure 3.9.3).

The Project Area is near the Ruth Mountain and South Mamm Peak Lynx Analysis Units in the GMUG. The Battlement Mesa lynx linkage area is immediately adjacent to the Project area (Figure 3.9.4). At least one of the transplanted lynx from southwestern Colorado was located a number of times in the general project area (Shenk 2001).

Even though lynx individuals appeared to persist in Colorado in the 1990's, it was believed that the population was so small in Colorado that it was incapable of rebounding and was augmented with a re-establishment program in 1999. The Colorado Division of Wildlife has released a total of 218 lynx in the San Juan Mountains from 1999 to 2006. Of the total 218 lynx released, there are 80 known mortalities as of June, 2006: 21% due to starvation or disease, 31% were human-induced which were attributed to vehicle collisions or gunshot and 33% unknown causes (Dr. Tanya Shenk, Research Wildlife Biologist, Colorado Division of Wildlife, periodic lynx update, 11/2006). This mortality pattern can be expected from reintroduced animals due to unfamiliarity with the area and large-scale movements often characteristic of reintroduced animals. Reproduction has been documented, with 37 dens with an average of 3 kittens each located from 2003-2006. In 2006, a female lynx that was born in Colorado gave birth to a litter of kittens, documenting the first recruitment of a Colorado-born lynx into the Colorado breeding population. 113 kittens have been documented born to date in Colorado, and the Colorado Division of Wildlife is safely estimating that, with all mortalities documented, there are approximately 200 lynx currently alive in Colorado. The current core area for lynx is from the New Mexico border to the north to Gunnison, west to Taylor Mesa and east to Monarch Pass (Shenk 2006).

No critical habitat for Canada lynx has been designated in Colorado. In November 2006, the U. S. Fish and Wildlife Service (FWS) designated critical habitat for the contiguous United States distinct population segment of the Canada lynx (USDI, Fish and Wildlife Service 2006). The FWS did not designate critical habitat for any NFS lands. These lands were not included because through the *Conservation Agreement* between the U. S. Forest Service (USFS) and the FWS (USDA Forest Service 2005) the USFS agreed to consider the conservation measures in the LCAS to guide actions on those lands they administer. Refer to the Federal Register (2006) notice for details of the critical habitat designation. The Recovery Outline (USDI FWS 2005) identifies core areas, secondary areas and peripheral areas, based on historical and current occurrence records, as well as confirmed breeding. The Southern Rockies (Colorado and southern Wyoming) were identified as a Provisional Core Area. This designation was identified because this area contains a reintroduced population, which has documented reproduction in the last three years.

Figure 3.9.3. Lynx Habitat in the Project Area.



3.9.3.2 Environmental Consequences Canada lynx

No Action

Under this Alternative, there will be no change to existing conditions.

All Action Alternatives

Effects on individual lynx potentially using Hightower area (disturbance): Noise and associated human activity associated with construction and maintenance activities have the potential to displace any lynx that may be using the area during the time that activity is taking place. As it is non-lynx habitat, the most likely time period that lynx would potentially use the area would be summer and fall. The disturbance associated with the Action Alternatives would occur year-round for up to 2 years.

Effects on Linkage Habitat Effectiveness: No activities will take place in lynx habitat. However, the Silt to Collbran road (FSR 270) bisects the linkage area (Figure 3.9.3).

Traffic counters were used to determine baseline averages for the roads in the project area: FSR 265, 266 and 270. There would be no project facilities within the designated linkage corridor, but heavy project-associated truck traffic is expected along the roads within the linkage area. The project would increase vehicular traffic on the Silt to Collbran road (NFSR 270), which bisects the linkage corridor, and this increased traffic may render the linkage corridor less attractive to lynx during their summer movements or dispersal (i.e.,reduce habitat effectiveness for lynx or result in avoidance of the area)

This project, as well as other proposed projects in the area, is expected to raise traffic volumes on this road, particularly during construction and drilling phases. Increased traffic could result in some avoidance of this linkage corridor by lynx during summer movements or dispersal.

Available information suggests that lynx do not avoid roads, except at high traffic volumes. From Ruediger et al. (2000): Traffic volumes that affect lynx mortality and dispersal have not been studied. It should be noted that Ruediger et al. (2000) are referring to paved roads when they use the term highway. There is little information to indicate that unpaved secondary Forest roads such as NFSR 270, even at relatively high traffic volumes, present barriers to lynx movement through linkage corridors.

Alternative 3 in EA reduces the amount of traffic on both FSR 265 and 266, as compared to Alternative 2, as the produced water will be transported via pipeline instead of trucking. The original proposal would have required that a water truck visit each pad daily. Activities may happen concurrently; for instance, the proponent is planning on up to 3 drill rigs and 3 completion rigs on pads at one time (C.Clark, pers. comm. 2007). Therefore, the more likely traffic increase on FSR 270, which bisects the linkage area, could be as much as an 8% increase in daily traffic from this project alone. Other projects may add to this increase.
The proposed activities are consistent with all LCAS conservation measures.

Cumulative effects, consisting of future non-Federal actions, were analyzed on how they may affect lynx within the Hightower and Buzzard Creek drainages. Most of these actions consist of future natural gas and pipeline development, including access roads on private lands. The private land is a combination of agricultural and rural residential, with several fairly large residential subdivisions. The majority of the habitat where this type of development is taking place is in non-lynx habitat, such as grasslands, agricultural lands and pinyon-juniper. Based on discussions with District personnel, Mesa County officials, and the CDOW, there are no known state or private actions that have the potential to affect lynx or lynx habitat within the Hightower Project area; however the activities described above could influence movement of lynx on private land.

Effects Determination: Based on the above rationale, the Hightower Project has a "**may affect, not likely to adversely affect"** determination for Canada lynx. Consultation has occurred with the United States Fish and Wildlife Service to obtain their concurrence on the determination for the proposed project activities.

3.9.4 Management Indicator Species (MIS)

MIS are those species that have been selected by the various Forests to represent the habitat needs of a larger group of species requiring similar habitats. Descriptions of the habitat relationships, distribution, population trends and other information are described in the Management Indicator Species Assessment for the GMUG in the GMUG's 2005 MIS Assessment (USDA FS 2005). MIS are analyzed in detail in Management Indicator Species Assessment for this project (Project File).

The MIS listed in the 2005 MIS GMUG Plan Amendment are summarized in Table 3.9.4 below, along with the determination of either their known presence or the presence of suitable habitat within the project area. Suitable habitat is based on field surveys, literature review, and FS mapping of the vegetation. All MIS with documented presence or known habitat within the Hightower and Buzzard Creek drainages that could potentially be affected by changes to or activities within the project area are addressed; those species are: elk, red-naped sapsucker, Brewer's sparrow, northern goshawk, and the four trout species. (See Section 3.8 for the trout species).

Project design criteria, mitigation measures and monitoring requirements are described in Chapter Two. These requirements are designed to promote attainment of the desired conditions and objectives for MIS identified in GMUG's Amended Land and Resource Management Plan (2005).

All GMUG 1991 Forest Plan wildlife standards and guidelines have been reviewed, along with the design criteria and mitigation measures in place for the Hightower project. The project is consistent with the GMUG Plan for all MIS that potentially occur in the Project Area.

Table 3.9.4. GMUG MIS, their habitat associations, and the potential for their occurrence in the Hightower MDP area.

Common Name	**Scientific Name**	**Habitat Associations**	**Habitat or species Present Within the Project Analysis Area?**
Rocky Mountain elk	*Cervus elaphus*	Early succession spruce-fir, Douglas-fir, lodgepole, aspen, mountain shrub. Also MIS for travel mgmt.	Yes
Abert's squirrel	*Sciurus aberti*	Mature to late seral ponderosa pine	No*
American marten	*Martes americana*	Late-succession spruce-fir, lodgepole pine	No*
Merrriam's Wild Turkey	*Meleagris gallopavo*	Oak and Pinyon-Juniper Aspen, mixed conifer	No*
Red-naped Sapsucker	*Sphyrapicus nuchalis*	Aspen/Cavity Nester	Yes
Northern Goshawk	*Accipiter gentilis*	Late-succession aspen, aspen/conifer mix	Yes
Brewer's Sparrow	*Spizella breweri*	Mature sagebrush	Yes
Colorado River cutthroat trout (CRCT)	*Oncorhynchus clarki pleuriticus*	Aquatic and riparian habitats	Yes**
Rainbow trout	*Oncorhynchus mykiss*	Aquatic and riparian habitats	No
Brown trout	*Salmo trutta*	Aquatic and riparian habitats	No
Brook trout	*Salvelinus fontinalis*	Aquatic and riparian habitats	Yes**

*The habitat associated with this species is not known to occur in the project area, and the species is either not known to occur there or its occurrence in the project area is incidental and not representative for its associated habitat. They will not be directly, indirectly, or cumulatively impacted by proposed activities and no further analysis is necessary**.**
**** See aquatic section 3.8 above**

3.9.4.1 Rocky Mountain Elk Affected Environment

Distribution and Abundance
This species occurs throughout the mountainous regions of the western United States and Canada. The populations throughout its range were very low in the early 1900s. Elk are habitat generalists and their populations respond to climate-induced factors (e.g., forage availability and quality). Hunter harvest also has a strong influence on populations. Hunter harvest on private lands is typically limited, as either access fees or landowner preferences restrict the number of hunters and the sex of elk harvested. Region-wide, most elk populations are at or above herd management objectives, which are established within an estimated carrying capacity and balanced with hunter demand and other resource objectives.

Habitat Associations

The habitat for this species occurs throughout the mountainous regions of western North America. The habitat on the GMUG includes all the major vegetation types, and most of the minor types. The GMUG provides most of the summer range for the herds in the general area. Certain areas in the extreme lower elevations of the GMUG are used as winter or transitional range, but the vast majority of the winter range is found off the GMUG. An exception is the Hightower MDP Area, all of which lies within designated elk winter range (Figure 3.9.4.1a).

Population Trends

The Colorado Division of Wildlife (CDOW) has specific elk management goals and objectives that have been developed in cooperation with landowners, the public, and federal land management agencies. These plans help guide CDOW's direction in the management of elk on the various Data Analysis Units (DAU) and provide data for recommending specific hunting regulations to meet State herd objectives.

Periodically (every 10 years), these DAU plans are updated to cover land management changes, new social perspectives, and changes in wildlife populations.

Data Analysis Units are composed of Game Management Units (GMUs) (Table 3.9.4.1). The GMUs are defined by boundaries and are used to implement harvest objectives defined in a specific DAU. The Hightower MDP Area is within DAU E-14.

Today, two of the largest influences on management of elk are human population growth and land development. Both of these can and do influence the way the CDOW manages big game populations. Most influence from land development can be seen on winter range and transitional range, with some influence associated with summer range, particularly the borders of federal lands or development occurring on federal lands. The human population is expanding every year, which also puts greater demands for hunting licenses and recreational activities, which in turn can influence big game population objectives.

Table 3.9.4.1. Population Objectives and Population Estimates

DAU	Game Management Units	Population Objective	Post Hunt Pop. Est. 2007
E-14	41,42,51,52,411,421,521	9,000-11,000	17,000

The Grand Mesa DAU (E-14), at 388,796 acres, is the third largest DAU on the GMUG, and 43% of the DAU is on National Forest System lands. In Colorado, elk population estimates in DAU E-14 rank second only to the White River DAU (E-6).

Topography, elevation, weather, livestock grazing, travel management, soil types, and plant communities are the main factors influencing habitat condition and capability. Elk are migratory, moving between winter and summer range throughout the year. Winter range is the most critical for this species, in that winter range is limited in supply in western Colorado. Summer range is generally in abundant supply, but can be critical if there is a very dry summer, which may decrease forage amount and quality.

The CDOW uses several methods to determine population objectives for the DAUs. Monitoring of populations may be done by one or more of the following methods: postseason aerial counts, radio telemetry, computer model simulations, density estimates, quadrant surveys, line transects, research projects, and phone or written hunter surveys.

Elk population estimates for 2004 are 11,837; for 2005, 11,495; and for 2006, 10,758. (Source: Colorado Division of Wildlife). The increase in population estimate for 2007 (17,000) was due to an improved model for estimating, not an actual change in numbers of elk on the ground (Duckett, pers.comm. 2008).

Suitable Habitat and Habitat Capability/Effectiveness

The results of a study evaluating the effects of roads on elk completed by a team of researchers from the USDA, Forest Service, Pacific Northwest Research Station were reported in the *Transactions of the 69th North American Wildlife Natural Resources Conference* (Rowland et al. 2004). While it is recognized that elk are sensitive to road density, and in particular, to sporadic (i.e. unpredictable) disturbance from vehicular traffic, the degree of their response is affected by numerous factors including:

- Traffic rates (Wisdom 1998; Johnson et al. 2000; Ager et al. 2003);
- The extent of forest canopy adjacent to the road (Perry and Overly 1977; Lyon 1979; Wisdom 1998; Wisdom et al. 2004b); and
- The type of road (e.g. primitive versus improved; Perry and Overly 1977, Lyon 1979, Witmer and deCalesta 1985, Marcum and Edge 1991, Rowland et al. 2000, Lyon and Christensen 2002, Benkobi et al. 2004), which also correlates with traffic volume.

A major factor in habitat effectiveness for elk is open road density as well as type of road (primary, secondary, primitive).

Figure 3.9.4.1a. Deer and Elk Winter Range.

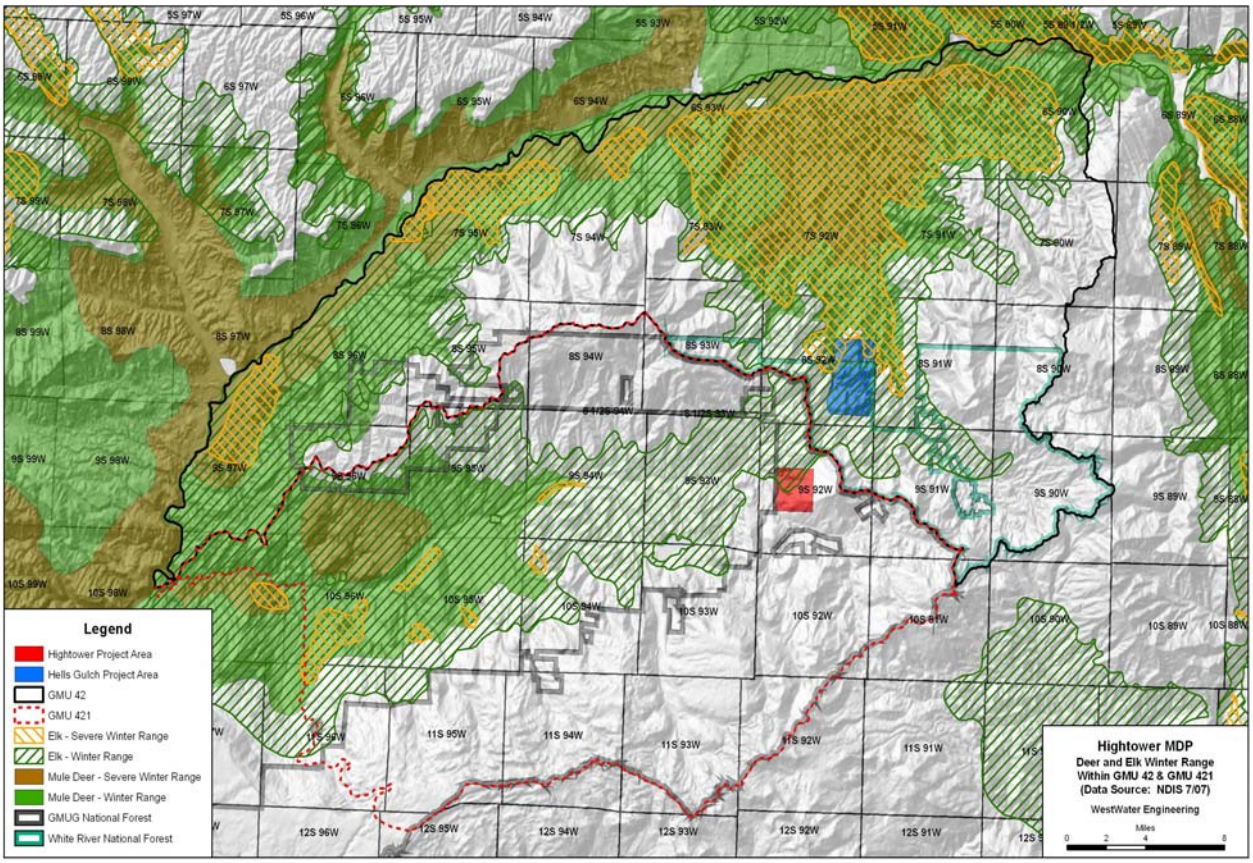
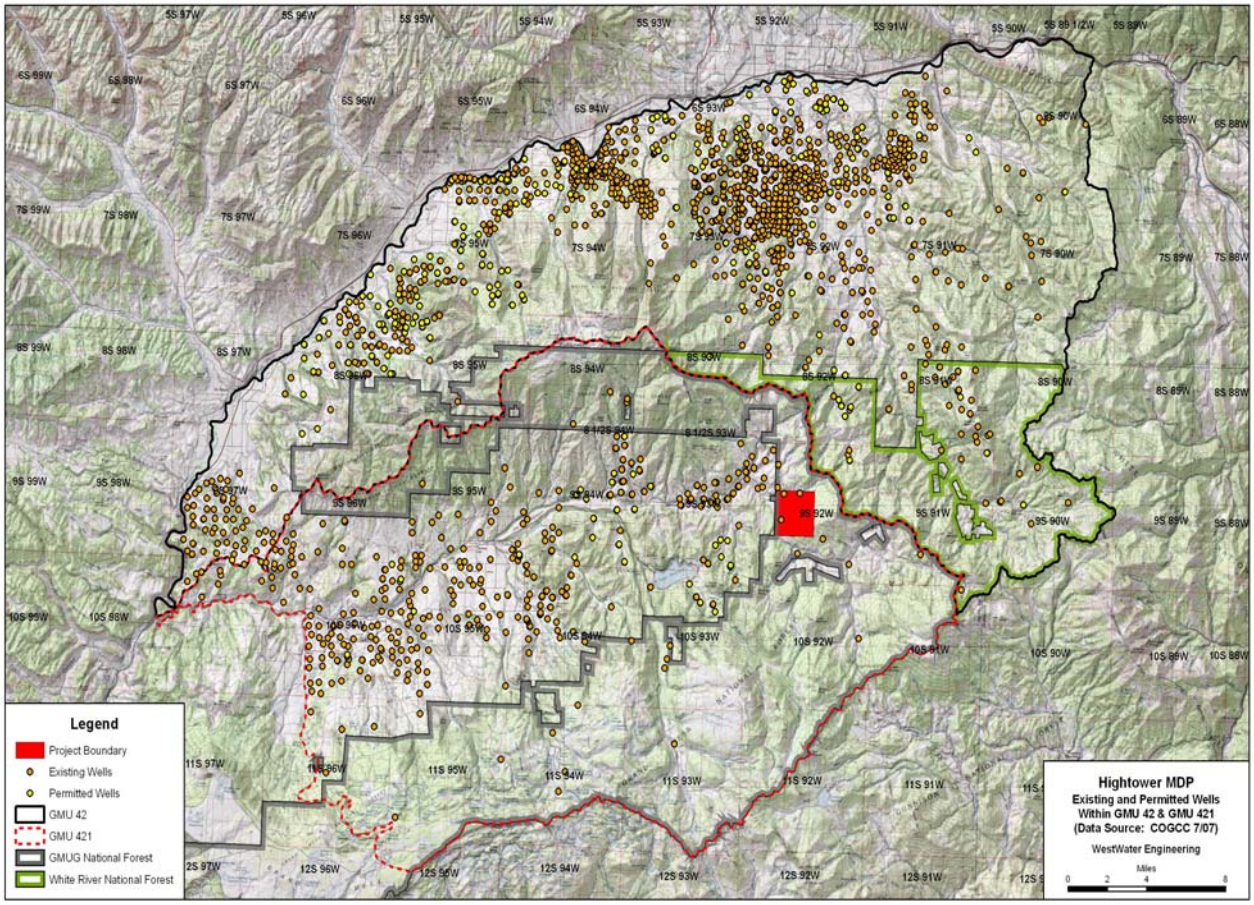


Figure 3.9.4.1b. Existing and Permitted Gas Wells in GMU-42 and GMU-421 (Cumulative Effects Area for Elk).



3.9.4.2 Rocky Mountain Elk Environmental Consequences

Table 3.9.4.2 summarizes the effects on both habitat and populations for the different alternatives of the Hightower MDP.

Table 3.9.4.2. Rocky Mountain Elk Summary of Environmental Consequences.

Alternative	Habitat Effectiveness	Effects on Hiding Cover	Effects on Population Size
Alternative 1 No Action	No effect	No effect	No effect
Alternative 2	Slight decrease for 2 years	48 acres short term 13 acres long term	Any slight change would not be detectable at the DAU level
Alternative 3	Slight decrease for 2 years	73 acres short term 16 acres long term	Any slight change would not be detectable at the DAU level

Alternative 1 – No Action

Under this Alternative, there will be no change to existing conditions.

Alternative 2 –32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

Elk habitat effectiveness within the project area may be reduced under the Proposed Action. Short term disturbances by road construction, drilling and pipeline construction would likely displace elk. The Hightower MDP Area is considered elk winter range by CDOW. However, it is near the upper limit of winter range, and severe winter range, the most critical category, is located well off the GMUG (Figure 3.9.4.1a). At these elevations, elk use the south slopes along drainages in the area where snow does not get as deep as on other slopes. This alternative would affect a total of approximately 48 acres of habitat now available for elk use; however, the area disturbed on south-facing slopes is considerably smaller. Of those 48 acres disturbed, all but 13.0 acres would be reclaimed with plants providing forage of equal or greater quality than those removed, or regenerated from the roots of aspen or oakbrush.

The long term disturbance of increased use of the existing roads and use of the roads required to access the new well locations may result in displacement of elk. Some studies (Thomas and Toweill 1982) suggest elk may move up to ½ mi from roads (see Figure 3.9.4.2). However, other studies (Wisdom et al. 2004) indicate elk readily become accustomed to disturbances which are regular and predictable. See Section 3.12 for a summary of projected additional traffic by activity type. The 1.1 miles of new roads necessary to access the proposed pads would not be open to the public, but would have high level of construction traffic for approximately one year. These high activity levels and noise will likely result in temporary displacement of elk that would normally use the project area. Figure 3.9.4.2 shows the potential area of displacement, based on the ½ mile influence zone around the roads.

The Action alternatives affect several attributes of elk habitat, both positively and negatively, which may have a slight effect on population levels. Negative effects include decreased availability of forage plants and disruption of elk migration and use patterns due to increased road traffic. Positive effects include long-term improved browse conditions in certain areas through removal of some mature Gambel oak and its replacement with more palatable forage plants. Overall, any changes in population size as a result of the Hightower MDP would be very slight, and likely not detectable at the DAU level.

Alternative 3 – All Buried Pipelines –

Direct and indirect effects would be similar in nature to Alternative 2, but greater in degree due to the larger area of initial disturbance, due to buried pipelines. This alternative would initially impact 73 acres of habitat, of which all but approximately 16 acres would be reclaimed. However, the additional habitat disturbance from the buried water and gas pipelines would be offset by less truck traffic to the well pads, long term, to gather and dispose of produced water.

Cumulative Effects: For elk, cumulative effects are addressed at the both at the population level (DAU E-14) and at the smaller level of Game Management Units 42 and 421. Figure 3.9.4.2 shows existing and permitted gas wells within GMU 42 and 421.

Other reasonably foreseeable actions that could cumulatively impact vegetation resources include continued livestock grazing, road improvements outside of the Project Area, prescribed burning, and recreational activities. Residential development activities and oil and gas development are expected to increase on private lands within the next three to five years which also contribute to cumulative impacts.

Livestock grazing is permitted over almost the entire CEA. Cattle probably do not compete directly with elk for forage on the winter range during years of normal precipitation.

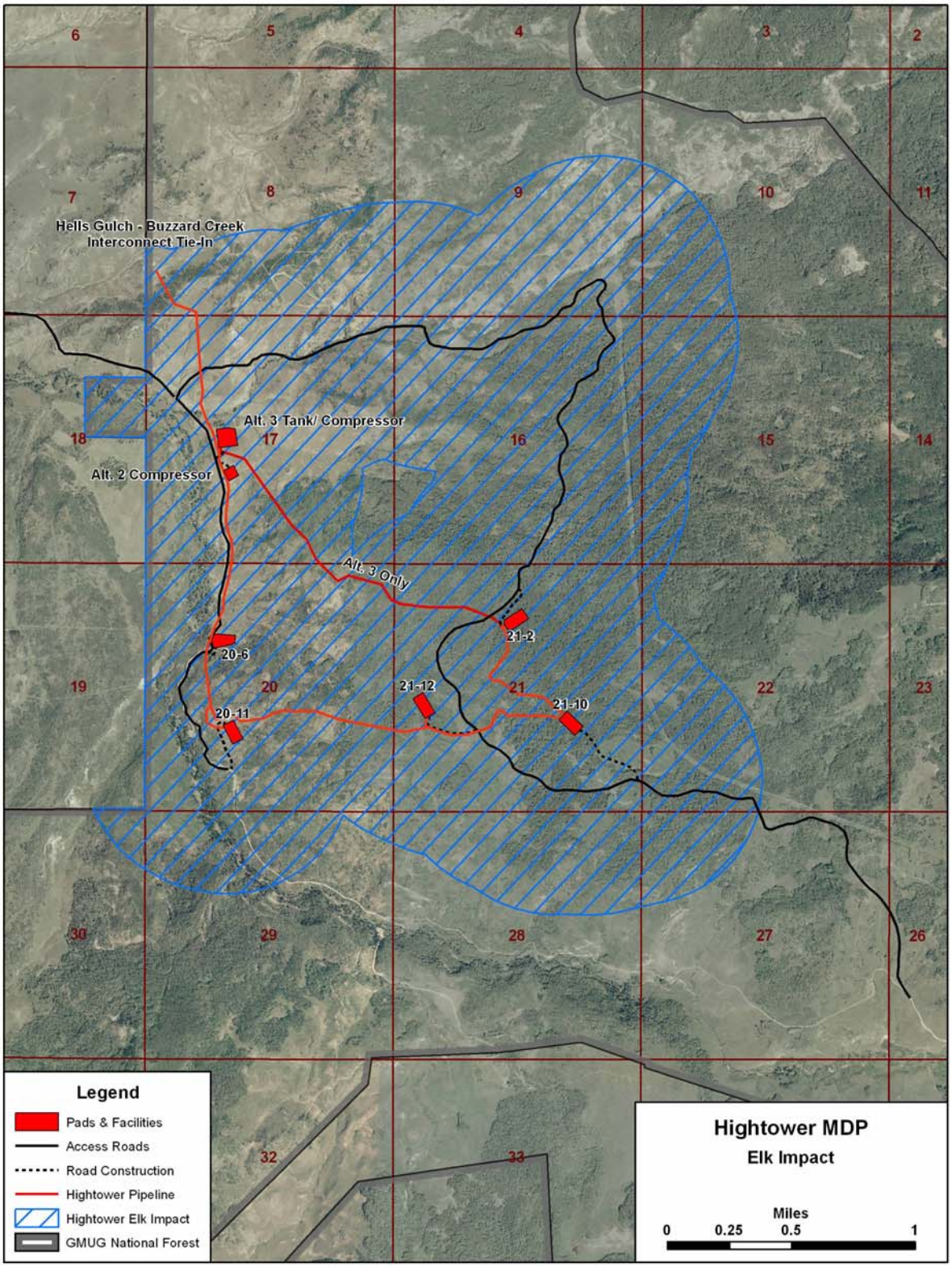
However, in drier years, cattle may utilize elk browse plants after the grass has been consumed. Livestock grazing and trampling may retard efforts to re-vegetate areas disturbed by construction.

Recreational activities include hunting, hiking, camping, mountain biking, and ORV use. These activities do not generally occur in the winter in the Project Area because FSR 265 is not maintained at that time. Snowmobiling does occur along Buzzard Creek (FSR 266).

There are numerous aspen treatment units in the area; two proposed well pads are located in regenerating clear cuts. The Porter Mountain aspen timber sale is on-going in the Buzzard Creek drainage. Aspen regeneration treatments are planned on 13 acres in the same vicinity as the upper well pads.

The Proposed Action is likely to contribute to cumulative impacts of other projects within the Cumulative Effects Area (CEA) for elk. Within the Hightower CEA for elk (GMU 42 and 421) there are approximately 4,529 existing wells and 1148 permitted/proposed wells (COGCC website, February, 2008). Two gas pipelines have been recently constructed or will soon be in the CEA: Hell's Gulch/Buzzard Interconnect and the Bull Mountain pipelines. There are currently up to 98 wells (including those of PXP) proposed to be drilled within the CEA for elk, on the White River, GMUG, BLM, and private land, in the next one to two years. Should the proposed gas wells prove to be productive, additional well field development is likely to occur.

Figure 3.9.4.2. Elk displacement impacts (potential); area within one half mile of roads.



3.9.4.3 Northern Goshawk Affected Environment

The northern goshawk is identified as a MIS associated with mature aspen forest habitat, representing the highly specialized habitat requirements of other species or groups of species that use mature aspen forest.

The Regional Forester of the Rocky Mountain Region of the Forest Service also lists the northern goshawk as a sensitive species. A Biological Evaluation has been written for this project that evaluates the potential effects of the alternatives upon this species and other sensitive species. The GMUG Plan includes standards and guidelines for management of habitat for the northern goshawk.

According to NatureServe (2005), threats include timber harvest, fire suppression, grazing, and insect and tree disease outbreaks that can result in the deterioration or loss of nesting habitat. Known or suspected predators include martens, fishers, black bears and wolverines. Although often persecuted historically, intentional shooting or trapping is no longer considered a significant source of mortality. The impact of falconry on goshawk populations is generally unknown; however, it is permitted in Colorado.

Northern goshawks inhabit mature forests of various cover types including aspen, lodgepole and ponderosa pine and spruce-fir. Individuals feed primarily on birds (small and medium-sized and grouse) and small mammals (red and ground squirrels, rodents and hares). They may use marshes, meadows and riparian zones for foraging (NatureServe 2005, Kennedy 2003).

Regardless of the cover type, goshawks require large blocks of forest for nesting and foraging. Goshawks tend to select nest trees on shallow slopes, flat benches in steep country, and fluvial pans on small stream junctions. Nest sites are often associated with small (<1 acre) openings (Kingery 1998).

Distribution:
Considered vulnerable in Colorado, the northern goshawk occurs throughout North America in the U.S., Mexico and Canada and circumpolar through Europe and Asia (NatureServe 2005). According to NatureServe (2005) and Kennedy (2003), trends are difficult to determine due to the paucity of historic quantitative data and because of biases inherent in the various methodologies used to track bird populations. Nesting range in the eastern U.S. is currently expanding as second-growth forests mature. In the western U.S., clearcut logging of old-growth forests, fire suppression, and catastrophic fire are postulated to be reducing habitat and thus populations, especially that of the subspecies *laingi*. However, conclusive data supporting the purported decline in the western U.S. are lacking. Christmas Bird Count (CBC) data (1959-1988), North American Breeding Bird Survey (BBS) data (1966-1996), and counts of migrants in the eastern U.S. (1972-1987) do not indicate any changes in populations.

In Colorado, goshawks occur at elevations of 7500 to 11,000 feet (NatureServe 2005, Kennedy 2003) and 64% of BBA breeding observations occurred in coniferous forests. On the GMUG, nesting occurs primarily in aspen or aspen mixed with conifer stands.

Nesting home ranges are considered to have 3 spatial components identified as: nest area, post-fledging family area (PFA), and foraging area.

Nest areas include one or more forest stands, several nests (usually within a few hundred yards of one another), several landform characteristics and range in size from 20-25 acres (8.09-10.12 ha) (Reynolds et al.1992). Goshawks seem to prefer mature forests with open understories, a relatively

closed canopy (60-90%) with large trees of moderate density (Speiser and Bosakowski 1987, Kennedy 1988, Reynolds et al. 1992, Daw et al. 1998, Bosakowski 1999). High canopy closure and tree basal area were the most uniform characteristics in nest areas between study sites in northern Idaho and western Montana (Hayward and Escano 1989). In a northern Colorado study based on 20 nests (10 in aspen), nest site preferences were as follows: basal area in aspen was 99-152, understory sparse or none, nests seldom farther than 902 feet (275 m) from water (not loud running water), gentle north and east facing slopes or benches and nest elevation was seldom lower than 7,546 feet (2,300 m). Nest tree dbh was 9.8 inches (25 cm) or greater in aspen (Shuster 1980).

Post-fledging area (PFA) surrounds the nest area. The PFA is used by the young from when they leave the nest until the young are no longer dependant on the parents (Reynolds 1992, Kennedy 1989). PFAs range in size from 300-600 acres (121.4-242.8 ha) (Reynolds 1992). Reynolds describes PFA habitat as similar to the nest area habitat though it includes a variety of forest conditions. He suggests the PFA should contain: an overstory of >50% canopy closure with a well developed understory, a mosaic of vegetative structural stages with 60% being mature stages of growth, 20% young forest, 10% seedling/sapling, and 10% grass/forb/shrub stage, with woody debris throughout, centered around nesting habitat and provide prey and hiding cover for fledglings.

Reynolds (1983) and Kennedy (1989) estimated goshawk nesting home ranges to be 5,000 – 6,000 acres (2,023-2,428 ha). Foraging habitat (within the nesting home range) has been defined in a number of ways in various studies. Studies suggest hunting habitat consists of forest types with high basal area, high density of large trees, a high canopy closure, and relatively open understories (i.e., mature/old growth) (Hargis et al.1994, Beier and Drennan 1997). Researchers have observed goshawks hunting along edges, clearcuts and openings but it is not known how important these habitats are for foraging (Shuster 1980, Kenward 1982). It has been recommended that desired foraging habitat should be 5,400 acres (2,185.3 ha) (not including any openings, PFA and nest site), surround the PFA and contain the same structural stages and characteristics as those for PFA habitat (Reynolds et al. 1992).

Limited information is available concerning goshawk winter habitats/home ranges. Many goshawks winter on their breeding home ranges (Squires and Reynolds 1997). On the average, winter ranges are larger than breeding ranges (Kennedy 2003). Stephens (2001) found that winter range size was highly variable. Based on 12 goshawks studied in Utah, winter range size was 2,471 – 19,644.8 acres (1,000-7,950 ha). Recent research on winter habitat use indicates that wintering birds will use habitat not used for nesting, i.e. pinyon-juniper woodland (Stephen 2001, Drennan and Beier in press).

On the GMUG, 110 active, alternate or suspected goshawks nests have been found in mature (4B, 4C habitat structural stage, HSS) aspen, aspen/mixed conifer, ponderosa pine, Douglas-fir and lodgepole pine stands. Based on the data for the 110 nests, nest site preference is for larger aspen trees. Average nest site characteristics for aspen are: dbh – 14.7 inches (37.3 cm), canopy cover – 64%, slope around the nest site – 10% and elevation range – 8,480-10,720 feet (2,584-3,213 m

Small aspen stands surrounded by conifer and/or mixed conifer/aspen stands made up 86% of nest sites, 14% of nests were in lodgepole pine stands. Elevation range for nest trees was 9,240 – 10,720 feet (2,816-3,267.4 m). The average characteristics for all species of nest trees were: dbh - 13.5 inches (34.3 cm), nest tree height – 72.5 feet (22.1 m), nest height – 45.7 feet (13.9 m), slope – 17.1 degrees and estimated canopy cover – 91.7%. Nest trees were located on all aspects except north to northeast. The elevation range for all goshawk observations on the GMUG is 8,800-10,800 feet (2,682.2-3,291.8 m).

Preferred nesting habitat within the project area is highly associated with mature and old growth aspen, mixed aspen and spruce/fir, and spruce/fir with remnant aspen trees. Nesting and post-fledging habitat areas are most dependent upon large continuous blocks of mature or old growth forest. A single nesting territory may contain several alternate nests. The same nest may be used for several seasons by the nesting pair. Nesting goshawks are particularly sensitive to disturbance, and repeated activities adjacent to nesting birds can result in abandonment of the nest.

Population Trends/Environmental Baseline

Within the GMUG MIS assessment (2005), known locations of goshawk nest sites, suspected breeding territories (evidence of goshawk breeding is present but nest sites have not been located), and goshawk sightings are documented for the GMUG. Locations date from 1984 to 2003 with a few goshawk nests known from the 1970s. Based on actual known locations of nest sites, suspected breeding territories, and sightings, the northern goshawk appears to be well distributed throughout the GMUG in suitable habitat (primarily mature aspen and mixed aspen/conifer forest). Records of known goshawk nest activity on the GMUG show that numbers of breeding goshawks and nest success (the young have fledged) have remained relatively stable, although low, over a 17-year period.

The Project Area includes suitable goshawk foraging and cover habitat; however, development activities will only affect those goshawk habitats within the aspen cover type.

3.9.4.4 Northern Goshawk Environmental Consequences

Alternative 1 – No Action (as required by NEPA)

No change would occur in the habitats for goshawk, therefore there would be no impact.

Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

Construction of the project would have no effect upon the northern goshawk populations within the Hightower and Buzzard Creek drainage or the GMUG-wide population due to the very small amount of nesting habitat altered (25 to 34 acres). There are no known goshawk territories in the Hightower and Buzzard Creek Drainage, and no individuals were noted during field work in 2006 and 2007, although calling surveys in suitable habitat were conducted. Approximately 25 acres of nesting habitat (mature aspen) will be removed by the project in this alternative, which is .003% of the GMUG forest mature aspen and .0013% of the potentially suitable nesting habitat on the GMUG. (USDA FS 2005).

Potential effects from construction on goshawk nesting habitat include the direct loss of the primary or alternate nest trees, disturbance to nesting birds, and loss of interior forest habitat conditions needed for foraging.

Numerous land use actions (e.g., oil and gas activity, recreational activity, livestock grazing, road building, housing development, etc.) on State and private lands surrounding the GMUG are reasonably certain to occur over the next several years. Where these activities fall within mature aspen and aspen mixed with conifer, these land uses have the potential to affect northern goshawk through loss or degradation of habitat, direct mortality during construction activities, and/or displacement from habitats. While the project would have a minimal impact on the species, the potential for displacement during construction activities and structural vegetation changes may

incrementally add to overall impacts on northern goshawk likely to occur in the GMUG. Cumulative impacts occurring are recent timber harvest in the aspen type with both the Hightower and Porter Mountain aspen timber sales.

The project would meet all GMUG Plan standards and guidelines.

Determination: Development activities in the Project Area affect suitable goshawk foraging and nesting habitat in aspen stands. Goshawks are potentially present in the Project Area based on available habitat and goshawk occurrence in similar adjacent drainages. Because proposed activities could reduce the amount of aspen habitats potentially used by goshawks for foraging and nesting, the proposed project **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning area, nor cause a trend to federal listing** for northern goshawk.

Alternative 3 – All Buried Pipelines – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines, including produced water lines.

This alternative would remove approximately 34 acres of potential nesting habitat (mature aspen), which is .005% of the GMUG forest mature aspen and 0018% of the potential nesting habitat on the GMUG.

Potential effects from construction on goshawk nesting habitat include the direct loss of the primary or alternate nest trees, disturbance to nesting birds, and loss of interior forest habitat conditions needed for foraging. Determination is the same as that for Alternative 2.

3.9.4.5 Red-naped Sapsucker Affected Environment

The red-naped sapsucker was identified as a MIS in the 2005 GMUG Plan Amendment for its relationship with aspen habitat, particularly mature stands of pure aspen associated with riparian areas containing a willow component. The red-naped sapsucker is closely associated with pure aspen stands for cavity nesting; these birds create sap wells in both aspen and willow for foraging.

The red-naped, yellow-bellied, and red-breasted sapsuckers collectively were long treated as forms of a single species, the yellow-bellied sapsucker, until 1983 when systematic studies showed distinctions sufficient to warrant taxonomic treatment as separate species (Walters et al. 2002). Although the biology of these three species appears to be quite similar, evidence from distribution, ecology, plumage, assertive mating, and genetics support treating this complex as three distinctly separate species making up the super species *Sphyrapicus varius* (Short 1969, 1982;; Cicero and Johnson 1995, Walters et al. 2002). Hybridization is known to occur among these three species where their ranges overlap, and hybrids between red-naped and Williamson's sapsuckers (*S. thyroideus*) have been documented (Walters et al. 2002).

Distribution

The red-naped sapsucker breeds throughout the Rocky Mountains from British Columbia to southern New Mexico. The GMUG is well within the breeding distribution range of this species. Throughout western and central Colorado, it breeds regularly within deciduous woodlands, especially where deciduous woodlands are associated with riparian areas that contain a willow component. On the GMUG, red-naped sapsuckers are primarily associated with mature aspen forests, mature aspen and conifer mixes, and aspen riparian areas with a willow component.

Red-naped sapsuckers are primarily short-distance migrants. They move south from their breeding range into Mexico, Baja California, southern California, Arizona, and New Mexico, although some individuals winter within their breeding range in Arizona and New Mexico (Walters et al. 2002). In Colorado, transient birds establish feeding territories during March in pinyon-juniper habitats before

moving to breeding grounds at higher elevations in early April (Hadow 1977). The timing of territory establishment and pair formation may be delayed by colder than average temperatures or other inclement weather (Walters et al. 2002). Pair formation and nest excavation typically begins within three weeks of arrival to the breeding grounds (Hadow 1977). Following territory establishment and pair formation, the nesting season extends from mid or late April to early August, with most nesting activity concentrated between mid-May to mid-July in Colorado (Hadow 1977, Walters 2002). Fall migration takes place from early August to late October, typically peaking in September (Campbell et al. 1990, Gilligan et al. 1994, Walters 2002). In Colorado, transient red-naped sapsuckers usually exhibit movements to lower elevations in pinyon/juniper habitats by early September (Hadow 1977) before migrating to winter ranges.

In early spring, the red-naped sapsucker feeds primarily in sap wells that it creates in the xylem of trunks or stems of conifer trees, including Rocky Mountain juniper, Douglas-fir, lodgepole pine, and ponderosa pine. Xylem sap wells are characterized by a series of parallel circular holes that usually completely surround a stem or trunk (Walters et al. 2002). Once deciduous trees and shrubs leaf out, the birds preferentially forages among aspen and cottonwood stands associated with willow riparian areas. During the breeding season, this species creates sap wells that tap the phloem tissue of stems or tree trunks, predominantly in aspen and willow vegetation, and less frequently in cottonwood riparian. Phloem sap wells are characterized by a rectangular shape and typically surround an aspen trunk or willow stem.

Although red-naped sapsuckers are specialized for sipping sap, their diet also includes insects, inner bark, fruit and seeds (Walters et al. 2002). This species feeds on aspen buds and has been observed fly-catching exclusively in aspen and gleaning insects from aspen, Douglas-fir, and cottonwood (Walters 1996). During the breeding season, the red-naped sapsucker spends the majority of its time maintaining sap wells and searching for insects to feed nestlings (Walters et al. 2002). Adults often crush prey and sometimes mix insects with sap prior to feeding young (Wible1960). Juvenile sapsuckers are capable of foraging on their own soon after they leave the nest (Crockett and Hansley 1977, Tobalske 1992).

Red-naped sapsuckers are apparently monogamous, with pair bonds maintained through the breeding season and usually re-established between years if mates survive (Walters et al. 2002). Mate fidelity may be attributable to general nest site fidelity; red-naped sapsuckers even reuse nest trees in subsequent years (Walters et al. 2002). Pair formation and nest excavation begins within three weeks of arrival on the breeding grounds, typically in early to mid-April. Nest sites may be chosen based on their proximity to suitable foraging habitat rather than on the characteristics of the nest stand itself (Crockett and Hadow 1975). Initially the male performs most of the cavity excavation with female participation increasing as the season progresses. Cavity excavation varies from six days to four weeks (Howell 1952, Walters et al. 2002).

Red-naped sapsuckers raise only one brood per season, although pairs sometimes re-nest if the first nest fails (Walters et al. 2002). In a study conducted at Hat Creek, British Columbia, Walters et al. (2002) reported that mean clutch size was significantly larger in old cavities than mean clutch size in new cavities. The point at which incubation begins for red-naped sapsuckers is unknown, although Walters et al. (2002) assumes that incubation begins on the day that the last egg is laid. Incubation is estimated to last approximately eight to twelve days (Walters et al. 2002) with both parents incubating, although the male likely does most of the incubating (Short 1982). In Colorado, Hadow (1977) recorded red-naped sapsuckers chick hatching in early June and fledging during the second week of July. On the Flathead National Forest in northwestern Montana, Tobalske (1992) reported that adults were most active and the juveniles most vocal two weeks prior to fledging.

Habitat Associations

Within the Hightower and Buzzard Creek drainages, the red-naped sapsucker primarily utilizes forests of mature aspen and aspen/conifer in structural stages 4A, 4B, and 4C/5 (mature to old growth with varying percentages of cover) that are in close proximity to stands of willow. Mature and old growth forest habitats contain key habitat elements for cavity nesting species. The red-naped sapsucker utilizes the numerous snags or live trees with damage or rot for nest trees. These trees are easier to excavate cavities in than sound, hard snags and live trees. Insect activity is also normally associated with snags, damaged trees, and down logs. Secondary habitat includes the younger stands of aspen and aspen/conifer in structural stages 3A, 3B, and 3C.

Nesting red-naped sapsuckers require aspen groves with two characteristics: aspen trees infected with shelf or heartwood fungus (for drilling nest holes) and nearby willow carrs (for drilling sap wells). They reject aspen groves that lack nearby willow riparian habitat. On the GMUG, red-naped sapsuckers are primarily associated with mature aspen forests, mature aspen and conifer mixes, and aspen riparian areas with a willow component.

On the GMUG, the abundance and distribution of this species is largely tied to the availability of deciduous woody vegetation, especially aspen and willows. This species is dependant on aspen stands or the aspen component of mixed stands for nesting and summer foraging, particularly when these habitat types occur in or adjacent to riparian areas. Primary habitat includes areas dominated by aspen, cottonwood, and willow vegetation, encompassing approximately 26 percent of the GMUG. Secondary habitat consists of approximately 21 percent of the GMUG (704, 772 acres) and is comprised of Douglas-fir, lodgepole pine, and ponderosa pine (both pure stands and stands with an aspen component), in addition to immature (3A, 3B, and 3C) stands of both aspen and cottonwood. Table A-10 in the MIS report for this project summarizes acres of red-naped sapsucker habitat by habitat quality on the GMUG.

Population Trends

The red-naped sapsucker is considered globally "secure" by the Natural Heritage Program due to its wide distribution across North America. According to the Breeding Bird Survey (BBS), populations appear to be stable to increasing in the United States, with areas of local declines (Sauer et al 2005). Local declines may be related to a loss of cottonwood and aspen nesting habitats. Based on BBS trend data for the period 1966 to 2004, red-naped sapsuckers have exhibited a significant positive population trend of 4.34 percent. However, BBS trend estimates may be confounded by recent changes in sapsucker taxonomy splitting the red-naped from the yellow-bellied sapsucker. Within the state of Colorado and the Southern Rockies physiographic region, red-naped sapsucker populations have exhibited similar upward trends, exceeding national trends.

Red-naped sapsuckers have been detected on nine BBS routes on the GMUG NF, with insignificant negative trends observed on three out of four routes within the Uncompahgre Plateau Geographic Area, a significant positive trend observed within the North Fork Valley and Grand Mesa Geographic Areas, and positive upward trends observed on three routes within the Gunnison Basin Geographic Area, one which was significant. Single site analysis on BBS routes within the GMUG may not be statistically valid due to low sample sizes and the amount of suitable red-naped sapsucker habitat sampled by the routes. Only 0.92 percent (6,806 acres) of all aspen habitats on the GMUG was sampled by the BBS from 1966 to 2004.

On the GMUG, from 1998 to 2004, Monitoring Colorado's Birds (MCB; a program implemented by the Rocky Mountain Bird Observatory) detected 186 red-naped sapsuckers on 25 transects, primarily in aspen and high elevation riparian dominated habitat types. Interestingly, 62 percent of all red-naped sapsuckers observations throughout the MCB survey were on the GMUG NF. Based on MCB

data, red-naped sapsuckers appear to be in an upward trend for transects that occur on the GMUG NF; average number of red-naped sapsuckers per transect range from 2.2 birds in 2001 to 4.15 birds in 2004.

Several nests were found in aspen in the Project Area during field work in 2006 and 2007; adults are conspicuous and chicks are very vocal, making it relatively easy to locate nests in occupied habitat.

3.9.4.6 Red-naped Sapsucker Environmental Consequences

Alternative 1 – No Action (as required by NEPA)

Under this Alternative, there will be no change in existing conditions

Alternative 2 – The Proposed Action –

Due to the small amount of habitat affected relative to that available in the Hightower Creek drainage and the GMUG, the project may temporarily displace or alter how individuals use affected habitats through habitat alteration and/or disturbance, but these effects will not result in a change in population numbers or trends at the project or GMUG-wide scales.

A small amount of nesting habitat (aspen) will be removed by the project (Table A-1 in MIS report). The amount removed is very small relative to that available on the GMUG; there are approximately 427,000 acres of aspen highly suitable for nesting, and 308,146 acres of aspen marginally suitable for nesting on GMUG (Table A-10 in MIS report). Alternative 2 would remove 25 acres of suitable nesting habitat, which is .003% of the mature aspen on the GMUG.

Potential effects from project construction to nesting habitat include the direct loss of the nest trees, disturbance to nesting birds, and loss of 25 acres of habitat.

Numerous land use actions (e.g., oil and gas activity, recreational activity, livestock grazing, road building, housing development, etc.) on State and private lands surrounding the GMUG are reasonably certain to occur over the next several years. Where these activities fall within mature aspen, these land uses have the potential to affect red-naped sapsucker through loss or degradation of aspen, willow and mixed conifer habitat, direct mortality during construction activities, and/or displacement from habitats. While the Proposed Action would have a minimal impact on the species, the potential for displacement during construction activities may incrementally add to overall impacts on red-naped sapsucker likely to occur in the GMUG.

There are no specific Standards/Guidelines for red-naped sapsucker.

Alternative 3 – All Buried Pipelines

A small amount of nesting habitat (mature aspen) will be removed by the project (Figure 3.9.2.2). Alternative 3 would remove 34 acres of suitable nesting habitat, which is .005% of the mature aspen on the GMUG. Potential effects from project construction are similar to Alternative 2 with effects to nesting habitat include the direct loss of the nest trees, disturbance to nesting birds, and loss of 34 acres of habitat.

3.9.4.7 Brewer's Sparrow

Affected Environment

Distribution

Considered apparently secure in Colorado, Brewer's sparrows are migratory birds found in the western provinces of Canada, through the western US and south into Mexico (NatureServe 2004). Brewer's sparrow is a common to fairly common spring and summer visitor in Mesa County's sagebrush and pinyon-juniper woodlands, BBS records document Brewer's sparrow occurrence in the Project Area vicinity with possible breeding (Kingery 1998). It is known to occur in the Hightower MDP Area based on FS records and observations during field work.

Breeding is strongly associated with sagebrush habitat but can also occur in mountain mahogany, rabbitbrush, bunchgrasses, bitterbrush, ceanothus, manzanita and openings in pinyon-juniper habitats (NatureServe 2004). These sparrows nest low in shrubs from just above ground level to about 1 meter high (NatureServe 2004). In spring and summer Brewer's sparrow consumes mostly insects (weevils, aphids, leafhoppers, caterpillars and beetles) from shrub perches, and switches to ground foraging on seeds in the fall and winter (NatureServe 2004).

Brewer's sparrow is a shrub obligate that is threatened by large-scale reduction and fragmentation of sagebrush activities due to land conversion, new roads and utilities, and widespread burning or other methods of sagebrush control. In the Hightower MDP Area, there is considerable nesting habitat in the form of sagebrush, mountain mahogany, and mountain shrub vegetation types even though all observations during field work were in large stands of sagebrush.

Invasion of non-native grasses, especially cheatgrass, can escalate the fire cycle, converting shrublands into annual grasslands. Brewer's sparrows are occasional hosts for brown-headed cowbirds; this rate can be elevated in the presence of livestock. Egg, nestling and adult predators are many and include ground squirrels, shrikes, ravens, magpies, weasels, chipmunks, many snake species, kestrels and prairie falcons.

Brewer's sparrows, usually the most abundant bird on their nesting grounds, reach densities of 370-740 birds per square mile (Lambeth 1998).BBS data for 1966-1996 show significant and strong survey-wide declines averaging 3.7% per year (NatureServe 2004). Significant declines are evident in California, Colorado, Montana, Nevada, Oregon and Wyoming with significant decline evident in Idaho (6%) (NatureServe 2004). During the same period, this species demonstrated a decline of 2.4% in Colorado, and a 2.1% decline in Colorado from 1980-1999. Sagebrush habitat on National Forest Lands in Region 2 is relatively stable (USDAFS SCP 2003). Direct causes of widespread decline on breeding grounds are uncertain; but possibly linked to widespread degradation of sagebrush habitats in the western US, especially on private lands (NatureServe 2004, USDAFS SCP 2003).

Suitable Brewer's sparrow habitat occurs in the Project area and it is likely that Brewer's sparrows occur in the area during the summer breeding season in sagebrush and other shrubland habitats.

9.4.8 Brewer's Sparrow Environmental Consequences

Alternative 1 – No Action

Under this Alternative, there would be no change in existing conditions. Not developing the area for gas production would eliminate potential disturbance to nests, and provide for unchanged sagebrush habitats within the Project Area; therefore, the no action alternative will have **no impact** on Brewer's sparrows.

Alternative 2 – The Proposed Action

The proposed activities have the potential to directly affect Brewer's sparrows and their habitat, as the lower wellpads and the compressor site will reduce Brewer's sparrow habitat. If the construction activities occur during nesting season, Brewer's sparrow would be directly affected through loss of eggs or nesting failure, and indirectly affected long-term from reduced and fragmented habitat. Alternative 2 would affect 11 acres of Brewer's sparrow habitat. Some nesting habitat will be removed by the project. There may be a slight decrease in populations at the local level, but this decrease would not be measurable at the scale of the GMUG. Field work suggests the population of Brewer's sparrows in the Project Area is low relative to the amount of suitable nesting habitat available, and that nesting habitat is not the limiting factor. Loss of a small area of habitat relative to that available on the GMUG should have no measurable impact on total numbers on the GMUG. The Hightower MDP would directly affect a total of 11 acres of various sagebrush vegetative types on the GMUG by removing these plants for construction of project features. The compressor site would be located in the largest tract of sagebrush. Direct mortality through nest destruction could occur if construction takes place during nesting season.

However, it is possible that a larger area may be rendered less attractive to this species. Recent work in Wyoming (Ingelfinger 2001) indicates negative impacts to this species extend to at least 100 yards beyond roads, pads, and pipelines. These effects are apparently not related to vehicle traffic, noise, or other ongoing disturbances, as populations were reduced along pipelines as well as roads and pads. Reasons for avoidance of sagebrush adjacent to disturbed areas are not yet known, but the edge effect created by such disturbance could allow access by Brewer's sparrow competitors or parasites such as horned larks or cowbirds.

Alternative 3 – All Buried Pipelines

Direct and indirect effects would be similar to the Proposed Action, although total sagebrush affected would be approximately 17 acres due to the buried pipelines.
Cumulative effects would include grazing, browsing by wild ungulates, additional oil and gas development, and some recreational activities such as hunting and off-road vehicle use. Cumulative effects to Brewer's sparrow habitat in the Project Area include historic conversion of sagebrush habitats to irrigated hay meadows on adjacent private lands, and additional contemporary loss of sagebrush habitat from housing development and brush-beating projects to improve grass production on private lands immediately below the Forest boundary. Based on the limited direct, indirect, and cumulative effects to habitat or populations there is not likely to be measurable effects to this species at the GMUG level.

There are no specific Standards/Guidelines in the Forest Plan for Brewer's sparrow. There should be no negative trends that would affect achieving GMUG Plan MIS objectives or create viability concerns for this MIS.

Determination: The proposed activities associated with the Master Development Plan will affect sagebrush habitats and could directly impact individual Brewer's sparrows within the Project Area. Development activities should continue to maintain overall habitat for Brewer's sparrow in portions of the Project area and across the Grand Mesa NF. Therefore, the proposed project **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning area, nor cause a trend to federal listing** for Brewer's sparrow.

3.9.5 USFS Sensitive Species

Table 3.9.5a is a list of Region 2 sensitive species that may occur within the GMUG on the Grand Valley Ranger District and their potential to occur in the analysis area. Habitat descriptions and distribution information are from several sources (Armstrong 1972; Fitzgerald et al. 1994; Andrews and Righter 1992; Kingery1998; Hammerson 1999; CDOW 2007; Spackman et al. 2002; and Weber 2001).

Table 3.9.5a. Grand Valley Ranger District Sensitive Species (Potential)

Species Common Name	Species Scientific Name	Status	Habitat Description	Habitat Found/Species Recorded or Observed in Project Area
MAMMALS				
Fringed myotis	*Myotis thysanodes*	Sensitive Species	Inhabits caves, mines, and buildings in low elevation conifer and oakbrush shrublands up to 7,500 feet. Forages over associated riparian habitat.	Habitat - No Species - No
American Marten	*Martes americana*	MIS & Sensitive Species	Inhabits mature spruce/fir and mixed conifer forests.	Habitat - No Species - No
Pygmy shrew	*Sorex hoyi*	Sensitive Species	Moist boreal environments, forest generalist, all captures of this species in Colorado have occurred above 9,600 feet.	Habitat - No Species - No
River otter	*Lontra canadensis*	Sensitive Species	Riparian habitats that traverse a variety of other habitats, mainly large river systems.	Habitat – No Species - No
Spotted bat	*Euderma maculatum*	Sensitive Species	Restricted to cliff or rock faces in arid canyons associated with waterways in ponderosa pine or Douglas fir at 6,000-8,000 feet.	Habitat – No Species - No

Species Common Name	Species Scientific Name	Status	Habitat Description	Habitat Found/Species Recorded or Observed in Project Area
Townsend's big-eared bat	*Corynorhinus townsendii*	Sensitive Species	Forages in semi-desert shrublands, pinyon-juniper woodlands and open montane forests. Roosts in caves, mines, buildings and crevices.	Habitat – Yes Species - No
Wolverine	*Gulo gulo*	Sensitive Species	Inhabits undisturbed high boreal forests and tundra near timberline.	Habitat – No Species - No
Rocky Mountain bighorn sheep	*Ovis canadensis canadensis*	Sensitive Species	High mountains.	Habitat – No Species - No
Desert bighorn sheep	*Ovis canadensis nelsoni*	Sensitive Species	Deserts, canyons at lower elevbations	Habitat – No Species - No
BIRDS				
American three-toed woodpecker	*Picoides dorsalis*	Sensitive Species	Species is resident in mature and old growth stands of spruce/fir.	Habitat - No Species - No
American peregrine falcon	*Falco peregrinus anatum*	Sensitive Species	Species nests on high cliffs overlooking rivers/lakes and forages over forests and shrublands.	Habitat - No Species - No
Black swift	*Cypseloides niger*	Sensitive Species	Species nests on high cliffs near or behind large waterfalls and forages high above the landscape over conifer forests.	Habitat - No Species - No
Boreal owl	*Aegolius funereus*	Sensitive Species	Mature spruce/fir or spruce/fir-lodgepole forests.	Habitat - No Species - No
Brewer's sparrow	*Spizella breweri*	Sensitive Species	Inhabits sagebrush-dominated shrublands; may also be found in alpine willow stands.	Habitat - Yes Species - Yes
Flammulated owl	*Otus flammeolus*	Sensitive Species	Nests in cavities in aspen and aspen mixed with conifer habitat to 10,000 feet, foraging close to nest sites, may forage over shrublands.	Habitat – Yes Species – No

Species Common Name	Species Scientific Name	Status	Habitat Description	Habitat Found/Species Recorded or Observed in Project Area
Lewis' woodpecker	*Melanerpes lewis*	Sensitive Species	Inhabits lowland and foothill riparian areas and nests in decadent cottonwoods 2,000-8,000 feet.	Habitat - Yes Species - No
Loggerhead shrike	*Lanius ludovicianus*	Sensitive Species	Species inhabits open country with available lookout perches, especially semi-desert shrublands.	Habitat - Yes Species - No
Northern goshawk	*Accipiter gentilis*	MIS & Sensitive Species	Mixed hardwoods and conifers in stands of mature timber above 7,500 feet.	Habitat - Yes Species - No
Northern harrier	*Circus cyaneus*	Sensitive Species	Nests and forages in dense portions of open montane grasslands and wet meadows.	Habitat - Yes Species - No
Bald eagle	*Haliaeetus leucocephalus*	Sensitive Species	Nests along large lakes and rivers; winters in a variety of habitats	Habitat – No Species - No
Olive-sided flycatcher	*Contopus cooperi*	Sensitive Species	This species breeds primarily in mature spruce/fir or Douglas fir forests.	Habitat - No Species - No
Purple martin	*Progne subis*	Sensitive Species	Species forages in open grassy parks, shores of lakes, meadows and around ponds; prefers aspen habitat near open water or wet meadows. Nests in mature aspen stands.	Habitat - Yes Species - Yes
Sage sparrow	*Amphispiza belli*	Sensitive Species	Desert sagebrush habitat	Habitat - No Species - No
Western yellow-billed cuckoo	*Coccyzus americanus*	Candidate Species	Lowland riparian forest, thickets, and urban woodlands	Habitat - No Species – No

Species Common Name	Species Scientific Name	Status	Habitat Description	Habitat Found/Species Recorded or Observed in Project Area
AMPHIBIANS				
Boreal toad	*Bufo boreas boreas*	Sensitive Species	Subalpine forest habitats with marshes, wet meadows, streams, beaver ponds, and lakes.	Habitat - Yes Species - No
Northern leopard frog	*Rana pipiens*	Sensitive Species	Wet meadows, marshes, beaver ponds, and streams.	Habitat - Yes Species - No
FISHES				
Bluehead sucker	*Catostomus discobolus*	Sensitive Species	Colorado River Basin Drainage: Variety of habitat, headwater streams to large rivers.	Habitat - Yes Species - Yes
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*	MIS & Sensitive Species	Headwater streams and lakes.	Habitat -Yes Species -No
Flannelmouth sucker	*Catostomus latipinnis*	Sensitive Species	Deep slow flowing pools in large rivers	Habitat - No Species - No
Mountain sucker	*Catostomus platyrhynchus*	Sensitive Species	Headwaters downstream to mid-elevation, low gradient, slow-moving water	Habitat – Yes Species - Yes
Roundtail chub	*Gila robusta*	Sensitive Species	Colorado River Basin Drainage: Variety of habitat, usually in slow-flowing water adjacent to fast moving water	Habitat - No Species - No
INSECTS				
Great Basin silverspot	*Speyeria nokomis nokomis*	Sensitive Species	Inhabits wetlands fed by springs or seeps; host plant violet at 5,200-9,000 feet.	Habitat – No Species - No
PLANTS				
Lesser panicled sedge	*Carex diandra*	Sensitive Species	Fens, calcareous meadows 6,100-8,600 feet.	Habitat - No Species - No
Lesser bladderwort	*Utricularia minor*	Sensitive Species	Aquatic plant found in floating fens to 10,000 feet.	Habitat- No Species- No

Species Common Name	Species Scientific Name	Status	Habitat Description	Habitat Found/Species Recorded or Observed in Project Area
Rocky Mountain (adobe) thistle	*Cirsium perplexans*	Sensitive Species	Found on barren gray shale slopes 4,500-8,000 feet. Rock, cliff, and canyon habitat.	Habitat - No Species - No
Harrington's beardtongue	*Penstemon harringtonii*	Sensitive Species	Found 6,800-9,200 feet in open sagebrush or, less commonly, pinyon-juniper habitat. Not documented in Mesa or Delta County.	Habitat - No Species - No
DeBeque phacelia	*Phacelia scopulina var submutica*	Sensitive Species	Found at low elevation 4,700-6,200 feet, on steep clay slopes in the Wasatch Formation.	Habitat - No Species - No
Sun-loving meadowrue	*Thalictrum heliophilum*	Sensitive Species	Sagebrush and pinyon-juniper habitat in underdeveloped soils, light colored clays with shale fragments; 6,300-8,800 feet	Habitat - No Species - No
Wetherill milkvetch	*Astragalus wetherillii*	Sensitive Species	Big sagebrush and pinyon-juniper habitat. Steep slopes, canyon benches, and talus below cliffs. On sandy clay soils derived from shale and sandstone 5,250-7,400 feet.	Habitat - No Species - No
Sphagnum moss	*Sphagnum angustifolium*	Sensitive Species	Fens, peatlands at higher elevations	Habitat – No Species - No

Based on this evaluation, it was determined that a number of these species are not expected to occur because the Project Area is either outside of their range and/or does not contain any potential habitat for them. This group of species will not be impacted by the proposed projects and a determination of "No impact" is appropriate. These species have been eliminated from detailed evaluation and are not discussed further in this BE.

The remaining sensitive species may occur in the Project Area based on known occurrences of, or the presence of suitable habitats for these species. The species evaluated are:

- Townsend's big-eared bat
- Brewer's sparrow (covered in Sections 3.9.4 of this document)
- Flammulated owl
- Lewis's woodpecker
- Loggerhead shrike
- Northern goshawk (See Section 3.9.4)
- Northern harrier
- Purple martin
- Boreal toad
- Northern leopard frog
- Colorado River cutthroat trout (covered in Section 3.8)
- Bluehead sucker (covered in Section 3.8)
- Mountain sucker (covered in Sections 3.8)

Detailed evaluations of the potential impacts of the proposed project on the remaining species are discussed in the following sections.

3.9.5.1 Townsend's big-eared bat (Corynorhynus townsendii)
Affected Environment

This is a bat of western North America, ranging from southern British Columbia to southern Mexico. Townsend's big-eared bats can be found throughout Colorado except in the eastern plains. Its distribution seems to be determined by the availability of roosts such as caves, mines, tunnels, crevices and masonry structures, and suitable roosting sites are one of the primary limiting factors to this species.

The Townsend's big-eared bat is generally solitary or gathers in small groups, although during the summer females may form larger maternity colonies. In Colorado they occur in mines, caves and structures in woodlands and forests at elevations up to 9,500 feet.

Breeding occurs in the fall, with ovulation, fertilization, implantation, and gestation occurring in the spring. Gestation takes 50-60 days to produce one young that is born in mid-June and can fly in 2 ½ to 3 weeks.

This bat feeds mainly on small moths, but also eats beetles, flies, and wasps. The Townsend's big-eared bat is usually a late flier and forages along the edge of vegetation. They sometimes glean insects from the vegetation.

Populations of Townsend's big-eared bat are highly susceptible to disturbance in their nursery and hibernaculum. Roost sites need to be protected for species conservation.

There are no documented occurrences of this species on the Grand Mesa NF. Habitats of primary concern are roosting sites, particularly those used for hibernacula and nurseries. Those sites include mines, buildings, caves, and other structures. There are not any known mineshafts or caves within the Project Area, but there are some structures and buildings. Available roosting sites within the Project area include natural cracks and crevices in rock outcrops.

Environmental Consequences

Alternative 1 – No Action

Under this Alternative, there would be no change in existing conditions.

All Action Alternatives.

There would be no direct, indirect or cumulative effects to Townsend's big-eared bat from the proposed activities.

Determination**: No impact**.

3.9.5.2 Flammulated owl (Otus flammeolus)
Affected Environment

The flammulated owl inhabits old growth or mature ponderosa pine forests but will also inhabit other conifer forests mixed with mature aspen. In some areas, birds are seen in pure aspen; some also occur in old-growth pinon/juniper woodlands (Andrews and Righter 1992). They prefer forests with dense canopy covers close to relatively open areas. They are an uncommon to common summer resident in foothills and lower mountains. They appear to be most common in western and southern Colorado. They are most commonly found between 4,500-7,800 ft. but will range up to 10,000 ft. They nest in old flicker holes or other woodpecker holes with eggs laid from early May to late June. They are found throughout the Grand Mesa National Forest in suitable habitat, which, in the Project Area is aspen or aspen mixed with conifer or shrubs.

Environmental Consequences

Alternative 1 – No Action

Under this Alternative, there would be no change in existing conditions.

Alternative 2 – The Proposed Action

Alternative 2 would affect 33 acres of aspen habitat, 13 of which is in a young sapling stage, which currently does not provide flammulated owl nesting habitat. All of the acres affected would result in a long term reduction of flammulated owl nesting habitat, perhaps 70-90 years (or more for the well pad sites) until they were suitable for nesting habitat.

Alternative 3 – All Buried Pipelines

Effects are similar to Alternative 2 except Alternative 3 would impact 34 acres of aspen habitat, 13 of which is the young sapling stage

Determination for Action alternatives: The long term reduction of flammulated owl nesting habitat on 34 acres is a small percentage of the overall flammulated owl habitat on the Forest. Therefore, the proposed project **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning area, nor cause a trend to federal listing** for the flammulated owl**.**

3.9.5.3 Lewis' woodpecker (Melanerpes lewis)

Affected Environment

The Lewis's woodpecker occupies a variety of habitats, including agricultural lands, urban areas, riparian woodlands, and pinyon-juniper woodlands at lower to middle elevations (Andrews and Righter 1992).

Environmental Consequences

Alternative 1 – No Action

Under this Alternative, there would be no change in existing conditions.

All Action Alternatives

The cottonwoods along Buzzard Creek provide possible nesting habitat, but this habitat will not be affected. Some juniper will be removed by each of the action alternatives, but the amount is small relative to that in the Project Area and on the Forest.

Determination: The action alternatives **may adversely impact individuals, but are not likely to cause a trend to federal listing or a loss of species viability on the Planning Area, nor cause a trend toward federal listing or a loss of species viability range wide.**

3.9.5.4 Loggerhead shrike (Lanius ludovicianus)

Affected Environment

The loggerhead shrike breeds in a variety of open habitats primarily shrublands and open woodlands up to 2,591 m (8,500 ft) (Andrews and Righter 1992).

Environmental Consequences

Alternative 1 – No Action

Under this Alternative, there would be no change in existing conditions.

All Action Alternatives

Suitable nesting habitat would be impacted through removal by the Action alternatives.

Determination: The proposed action and alternatives **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability range wide.**

3.9.5.5 Northern harrier (Circus cyaneus)

Affected Environment

Considered vulnerable in Colorado, northern harriers occur throughout North America and Eurasia, reaching their highest densities in the prairie-pothole region of the US and Canada (Kingery 1998). According to NatureServe (2005), overall global trend appears more or less stable, but southern Canada showed a significant annual decline of 4% from 1990-2000. Globally, northern harriers have declines where large wetlands and moist grasslands have been lost.

In Colorado, northern harriers occur in lower elevation grasslands, agricultural lands and marshes but may range up to the tundra in the fall. The most common breeding habitats are emergent wetlands, croplands and tall desert shrublands; their current distribution in Colorado favors the shortgrass prairie and lower elevations of the western slope (Kingery 1998).

Northern harriers are generally found from 5000 to 9000 feet in Colorado, with additional fall use in high elevations (Kingery 1998), northern harriers are strongly associated with natural wetlands, moist grasslands, and other irrigated agricultural habitats, and tundra in the fall (NatureServe 2005). In Colorado, breeding chronology is affected by elevation with courtship from mid-April to late June, eggs laid from April through June and chicks fledged from May to August (Kingery 1998). Nests are built on the ground in areas of dense vegetation and are composed of grasses, forbs and twigs. The female incubates and feeds the young and she rarely leaves the nest. Males deliver small mammal and bird prey items captured in open grassland, shrubland and agricultural habitats (NatureServe 2005). In Colorado, the greatest threat to northern harriers is the continued loss of wetland habitats from urban, residential, industrial and agricultural development (Kingery 1998).

Suitable habitat exists in the wet meadows on the Grand Mesa and Battlement Mesa. Kingery (1998) lists a probable recent nesting record for the Grand Mesa National Forest in the general area of the project.

Environmental Consequences

Alternative 1 – No Action

No change in habitat would occur under the No Action alternative, therefore there would be **no impact** to northern harriers.

All Action Alternatives

Gas development activities within lower elevation grassland and shrubland habitats on the Project Area has some potential to directly affect northern harriers by direct habitat loss. Indirectly, human activities within potential harrier nesting habitat may reduce the habitat effectiveness of the nesting habitat due to motorized activity and construction activities. Project activities may also alter the character of available forage and cover needed by northern harrier prey species. Although northern harriers may use sagebrush shrublands, they more commonly nest and forage in open, moist meadows or agricultural areas. Limited amounts of moist meadow habitats are available in the lower elevations of the project area and, far more extensively, immediately adjacent on private lands. These habitats on adjacent private lands are affected by potential land sales, rangeland mechanical treatments, hay production and livestock grazing, changes in agricultural use, conversion of agricultural uses to development, noxious weed invasion, and road and subdivision development.

Determination: Because northern harriers are known from the vicinity and the area contains limited suitable harrier habitat, the proposed activities have the potential to affect harrier nesting and foraging habitat. Therefore, the action alternatives **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning area, nor cause a trend to federal listing** for northern harriers.

3.9.5.6 Purple martin (Progne subis)
Affected Environment

In Colorado, the purple martin is a common summer resident in the lower mountains of the west-central portion of the state (Andrews and Richter 1992). Nests of this species occur almost exclusively in cavities in mature aspen and only occasionally in mixed aspen/ponderosa pine or aspen/Douglas-fir forests (Andrews and Righter 1992). Nests are often within 1,000 feet of water, including small creeks and stock ponds.

Suitable nesting habitat for this species occurs in older-growth aspen on the Forest and in the Project area. A nesting colony was present on upper Hightower Creek in 2006 and 2007. Individuals were observed regularly in 2007 in the aspens surrounding the three upper proposed well pads.

Environmental Consequences

Alternative 1 – No Action

No change would occur in the habitats for purple martin, therefore there would be **no impact**.

All Action Alternatives

Development activities within aspen habitats would reduce the amount of mature aspen habitat, which is nesting habitat, by up to 21 acres. This directly affects the purple martin long term.

Determination: The action alternatives directly affect up to 21 acres of purple martin nesting habitat. However, this is a very small percentage of the aspen habitat found on the Forest. Therefore, the action alternatives **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning area, nor cause a trend to federal listing** to the purple martin**.**

3.9.5.7 Boreal toad (Bufo boreas boreas)
Affected Environment

Distribution: Boreal toads in Colorado are part of the Southern Rocky Mountain (SRM) population, which were petitioned for federal listing. In 1995 the U.S. Fish and Wildlife Service determined that federal listing was warranted but this population was precluded from listing due to the need for action on higher priority species (NatureServe 2005). The September 2005 Final Rule found that the SRM population was not warranted for federal listing due to a lack of clear definition of a Distinct population Segment (DPS).

Although once considered fairly common in most mountainous areas of the Southern Rocky Mountains, it is much less common today and absent from many historically occupied locations. Specifically, 1986-1988 surveys found that toads had disappeared from 83% of historic locations in Colorado and from 94% of Wyoming historic sites (Loeffler 2001). Boreal toads occur in two locations on the Grand Mesa.

Southern Rocky Mountains boreal toads occupy forest habitats between 7,500 and 12,000 feet. Boreal toads require breeding ponds, summer range, and overwinter refugia, within or adjacent to lodgepole pine or spruce-fir forests. Breeding habitat includes large lakes, glacial ponds, beaver ponds, man-made ponds, wetlands and roadside ditches and puddles. Egg placement occurs in shallow, quiet water where thermal effects of the sun on egg masses can be optimized. Young toads are restricted to moist habitats while adult toads can move several miles through upland habitats. Hibernacula include

rodent burrows and beaver dams and lodges. Summer range includes upland forests and rocky areas with springs and seeps (Loeffler 2001).

The greatest threat to boreal toad persistence appears to be the pathogen *Batrachochytrium dendrobatidis* (a chytrid fungus also referred to as Bd). Current thinking is that an unknown combination of environmental factors are causing sub-lethal stress in toads; stress is causing suppression of the immune system; and immunosuppression, cold body temperatures and a moist environment leads to infection and widespread mortality. Other secondary threats include alteration of habitat; aerial application of insecticides and piscicides; and predation from tiger salamanders, corvids, snakes, raptors, predaceous diving beetles, and others (Loeffler 2001).

In Colorado, evidence of boreal toad declines has been thoroughly documented (Loeffler 2001). The Grand Mesa has two populations of boreal toads, one of which has confirmed breeding. This breeding population is within the same watershed as the project area, and as such, there is potential breeding habitat in the ponded wetlands within the Project area.

Environmental Consequences

Alternative 1 – No Action

There would be no habitat changes, no risk of heavy equipment trampling individuals or spreading Bd disease, therefore there would be **no impact to boreal toads.**

All Action Alternatives

Direct effects of gas development activities may include trampling of toads, tadpoles or egg masses. Potential indirect effects include changes in riparian vegetation and stream bank effects that could cause unfavorable conditions for eggs or tadpoles; hydrologic changes resulting from road construction and well pad construction; and changes in water quality as a result of sedimentation. Heavy equipment may also be a vector for Bd spread if they move between Bd positive and Bd negative sites.

The US Forest Service is a partner on the 2001 *Conservation Plan and Agreement* (Loeffler 2001) for the Southern Rocky Mountain population of the boreal toad and agrees to support recommended conservation actions.

Determination*:* Development activities **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning area, nor cause a trend to federal listing** for boreal toads**.**

3.9.5.8 Northern leopard frog (Rana pipiens)

Affected Environment

Distribution: Considered vulnerable in Colorado (NatureServe 2005), northern leopard frog range includes the southern provinces of Canada, south through the US to Texas (Hammerson 1999). Although still widespread and common in many areas, many populations have drastically declined, especially in the Rocky Mountains of Colorado, Wyoming and Montana. Similar declines have been reported for Washington, Oregon and Alberta (NatureServe 2005). Leopard frog records from Colorado occur from 3500 to 11,000 feet but exclude southeastern Colorado (Hammerson 1999).

Natural History: Northern leopard frogs can be found in springs, slow-moving streams, marshes, bogs, ponds, canals, floodplains, reservoirs and other lakes with rooted aquatic vegetation. They can also be found in wet meadow habitats in the summer. They overwinter underwater. Shallow, still, permanent water with good exposure to sunlight is needed for egg deposition and development. Metamorphosed frogs eat a variety of small invertebrates. Tadpoles eat algae, plant tissue, organic debris and some small invertebrates. Threats to leopard frogs include habitat loss, over-harvest, and competition with and predation from introduced bullfrogs. Like many amphibians, leopard frog declines appear related to environmental changes that alter the frog's susceptibility to disease (e.g. red leg disease) (NatureServe 2005, Hammerson 1999).

Environmental Baseline: According to Hammerson (1999) the formerly abundant leopard frog has become scarce in many areas of Colorado.

Environmental Consequences

Alternative 1 – No Action

There would be no habitat changes and no risk of heavy equipment trampling individuals, therefore: No impact to northern leopard frogs.

All Action Alternatives

Similar to the discussion for boreal toads, gas development activities has the potential to directly affect leopard frogs, tadpoles and egg masses via equipment trampling. Potential indirect effects are numerous and include any effects to wetlands and riparian areas that contribute sediment, change water quality or chemistry, alter hydrology, or change the existing vegetative cover at an occupied site.

Determination: Equipment may trample egg masses during the breeding season, or individual frogs. Indirect effects include possible changes to water quality and wetlands. Therefore, the proposed action **may adversely impact individuals, but is not likely to result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability range wide**.

Table 3.9.5b Sensitive Species with a MAII determination

Common Name	Scientific Name
Brewer's sparrow	*Spizella breweri*
Flammulated owl	*Otus flammeolus*
Lewis' woodpecker	*Melanerpes lewis*
Loggerhead shrike	*Lanius ludovicianus*
Northern goshawk	*Accipiter gentilis*
Northern harrier	*Circus cyaneus*
Purple martin	*Progne subis*
Boreal toad	*Bufo boreas*
Northern leopard frog	*Rana pipiens*
Bluehead sucker	*Catostomus discobolus*
Mountain sucker	*Catostomus platyrhynchus*
Colorado River cutthroat trout	*Onchorhynus clarki pleuriticus*

3.9.6 Other Terrestrial Wildlife Species

Affected Environment

Migratory Birds

The FWS (FWS 2002) has compiled a list of migratory bird species which appear to be declining in numbers or distribution, or for which more information is needed. These species are known as Birds of Conservation Concern (BOCC), and the list for the Southern Rockies/Colorado Plateau is presented in Table 3.9.6.

Nesting habitat for northern harrier, Swainson's hawk, flammulated owl, Lewis's Woodpecker, Williamson's sapsucker, pinyon jay, and Virginia's warbler is found in the Project Area (Andrews and Righter 1992). Northern harrier, Swainson's hawk, and Virginia's warbler were observed during field work. Habitat for black-throated gray warbler is present, but the Project Area is at or above the known elevational breeding range (<7,500 feet) of this species (Andrews and Righter 1992.

Table 3.9.6. Bird Species of Conservation Concern (BOCC)

Common name	Scientific name	Common name	Scientific name
Northern harrier	*Circus cyaneus*	Short-eared owl	*Asio flammeus*
Swainson's hawk	*Buteo swainsoni*	Black swift	*Cypseloides niger*
Ferruginous hawk	*Buteo regalis*	Lewis's woodpecker	*Melanerpes lewis*
Golden eagle	*Aquila chrysaetos*	Williamson's sapsucker	*Sphyrapicus thyroideus*
Prairie falcon	*Falco mexicanus*	Gray vireo	*Vireo vicinior*
Peregrine falcon	*Falco peregrinus*	Pinyon jay	*Gymnorhinus cyanocephalus*
Gunnison sage-grouse	*Centrocercus minimus*	Bendire's thrasher	*Toxostoma bendirei*
Snowy plover	*Charadrius alexandrinus*	Crissal thrasher	*Toxostoma rufum*
Mountain plover	*Charadrius montanus*	Sprague's pipit	*Anthus spragueii*
Solitary sandpiper	*Tringa solitaria*	Virginia's warbler	*Vermivora verginiae*
Marbled godwit	*Limosa fedoa*	Black-throated gray warbler	*Dendroica nigrescens*
Wilson's phalarope	*Phalaropus tricolor*	Grace's warbler	*Dendroica graciae*
Yellow-billed cuckoo	*Coccyzus americanus*	Sage sparrow	*Amphispiza belli*
Flammulated owl	*Otus flammeolus*	Chestnut-collared longspur	*Calcarius ornatus*
Burrowing owl	*Athene cunicularia*		

Raptors
Raptors (hawks, eagles, owls, falcons) are birds of prey which generally occupy the top of the avian food chain. Suitable habitat is present in the Project Area for the following raptor species: sharp-shinned hawk Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, American kestrel, flammulated owl, western screech owl, great horned owl, northern pygmy-owl, long-eared owl, and northern saw-whet owl.

During field work in June 2007, suitable raptor nest trees were searched within ¼ mi of project features. This survey included the playing of recorded calls of great horned owl and northern goshawk in accordance with a protocol developed by Kennedy and Stahlecker (for goshawk) (Kennedy and Stahlecker 1993) and protocol for great-horned owl utilized by the Bureau of Land Management. Neither of these species were documented.

Two active red-tailed hawk nests were located during the survey; one along Hightower Creek and the other at the head of a tributary of Hightower Creek. Neither nest lies within one quarter (0.25) mile of any project feature.

Mammals
Mammal species likely to be present in the Project Area include masked shrew, deer mouse, long-tailed vole, least chipmunk, golden-mantled ground squirrel, yellow-bellied marmot, Nuttall's cottontail, white-tailed jackrabbit, ermine, long-tailed weasel, bobcat, mountain lion, black bear, red fox, coyote, mule deer, elk, moose, and various species of bats.

Rocky Mountain elk is addressed under the MIS section, 3.9.4.1.

Moose, recently introduced to the Grand Mesa by CDOW, forage in the aspen, oakbrush and willow vegetation types primarily in this area. The Hightower area has become a heavily used area by moose, and is considered a concentration area by the CDOW at this point in time (Duckett pers.com.2008). However, it is still early in the establishment of the population, as they have only been on the Forest since 2005. The current population estimate by CDOW is approximately 110 moose in the herd, but it is difficult to estimate numbers for just the Project Area.

Environmental Consequences
Habitat loss is a direct impact to species dependent on those vegetation types that will be affected (Tables 3.9.2.2 and 3.9.2.3 above). Direct impacts may also include increased mortality of larger mammal species and birds due to collisions with motor vehicles, or destruction of nests, burrows, or dens. Accidental spillage of fuels and drilling chemicals may cause increased mortality in some species. Indirect impacts, such as increased noise, dust, vehicular traffic, and human activity could cause displacement of animals into adjacent habitats resulting in increased habitat competition. Non-native invasive plant species introduced by construction could spread to adjacent habitats and degrade their quality.

Alternative 1 – No Action

No environmental consequences for any wildlife species are associated with the No Action Alternative. Section 2.2.1 describes the No Action Alternative.

Alternative 2 – Proposed Action

Migratory Birds

Direct effects for migratory birds involve mortality due to collisions with vehicles and destruction of nests or nesting habitat from construction activities. The reserve pits are not expected to have impact to migratory birds, as it will be netted and fenced. Until disturbed areas are reclaimed, vegetation removal associated with the Proposed Action would result in some loss of existing nesting and foraging habitat within the action area. The aspen dependent species, such as warbling vireo and swallows will have a long-term impact to nesting habitat, on 13 acres. However, there are xx acres of remaining suitable nesting habitat on the Forest.

Indirect effects: Some habitat fragmentation will result from the project from the clearing of vegetation for wellpads and access roads; such fragmentation may increase the "edge" effect and favor some species such as cowbirds. The result may be an increase in cowbird parasitism of some species' nests.

Raptors

Direct effects for raptors involve mortality due to collisions with vehicles and loss of nests or nesting habitat due to construction activities. The reserve pits are not expected to have any impacts to raptors, as it will be fenced and netted.

Indirect effects on raptors would be similar to those for other bird species, although raptors are not subject to cowbird parasitism. Some raptors species will not be able to tolerate the increased noise, dust, and human activity and may avoid the area. More tolerant species, such as great horned owl and red-tailed hawk, may benefit from a potential increased availability of prey base.

Mammals

Habitat loss, short term and long term, would directly affect the species dependant on the affected vegetation. Other direct effects for mammals include collisions with motor vehicles and destruction of dens and burrows by construction. The reserve pit is not expected to have any impact to mammals, as it will be netted, with escape ramps for small mammals, and the fence around the pit will have flashing around the bottom of it to deter small mammals from entering.

Those species dependent upon affected vegetative types will likely be displaced from the affected acres in the short term.

Elk will be addressed in the MIS section.

Moose

The Proposed Action is situated within moose habitat that was identified during the Grand Mesa moose re-introduction project that was implemented in 2005 by the CDOW, USFS and adjacent landowners. Aspen is a valuable forage habitat for moose in the Rocky Mountain Region and was considered suitable habitat for moose in the Grand Mesa moose re-introduction feasibility analysis. Aspen clear-cuts are not only beneficial, but are favorable foraging areas for moose since re-growth of aspen is highly palatable to moose and generally available in dense stands (Snyder 1991). Additionally, during the fall period, fallen aspen leaves are an important part of moose diets. Approximately 25 acres of moose habitat will be affected with the removal of mature and sapling stage aspen in the project area. About 12 acres of aspen removal on well pads and access roads will most likely be a long term impact. Until the disturbed aspen areas are reclaimed with suitable aspen stands moose forage values will be diminished long term on 12 acres of affected aspen. Habitat

effectiveness will decrease slightly short term, as a result of aspen disturbance of this project, but is not expected to impact the Grand Mesa moose population, as there are approximately 740,000 acres of aspen habitats and 300,000 acres of Gambel oak and mountain shrub communities on the Forest.

As with other ungulates noise disturbance from construction and drilling related activities, increased use of roads and the general increased human presence is likely to cause some moose to avoid the Project Area. Traffic related to the project is expected to increase from present levels for a 13-month period during facilities construction and drilling, and at least twice weekly during well operation and may disrupt some foraging and migration patterns. Moose distribution studies in Nova Scotia suggest that moose are sensitive to impacts associated with roads. In Nova Scotia an analysis performed of habitat suitability, road density, and a moose pellet group inventory showed moose did not use areas of higher road density (Beazley et al. 2004). This suggests that moose may be sensitive to the vehicular disturbance that is associated with the presence of a road.

Non-native invasive plant species introduced by construction could spread to adjacent habitats and degrade their quality

Alternative 3

The direct and indirect, effects from this alternative would be similar to those of the Proposed Action of Alternative 2, but a larger area would be disturbed, more habitat would be altered, and the carrying capacity of those species dependent upon the vegetation types removed would be reduced. The greater area of disturbance would increase the probability of siltation, erosion, and noxious weed infestation. With fewer vehicle trips required as a result of piping produced water from well sites, there would be less noise and dust as well as decreased chances for vehicle/wildlife collisions. Fewer vehicle trips would also reduce disruption of moose foraging and migration patterns.

3.10 Cultural Resources

The direct effects analysis area for cultural resources is limited to the areas which are physically disturbed by project activities. The indirect and cumulative effects analysis area is the four section area encompassing the travelways through the project area (sections 16, 17, 20 and 21).

3.10.1 Affected Environment

Five proposed drilling locations, compressor facility, associated access roads and gathering pipelines were inventoried. These locations are described in Chapter 2, Section 2.2.2 and 2.2.3. Drilling locations are described in Table 2.2.1 and all infrastructure locations are displayed in Figure 2.3 (Proposed Action) and Figure 2.4 (Alternative 3). No previously recorded cultural resources are known to be located within a quarter mile of the proposed access roads, compressor/central facility or drilling locations. All of the inventoried areas are covered with heavy vegetation that limited the observation and identification of cultural resources, which may be present. The negative result of the inventory may be more an indication of the heavy ground cover, rather than the absence of cultural resources.

Native American Concerns. The three Ute tribes were sent scoping information on this project; none of the tribes identified any known sacred sites or Traditional Cultural Properties within the project area. An intensive cultural resource inventory of the project area was conducted by Grand River Institute. The inventory did not locate any sacred sites or Traditional Cultural Properties. Should a sacred site or Traditional Cultural Property be located on Forest Service lands before or during project

implementation, all activities will cease and the Forest Archaeologist at the Supervisors Office will notify the tribal representatives of the find. All sacred sites and Traditional Cultural Properties on Forest lands will be protected and avoided, as if these sites were Eligible to the NRHP.

3.10.2 Inventory Methodology

In the fall of 2006, Grand River Institute conducted two Class III (100%) cultural resource inventories for the proposed project features which were being developed and further refined. The cultural resource surveys were conducted in compliance the Historic Sites Act of 1935 (Pl 74-292), National Historic Preservation Act, 1966 (Pl 95-515), as amended (PL 102-575), National Environmental Policy Act 1969 (PL 91-190), Executive Order 11593, 1971 (16USC 470), Archaeological and Historic Data Preservation Act, 1974 (PL 93-291), American Indian Religious Freedom Act, 1978 (PL 95-341), and Native American Graves Protection and Repatriation Act 1990 (PL 101-601).

The first survey examined the proposed drilling locations, compressor site and access roads (GRI 2006a, b). A 40-acre block centered on the staked well head was inventoried for each drilling location. A 10-acre block centered on the staked pad was inventoried for the compressor site. Centered corridors, 200-foot wide, were inventoried on the proposed access roads. The second survey addressed proposed gathering pipelines where centered corridors, 200-feet wide, on the proposed pipeline alignments were inventoried. A third survey was conducted in the summer of 2007 (Conner 2007), which included the pipeline alignments proposed for Alternative 3, including the additional pipeline connecting the proposed 21-2 drilling location to the central facility.

The Forest Service Archeologist surveyed the two aspen regeneration clearcut units in the fall of 2007.

The cultural resource inventory reports were produced in accordance with OAHP and FS guidelines. No cultural resources were found during the inventories.

3.10.3 Environmental Consequences

3.0.3.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative. Section 2.1 describes the No Action Alternative.

3.10.3.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

There were no cultural resources identified in the project area during Class III inventory work. Should any cultural resources be located during excavations related to the project, the operator will notify the FS archeologist immediately as stipulated on the oil and gas lease. The operator will then coordinate with the Forest Service on appropriate measures to be implemented.

Operations may resume at the discovery site upon receipt of written authorization by the authorized officer. Approval to proceed would be based upon evaluation of the resource.

Indirect effects to cultural resources due to increased use in the vicinity of the project could range from illegal collection and excavation to vandalism. However, this is unexpected due to the lack of cultural resources recorded in the area.

Cumulative Effects: Worldwide, the trend is loss of cultural resources due to development, public access, natural weathering, erosion and fire, to list a few examples. Cultural resources are a nonrenewable resource whose financial and educational value is just being realized. The increase in accessibility/use of public lands and increasing populations has the potential to adversely effect the cultural landscape.

3.10.3.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

Effects to cultural resources are anticipated to be similar to that described for Alternative 2.

3.11 Recreation

The direct, indirect and cumulative effects analysis area includes the 6th level Buzzard Creek watershed boundary shown by the dashed line in Figure 3.0a.

3.11.1 Affected Environment

This section describes the affected environment and analyzes the effects to the recreation resource on the GMUG. The environmental analysis evaluates short-term effects related to construction activities and long-term effects related to the operation, maintenance and existence of the drilling operations on the landscape, by alternative.

Recreation use on the GMUG forests for fiscal year 2003 was estimated at 3,385,808 national forest visits (USDA 2004). The top primary activities, according to the National Visitor Use Monitoring (NVUM) study conducted on the forest were downhill skiing, snowmobiling, hunting, viewing natural features, hiking/walking (USDA 2004). The primary recreational activities on the GMUG and within the analysis area are big game hunting, dispersed camping, four-wheel driving, ATV riding, snowmobiling and horseback riding. There are no developed recreational facilities on the GMUG within the analysis area. Recreation use in the project area can be generally characterized as dispersed recreation with a relatively low level of intensity, with the exception of big game hunting in the fall.

Recreation Opportunity Spectrum

The Recreational Opportunity Spectrum (ROS) classes assigned to the project area are according to the GMUG Forest Plan are:

- Roaded Natural (RN)- RN area is characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high, with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities.
- Semi-Primitive Motorized (SPM)-SPM area is characterized by predominantly natural-appearing environments with low evidence of the sights and sounds of people. Interaction between users is rare. Resource modification and utilization practices are also rare and generally compatible with the natural environment. Motorized travel is allowed on designated motorized roads and non-motorized travel is allowed on designated non-motorized trails. Snow-machine travel on travel may occur.
- Semi-Primitive Non-Motorized (SPNM)-SPNM area is characterized by predominantly natural environments with low evidence of the sights and sounds of people. Interaction between users is rare. Resource modification and utilization practices are also rare and are

compatible with the natural environment. Cross-country travel and travel on non-motorized trails is typical.

Hunting

Big game hunting is one of the primary recreation uses within the project area. There is a mix of day use hunters and overnight hunters throughout the project area. The project is located in DOW game management unit (GMU) 421, the Buzzard Creek area. This area has historically been very popular with big-game hunters and can be expected to remain so in the future. In the years 2001-2005, the average annual number of elk hunters in GMU 421 was 3,600 and the average number of deer hunters was 1,670 (CDOW 2006). It should be noted that as part of public awareness, the FS has provided a brochure regarding the location and purpose of the Hightower MDP which is available in the Collbran FS and Grand Valley FS Offices and posted information on the signboard near the FS boundary on NFSR 265 in order to inform hunters of ongoing work in the area (Geary 2007).

Big game hunting season begins in late August with archery season. Hunting during archery season is considered moderate to high in the project area. Muzzle loading season occurs in mid-September and use is typically moderate. Rifle season is mid-October through mid-November. Rifle season is the most popular big game season and use in the project area is very high.

There are three permitted outfitter guides operating on the GMUG near the project area:

- Chuck Davies Guide Service Outfitters base camp is located on the White River National Forest, where the Gunnison, White River and Grand Mesa National Forests converge, but their primary hunting areas are located on the GMUG. They operate a "drop camp" in the SE quarter of Section 29 of T9S R91W. The drop camp is an outfitted and supplied camp for clients, but hunters are self-guided. This outfitter is permitted 100 service days of summer use for trail rides, horse pack trips and fishing trips. They are also permitted 223 service days during big game hunting season.

- TNT High Mountain Outfitters is permitted on the GVRD. They operate a base camp in Section 29 of T10S R92W, south of the project area. NFSR 265 is the primary access to their camp and hunting area. This outfitter is permitted 216 service days for big game hunting.

- Hills Guide Service operates in the Plateau Creek area, south of the project area. Their base of operations is located on private land north of the forest boundary, with one drop camp in Section 15 of T10S R93W. This outfitter is permitted 40 service days of summer use for horseback rides, and 170 service days during big game hunting season.

Dispersed Camping

Dispersed camping is concentrated along forest development roads. Overall incidences of summer dispersed camping is low and is associated primarily with ATV riding and four-wheeling. Dispersed camping during hunting season would be considered high with camps occurring along all accessible roads.

Summer/Fall Motorized Recreation

Use of ATV's has increased substantially forest-wide since the 1980s. The Grand Mesa National Forest has completed travel management planning. ATVs and motorcycles are allowed on a network of designated forest development roads and trails. Cross-country travel during the snow-free season is prohibited.

Many forest visitors are using ATVs for recreational riding along roads and to access more remote areas of the forest. The majority of ATV use occurs during hunting season; however, summer recreational riding is increasing. NFSRs 265 and 266, are part of a popular motorized ATV loop that originates in Vega State Park to the west and many take the ATV-only route over the top of Hightower Mountain. ATV use originating from this park is increasing. ATV use is allowed on the trail that follows the Hightower Transmission Corridor Trail. All ATV travel is restricted to designated routes in all areas of the Grand Mesa National Forest.

Off route ATV activity has historically occurred in this area; however the Grand Mesa Travel Management Plan and subsequent amendments to the decision have restricted use to designated roads and trails. For several years, the district has closed non-system routes using physical barriers, installed signs on open routes, updated and distributed maps to the public, posted news releases, and increased presence in the field via hunting season patrols. As a result of these efforts, the district has seen an increase in compliance with the travel plan. The majority of illegal use which still occurs is during the hunting season and is typically associated with people utilizing ATV's to hunt or to retrieve game.

Driving for pleasure using passenger vehicles to view scenery and fall colors or wildlife are popular activities for the recreating public. These motorized activities occur along all open roads, but are mostly concentrated along the main arterial routes.

Winter Motorized Recreation

The Sunlight to Powderhorn (SP) Snowmobile Trail follows portions of NFSRs 265, 266, 268, and trail 536 and is routinely groomed. NFSR 266 provides an access point to the S-P trail, and vehicles and trailers park where the county plows a pullout by the forest boundary near the Hightower Guard Station.

The NFSR routes in the project area are not plowed of snow or maintained for regular vehicle traffic from November 15- May 1. . NFSR 265 is gated and locked from December 1 through May 30 to protect the soft roadbed under a Forest Order. The general public utilizes most of the road corridors in and around the project area for snowmobile routes. These corridors, regardless of whether or not they are part of the official SP Trail system, provide excellent opportunities for loops and access to a wide variety of snowmobile terrain.

Non-Motorized Recreation

Non-motorized use occurs on non-system trails, open roads, and roads that are closed to motorized vehicles throughout the project area. Snow-free non-motorized uses include hiking, mountain biking and horseback riding.

Many non-system trails exist in the area, ranging from game trails to trails developed for human use. Many of the roads that are closed to motorized use are being used for non-motorized activities and could be considered non-system trails. The FS does not maintain non-system trails, nor does it regularly maintain an inventory of these trails.

Hikers, horseback riders and mountain bikers are the primary non-motorized users of non-system trails and closed roads. This type of use would be characterized as low during the summer months, when compared with other areas of the Forest. Hiking and horseback riding increases significantly during various hunting seasons and would be characterized as high during that time of year.

There is one permitted outfitter/guide that offers guided mountain bike rides south of the project area, off of the Buzzard Road. America's Adventure is a permitted outfitter/guide that offers guided mountain bike rides south of the project area off of the Buzzard Divide Road (NFSR 265). They ride

north along NFSR 265 from the Mesa/Delta County line, then west on NFSR 263 to Plateau Park. America's Adventure is authorized a maximum of 260 service days each year across the district. Although it varies, approximately 10% (26 client days) occur within the project area.

Noise

Noise testing requirements: COGCC Rule 802, Noise Abatement, gives information on maximum allowable levels of noise generated by oil and gas operations at well sites, production and gas facilities, as well as noise levels permissible during drilling, completion, gas line construction. Noise levels allowed depend on applicable zoning to the site. For residential/agricultural/ rural settings, noise levels of 55 db from 7:00 am to 7:00 pm and 50 db from 7:00 pm to 7:00 am are allowed for oil and gas operations. During drilling and construction, allowable noise levels cannot exceed 80 db. Table 3.11.2.2 shows a comparison table of common noise sources. COGCC Rule 802 gives guidance on how and where to measure sound levels: noise should be measured at 350 feet away from the noise source, when wind velocity does not exceed 5 mph, measured 4 feet above the ground, and averaged over a 15 minute time period. Noise measurements take the existing ambient noise level from all other sources in the surrounding area as the baseline to determine the contribution from the oil or gas facility. Cordilleran Compliance Services gathered baseline noise samples during the summer of 2007 in the project area near the compressor site, near the five drillpads, south of the 21-10 pad at a dispersed site along NFSR 265, at the Buzzard Creek campground, and at a dispersed campsite located at the junction of NFSR 266 with Trail 536 approximately one mile southeast of the 20-11 pad. A copy of that report is in the project file.

Table 3.11.2.2. Common Noise Levels

Noise Source	Average Noise (dBA)	"Loudness" based on normal conversation (baseline=1)
Normal conversation 5 feet apart	60	1
Ambulance siren at 100 feet	100	16
Single car passing at 25 feet	65	1.5
Average highway noise at 100 feet	60	1
On a typical construction site	85	6
Rural area during day	40	0.25
Rural area at night	35	0.18
Threshold of hearing	20	0.06

Source: EPA (1974), Harris (1991)

3.11.2 Environmental Consequences

3.11.2.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative. Section 2.1 describes the No Action Alternative.

3.11.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

The following sections summarize effects to recreation:

ROS
Direct effects for the Proposed Action would be consistent with the assigned ROS classes of SPNM, SPM and RN. Construction and drilling operations in the project area could affect the recreation setting to the extent that people seeking a back-country experience may go elsewhere to recreate; however, the ROS designation would not change.

Hunting
The general effects of construction and drilling on hunting are primarily a result of a combination of effects to other resources and activities such as transportation, wildlife, dispersed camping, motorized and non-motorized recreation.

Direct effects would be most noticeable during big game season when use is very high. These effects would be most evident during the construction and drilling/completion phases of the project. There would be short-term displacement and disturbance of game animals and hunters, primarily along access roads during construction. Displacement and disturbance of game animals and subsequently, hunters, would occur to a much lesser degree in the long term as four water trucks per day service the 5 drilling locations year-round.

Areas under forest closure due to construction would be unavailable for hunting or other recreational uses. Areas under closure may shift as construction and rehabilitation is completed. These effects would last during the 16-month construction phase of the project.

Temporary closures on forest roads may delay hunters. Hunters may become frustrated due to the delay in reaching their hunting and camping areas. These effects would be present during the construction phase of the project.

The three outfitter/guides providing big game hunts near the project area may be affected by the Proposed Action due to the direct effects on hunting overall. If construction or the conditions created by construction were substantial, these outfitter/guides might lose business during the construction phase of the project.

Hunters who are displaced may be frustrated that they are not able to hunt in their “traditional” areas. Hunters that have traveled a long distance and are not aware of the construction activity and closures could be upset that their planned hunting vacation has to be modified and a new hunting area has to be found. Displaced hunters would have the opportunity to explore new areas that may enhance their outdoor recreation experience. Displaced hunters may move to adjacent areas, thus impacting others’ hunting experience. These effects would be present during the construction phase of the project.

If any of the three outfitter/guides have to shut down operations for a season, their clients may choose to hire another guide. These clients may not return and this may lead to a permanent loss of business.

Dispersed Camping
There would be short-term loss and/or disturbance during construction and drilling, of existing dispersed campsites located along roads used to access the project area. Short-term loss of sites could occur as a result of sites being used as staging/parking areas for construction activities or site closure for safety reasons. Disturbance of campers would occur due to machinery noise, presence of construction workers, increased traffic on roads and dust.

Additional dispersed sites may develop as recreationists begin to use construction features such as truck turnarounds, pipe staging areas, or road pullouts.

Summer/Fall Motorized
Road improvements within the project area may change the character of the routes historically used by recreationists making them undesirable for the recreation experience they are seeking. Other recreationists may enjoy the improved routes as they may be less difficult to negotiate. These effects would be long-term due to the changed character of the routes.

NFSR's 265 and 266 are open to ATV use. Recreationists may encounter drilling and fracing vehicles and trucks hauling heavy equipment and pipe sections. Large truck traffic in conjunction with ATV use can create a safety issue related to visibility due to dust, size difference of vehicles using the same roads and condition of the roads. The potential of encountering large trucks coming from the opposite direction would likely require increased attention to driving and a willingness to yield the right-of-way on the part of the recreational driver. Slow moving vehicles may be encountered. Passing opportunities are limited on forest development roads.

Recreational motorists may experience traffic delays during construction operations. ATVs may be able to negotiate around equipment and construction activities that are blocking roads. Recreationists driving typical passenger vehicles or full-sized may experience significant delays, resulting in frustration.

Effects on ATV users would be greatest during big game hunting season when use is considered the heaviest of the year. ATVs are used by hunters to access campsites, hunting areas and to scout for game. Effects on summer ATV use would be greatest on weekends and holidays, although use would be considered low to moderate.

The Proposed Action and alternatives do not intersect any forest system trails. System trails are not proposed to be used for construction access. Therefore, system trails would not be directly affected by forest closures along the construction areas and pipeline corridors.

There is potential for illegal ATV activity along and originating from the pipeline corridors associated with the project. ATV users may be tempted to pioneer trails through the reclaimed corridors, looking for challenging rides. These types of illegal activities would be difficult to discourage until the pipeline corridors are revegetated, however a design criteria which calls for signing, blocking and closing pipeline corridors will alleviate this concern.

Resource damage associated with illegal ATV/4WD use includes road proliferation, soil erosion and compaction, destruction of vegetation, fragmentation of wildlife habitat, introduction of noxious weeds on disturbed ground, disruption of wildlife, negative effects to water quality, disturbance to

other forest visitors and conflicts with private landowners. The magnitude of these types of effects depends on many factors including the level of use occurring, effectiveness of physical closures, law enforcement presence and information available to users.

Winter Motorized
Recreationists who are displaced may be frustrated that they are not able to utilize their favorite routes and areas. This effect would be short-term, lasting during the construction phase of the project.

Winter motorized recreation would be effected both in the short term during construction and drilling, and long term as the wellpads are serviced throughout the year. Roads to wellpads and the compressor site would be plowed under Alternative 2, so that water trucks and service vehicles could travel to each site daily. NFSR 266 is part of the S-P trail and there could be some conflict from the snowmobile parking area to the 20-11 access road intersection. This conflict would be most pronounced during drilling operations and to a lesser extent in the long term as water trucks service the 20-6 and 20-11 drilling locations daily.

During winter months snowmobile use within the entire Buzzard Creek watershed is restricted to marked routes as depicted on the Winter Recreation Map annually from April 15 to the end of snowmobiling season in the spring, usually May 15. Road 265 on the north end is not considered a marked route; however access is permitted on the Buzzard Road, to ATV trail #536, which travels adjacent to Buzzard Creek and joins NFSR 266. This restriction is for protection of big game during elk calving and the big game spring transition range. This restriction is also dependent on snow conditions and presence of animals.

Road improvements to NFSRs 265 and 266 may make some roads more desirable for snowmobiling. Straightening and widening roads may encourage snowmobilers to travel at higher speeds. Higher speeds can lead to an increase in the incidence of accidents and injuries to snow mobile users.

Non-motorized
The majority of non-motorized use occurs on the weekends with the exception of hunting season. Most non-motorized recreationists also utilize motor vehicles to access the area so they would experience the same delays and road closures due to construction.
Mountain bikers that ride along open roads may experience the same effects of dust, noise and safety concerns that would affect the motorized user. This could potentially affect the mountain bike outfitter near the project area.

Recreational horseback riding, excluding hunting use, is not significant when compared to other areas of the forests. Horseback riding and hiking in association with hunting would be effected the most. Similar terrain and routes would be available for use within and adjacent to the project area. Displacement to other areas would be short-term, lasting during the construction phase of the project.

There could be minor effects to adjacent areas of the forest due to displacement of those non-motorized users. However, the potential for any noticeable increase in use to any other particular area due to such displacement would be negligible.

Noise

Project activities can be broken down into six phases, each with varying levels of traffic and construction noise associated with them:

a) Timber sale of merchantable timber located in the two aspen regeneration clearcuts, at drilling locations containing aspen, and along pipeline and access road corridors. Most of this activity will occur along NFSR 265 with only a very few merchantable aspen located along NFSR 266. Expect 6-8 one way trips per day for 27 days associated with timber removal.
b) Pipeline construction: Sorenson Engineering Inc., 3/13/07 located in the project file, estimates 18 average and up to32 one way trips per day for 38 days. This will include a lowboy transporting a backhoe, trenchers, 18 wheeler trucks carrying pipe, 6 wheel welding trucks, fuel trucks and pickup trucks.
c) Pad and access road construction and gravelling: Sorenson Engineering (3/13/07) estimates 17 average one way trips per day and up to 20 per day over 113 days. This includes lowboys, several 18 wheel belly-dumps, graders, excavators, backhoes, fuel trucks and pickup trucks.
d) Drilling 32 wells on 5 pads: Sorenson Engineering (3/13/07) estimates 7 average one way trips per day, up to 30 per day over 382 days. Equipment includes a drill rig transported on an 18 wheel rig truck, 10 wheel water trucks, 18 wheel flat bed delivering surface and production casing, 18 wheel cement trucks, 10 wheel fuel truck, and pickup trucks.
e) Complete 32 wells: Sorenson Engineering (3/13/07) estimates 43 one way trips per day up to a maximum of 100 trucks per day over 206 days. Equipment includes several 10 wheel tractors transporting frac tanks, several 10 wheel water trucks, several 18 wheel sand trucks, a flat bed transporting tubing, and pickup trucks.
f) Production operations: Once the wells are put into production, there would be a long term need to service and maintain the wellheads and to remove produced water. It is estimated that 4 water trucks per day will need to access the five wellpads, year-round, as well as 2 service trucks per day. This will require snow removal along NFSRs 265 and 266 and the access roads.

Since some of the above activities could be occurring simultaneously, construction and traffic noise would be compounded.

The compressor will have a hospital grade muffler and will be housed inside a sound-reducing building. Per the Design Criteria (Table 2.2.15), noise from the compressor must not exceed thresholds set by the state. The closest dispersed site to the compressor is the Buzzard Creek campground, which is one mile to the south, separated by small ridges from the compressor and down an embankment along Buzzard Creek, it is unlikely that noise from the compressor would be noticed.

Cumulative Effects

Timber sales and potential future drilling activities in the area could cumulatively add to traffic, noise and displace big game wildlife, particularly noticeable to hunters, campers and ATVrs during big game hunting seasons.

3.11.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

The direct, indirect and cumulative effects of Alternative 3 would be essentially the same as Alternative 2 with the following exceptions:

Additional sections of buried pipeline construction corridors would be visible to recreationists until fully reclaimed which may create temptation to use cleared area to for illegal ATV access. A Design Criteria which calls for signing, closing and blocking these pipeline corridors will reduce this problem.

Water hauling from the central facility will result in a long term, year-round reduction in heavy truck traffic to service the wells along NFSRs 265 and 266. Roads to access the wells will not be plowed once the wells are put into production. There will be fewer opportunities for ATV's and other motorists to encounter heavy trucks along NFSRs 265 and 266 in the long term. Big game would not be displaced by heavy truck traffic, thus returning the area to the more traditional hunting experience after the wells are put into production.

Snowmobilers accessing the S-P trail from NFSR 266 will not have to face water truck traffic servicing the 20-6 or 20-11 pads. Roads would be plowed to the central facility and a snowmobile parking area would be also be plowed by the operator on the west side of 266, just beyond the central facility, to provide access to the S-P trailhead. NFSR 266 is part of the S-P trail and there could be some conflict from the snowmobile parking area to the 20-11 access road intersection in the short term during drilling operations, but would not occur after drilling is complete.

Noise
Project activities are at the same levels as for Alternative 2, with these exceptions:

a) more timber would be removed along the added pipeline segment from the 21-2 pad to the central facility, as well as timber removal along a larger width in the buried pipeline corridor.
b) More time required for pipeline construction, due to additional 7,819 feet of pipeline from the 21-2 pad to the central facility, as well as increased corridor width clearing for all the pipelines.
c) Pad and access road construction and gravelling. No change
d) Drilling 32 wells on 5 pads. No change.
e) Complete 32 wells. No change.
f) Production operations. Produced water will be transported by pipeline to the central facility, from where it will be hauled to a commercial disposal facility. The central facility is located approximately 0.5 mile from the forest boundary. This will reduce water hauling on NFSRs 265 and 266 by approximately 4.7 miles, year round for the producing life of the wells. It will also eliminate snowplowing operations to the five wellpads.

3.12 Transportation

The transportation network analyzed for effects resulting from the proposed project and cumulative effects includes segments of state highways, county roads and FS roads in Mesa County serving the project area (Table 3.12.1).

The area chosen for the cumulative effects analysis area for transportation is the Hightower MDP project area. In the Plateau Creek and Silt Divide Creek country including the Silt-Collbran road, there was early local travel between ranches until energy exploration travel started in the 1960s and 70s. A number of timber harvests have occurred in the Buzzard Creek drainage and other timber harvests are ongoing or planned for the near future. Timing restrictions for current Hightower Timber Sale prohibits logging during elk calving with an expected date to resume logging operations July 1, negotiable depending on the elk calving activity for that particular spring.

3.12.1 Affected Environment

This section describes the existing roads that access the Hightower MDP area and their conditions. Transportation conditions were examined on segments of the highway and road network that would serve as primary access routes for project-related traffic and are also important for tourism and recreation.

Routes and road segments that would be used by light trucks, heavy trucks, drill rigs and other heavy equipment are addressed in this section. It is assumed that the vast majority of contractor, vendor and employee-related trips to the project area would originate in or pass through the Town of Collbran, enroute to the project area. It is estimated that 10-15% of vehicle trips would originate from communities north of the project area in Garfield County. The following is a list of existing highways and roads would be used to access the project area from the west:

- Interstate 70 to State Highway (SH) 65 to SH 330
- SH 330 to Collbran, then County Road 330E to County Road 71.4
- County Road 71.4 to National Forest Service Road (NFSR) 265 and to the east part of the project area
- NFSR 265 to NFSR 266 to the project area
- NFSR 270 from Garfield/Mesa CR 330E

Table 3.12.1.1 and the paragraphs below detail the existing condition of these routes.

Table 3.12.1.1. Highways and Roads Serving the Project Area.

Highway/Road Segment	Travel Lanes	Surface Type
SH 65 from I-70 to SH 330	2	Paved
SH 330 from SH 65 to Collbran	2	Paved
Mesa CR 330E from Collbran to CR 71.4	2	Paved and gravel
NFSR 270 (to Hells Gulch development)	2 or 1	Gravel or Dirt
CR 71.4 to NFSR 265	2 or 1	Gravel or Dirt
NFSR 265	2 or 1	Gravel or Dirt
NFSR 266	2 or 1	Gravel or Dirt

Within the project area, individual drilling locations would be accessed by new access roads off existing roads NFSR 265 and 266. These existing forest roads are also open for public access for a range of activities including hunting, ATV riding, bicycling, sightseeing, as well as FS management permitted activities in the area such as livestock management, management and maintenance of water resources, and timber harvest.

State Highway 65
SH 65 parallels Plateau Creek to access the Grand Mesa. It is a two lane, asphalt surface road, and intersects SH 330 enroute to Collbran.

State Highway 330
SH 330 continues to parallel Plateau Creek enroute to Collbran. It continues as a two lane, asphalt surface road and passes through Molina and Plateau City northeast into Collbran, where it Becomes Mesa County Road (CR) 330E, a paved road.

Mesa County Road 330E
CR 330E is asphalt surface from Collbran to a point approximately 10 miles from Collbran, where it becomes aggregate (i.e. gravel surface). CR 330E meets 71.4 Road near the confluence of Sheep Creek, Cheney Creek and Buzzard Creek. CR330 is an access to the site from the east, in Garfield County.

Mesa County Road 71.4
CR 71.4 is an aggregate and dirt road running northwest to southeast that ends at the intersection of NFSR 265 and NFSR 266. CR 71.4 road crosses Buzzard Creek where the aggregate eventually ends and dirt road begins. NSFR 265 and 266 are the main routes to the drilling location access roads.

NFSR 270
NFSR 270 (Road Gulch) is an aggregate and dirt road commuter route between Plateau Creek Valley and the I-70 corridor. It is estimated that 10-15% maximum traffic may access the project area using this road. This includes mostly light duty pick up trucks, some water trucks, sand trucks as well as drill rigs.

NSFR 266
NSFR 266 is also known as Porter Road. The route parallels the riparian area of Buzzard Creek. Prior to the mid 1980's this roads was the main route to Paonia. The road was prone to massive earthflows south of the project area, some taking out the entire roadway. The road was re-located to the current location of NFSR 265. NFSR 266 continues to slide in spots and much of the route south of the project area has been converted into ATV trail 536, closed to full-sized vehicles. The road surface is currently a mix of native soil, rock and some residual surface materials. The road is normally impassable due to snow accumulation between November and April in a typical year, however, here is no closure gate to keep traffic off the road. The road is slick when wet and prone to rutting. It provides access to private inholdings south of the project area. Logging trucks accessing the Porter Mountain Timber Sale use NFSR 266 during the winter, hauling 6-8 loads per day. The road is used by ATV's and also provides snowmobile access to the S-P trail.

Access roads to the compressor site, central facility, HT 20-6 and HT 20-11 drilling locations are from NFSR 266.

NSFR 265
NSFR is also known as Buzzard Divide Road and provides access to the 21-2 and 21-10 pads. It is an aggregate and dirt road that follows Hightower Creek and then turns south near the power line. Outside the project area, NFSR 265 provides access to SH 133 and the Town of Paonia. Access roads to the planned 21-2 and 21-10 drilling locations will intersect this road. Logging trucks hauling timber from the Porter Mountain Timber Sale use NFSR 265 year-round (subject to a springtime shut-down to protect the roadbed). Typically, 6-8 loads are hauled per day.

NFSR 265 is used by ATV's. Under Forest Order, the road is gated and closed from December 1 to May 1 to protect the soft roadbed.
The Colorado Department of Transportation (CDOT) reports annual average daily traffic volumes (AADT) for all state and federal highways in the state. Reported traffic volumes are based on actual counts at selected locations, with estimates for the intervening road segments. Similarly, the Mesa County Road and Bridge Department also compiles traffic counts on roads it operates and maintains. Recent traffic count data, as available near the project area is summarized in Table 3.12.1.2.

Paved roads maintained by the State and Mesa County are open to the public year-round. However, winter weather and muddy conditions in the spring necessitate seasonal closure of NFSRs in the project area. The FS is responsible for maintaining roads under its control at standards that are consistent with applicable resource and travel management plans and the design, function, and use of the roads. The objective for portions of NFSRs 265 and 266 proposed for project use are graveled and suitable for truck traffic, recreational vehicles, passenger cars, and other light-duty vehicles. Motorized travel on the affected portion of the Grand Mesa National Forest is restricted to designated roads and trails.

A series of road maintenance levels define the level of service provided by, and maintenance required for specific roads. Road maintenance levels, divided into a five-point scale from 1 to 5, with higher numbers indicating higher maintenance, consider factors such as resource program needs, user safety, functional classification, surface type, and protection of prior road investments. Maintenance levels for the three NFSRs in the project area are listed in Table 3.12.1.3.

Table 3.12.1.2. Annual Average Daily Traffic on Roads Serving the Project Area.

Road Segment - Description	AADT Average (SADT Average)	Truck AADT	Trucks (%)
SH 65 (West to East)			
East of I-70	2400	230	9.4
0.25 mile north of SH 330	2500	190	7.6
0.25 mile south of SH 330	1500	60	4.0
SH 330			
East of SH 65	1500	80	5.5
West of Grove Creek Rd	1900	160	8.2
Mesa County Roads			
CR 330E 1000 ft east of CR 64.6	324	N/A	N/A
NFSRs			
NFSR 270	(130)	N/A	N/A
NFSR 265	(61)	N/A	N/A
NFSR 266	(39)	N/A	N/A

Source: CDOT 2007, Mesa County 2007, GMUG 2007 N/A = Not available

Table 3.12.1.3. Maintenance Levels for FS Roads in the Project Aera.

Road Name	Road Number	Maintenance Level
Buzzard Divide	NFSR 265	4
Porter Creek	NFSR 266	3
Silt to Collbran Road	NFSR 270	4

Maintenance levels are a design level and do not necessarily represent physical condition on the ground, but are defined as follows: 1) Minimal maintenance, roads may be closed or no longer needed, vehicular traffic prohibited or eliminated. 2) Roads open to use by high clearance vehicles, low traffic volumes, mostly administrative or specialized uses (e.g., timber hauling). 3) Roads open seasonally or year-round for general travel including passenger cars and other low clearance vehicles. 4) Roads open year-round, with aggregate or bituminous surfaces, connecting key facilities and sites to other local, state, and federal roads, often providing double lanes and accommodating moderate travel speeds. 5) Normally double lane, paved facilities, open year-round, and providing a high degree of user comfort and convenience.

3.12.2 Environmental Consequences

3.12.2.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative other than existing use from other approved project, wear and tear and maintenance activities that would occur with or without project activities.

3.12.2.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

Potential transportation effects associated with Alternative 2 would include:

- Increases in traffic volumes on roads serving the project area;
- Traffic related conflicts with non-project motorists (including a potential for delays, temporary road closure or lane closure, and increases traffic accidents); and
- Potential effects to the condition of existing roads, access to Trail 536, and winter access to the S-P trail due to project activities and heavy truck traffic.

Alternative 2 would require hauling produced water from some or all of the proposed new wells. Should hauling be required, one selected disposal site is located south of DeBeque and outside the study area. The designated haul route involves the use of NFSRs 265 and 266 and possibly NFSR 270 (depending if haul routes include operations on the White River National Forest) out of the project area to CR 71.4 then Highway 330 west to Highway 65, then north on Highway 65.

Direct effects under Alternative 2 include short-term increases in the volume of both light and heavy truck traffic on NFSRs 265 and 266, which would include timber removal, road and drilling location construction, well drilling and completion, production equipment installation, gas pipeline installation and interim reclamation on five drilling locations, the compressor station, and associated roads and pipelines. Project activities and thus project-related traffic could commence in 2008. It is anticipated these activities could occur for 16 months, assuming no unforeseen circumstances occur. The development phase could commence in 2008 and would continue for about 16 months.

Table 2.2.8 shows estimated increases in one way trips by activity. The largest volume of traffic occurs during the well completion phase.

During the development phase of the project, project-related vehicle traffic would consist of workers commuting to the various construction and drilling locations in light vehicles and heavy trucks hauling equipment and supplies. As described in Section 2.2.2, this traffic would travel on both existing roads and new roads that would be constructed specifically for the project. New road construction to access the five roads and compressor facility is about 1.1 miles.

Estimates of the highest levels of project-related traffic for the Proposed Action were developed using the information in Table 2.2.8 for drilling and completion activities. An assumption was made that 3 drill rigs and 2 completion rigs would be used simultaneously during development. Results are shown in Table 3.12.2.2, and would last for the duration of drilling and completion, approximately 12 to 16 months.

Table 3.12.2.2. Alternative 2 Summary of Proposed Traffic Increases by Road During Drilling and Completion Activities (for 3 drill rigs, 2 completion rigs)

Road	Baseline Average Daily Traffic	Project Average Daily Traffic	Percent Increase
*Highway 65 west of Highway 330	2500	96	4
*Highway 330	1900	96	5
*CR 330E	324	96	30
NFSR 265[a]	53	64	121
NFSR 266[b]	32	43	134
NFSR 270[c]	130	11	8

* CDOT 2007 and Mesa County 2007

[a] – USFS traffic counter seasonal average daily one way traffic for 5/19-10/23, 2006
[b] – USFS traffic counter seasonal average daily one way traffic for 5/19-10/23,
[c] – USFS traffic counter seasonal average daily one way traffic for 7/19-10/8, 2007.

In terms of travel routes, it was assumed that 90% of project trips would come from communities in Mesa County on Highway 330 through Collbran and ten percent (10%) were assumed to originate from Garfield County and use NFSR 270 to reach the project area.

Based on these assumptions regarding traffic volumes and travel routes, implementation of Alternative 2 is projected to temporarily increase traffic during drilling and completion operations by 4% on Highway 65, by 5% on Highway 330, by 30% on Mesa CR 330E. Traffic on Forest Roads is projected to temporarily increase by 8% on NFSR 270, by 121% on NFSR 265 and by 134% on NFSR 266. This assumes 3 drilling rigs and 2 completion rigs operating simultaneously.

Short-term effects are increased traffic loading and potential increased sediment movement due to soil disturbance generated from road maintenance or upgrade activities. The operator will be required to conduct all road construction, upgrade and maintenance activities according to Design Criteria listed in Table 2.2.15. These will serve to minimize these effects. See also Water Resources section 3.4.

Additionally, there would be an increase in the probability of accidents and increased risk of livestock collisions, associated with the increase in traffic volume during project development. This is of particular concern due to potential mixing of heavy commercial traffic with recreational and off-highway vehicle (OHV) users. However, several Design Criteria will help to alleviate these effects; a)

mob and de-mob of drilling, completion and fracing equipment is not allowed on Friday, Saturday or Sunday of the opening weekends of the combined muzzleloader/archery season, first and second rifle season, b) the operator will communicate with permittees on the Buzzard and Porter allotments and the FS Range Conservationist for mob/de-mob activities during or near on/off dates, and the operator with the Road Use Permit application.

Over the long term during the production phase, it is estimated that four water trucks/day will service the wells and two light duty service trucks/day will be used by operation and maintenance personnel. Thus, the number of vehicle trips per day would have a negligible effect on traffic volumes and accident rates on roads that serve the project area. The distance traveled on NFSRs 265 and 266 to reach all five wellsites is approximately 4.7 miles.

On occasion, when a workover or recompletion is required on an operating well, a few additional light and heavy vehicle trips per day would be required for short periods of time (estimated to be less than two weeks per work-over or re-completion).

Direct effects due to project-related road improvements would have both positive and negative effects on the condition of existing roads. As described in Section 2.2.2, the road improvements and on-going maintenance are needed to ensure public safety, protection from erosion, and would maintain established access to properties, utilities and other facilities along the existing NFSRs. The GMUG Forest Plan calls for roads to be constructed to the minimum standards needed to support the activity.

Overall, the operator would bear the design, construction, maintenance, and rehabilitation costs for project-required improvements of existing roads and proposed access roads. New road construction and upgrades to existing roads will be done in accordance with Design Criteria (Table 2.2.15). Use of these designs will ensure that roads are constructed to a standard suitable for the traffic, season of use and safety concerns.

In the long-term, snowplowing from drilling through production would negatively affect snowmobilers use of these roads, particularly NFSR 266 which is the access route to the S-P trail. Snowplowing would also encourage additional traffic year-round in the area.

Passenger cars would benefit from the improvements in road surface, drainage, and geometry put in place as part of Alternative 2, particularly on NFSR 266. In the short-term, road improvements made as part of Alternative 2 would reduce Forest Service and county maintenance burdens on the affected road segments. The operator would share in the on-going maintenance of the affected NFSRs during the life of the project.

However, other maintenance requirements could be accelerated by project-related traffic, primarily due to heavy truck traffic during the approximately 16 month duration of the project development phase. For instance, NFSRs 265, 266 and 270, may be more prone to accelerated wear from project-related heavy truck traffic than paved state highways or county roads due to their lower design capacity. Expected physical changes to the road prism of 265 are nominal and may not even be noticeable to the driving public. Road 266, if reconstructed to the degree that is anticipated to accept the heavier loading and amount of traffic related to this proposal, is expected to change in character from 4wd when saturated to 2wd, at least for the life of the project. 4wd drive enthusiasts may see this as a loss, limiting the challenge of this road section of which they have become accustomed to. In contrast, those driving sedans and other standard vehicles will see the change in road surface as an invitation to get a little further “out” on a rainy day. More drivers will be on the route more of the time while the road is maintained in its improvement condition.

As described in Section 2.2.2, various design features have been incorporated into Alternative 2 to reduce negative effects on local area roads. Improvements to NFSRs will be needed for the structural capacity as well as surfacing requirements such as depth and type of surfacing and road base that will support repeated passes of heavy vehicles such as water trucks, frac trucks and drill rigs. Many of the improvements/upgrades are considered heavy maintenance needs which will return road character to its original design of a 14'-16' running surface with necessary turn-outs for visibility and safety, but with added structural capacity.

Maintenance activities including dust suppression would be performed by the operator, as directed by the FS official in compliance with their Road Use Permit. Dust abatement would be mostly by water trucks. Mesa County and the FS have an agreement to apply Magnesium Chloride to portions of NFSR 265. The operator would be responsible for sharing in those costs.

Maintenance would consist of repair and protection of the roadbeds, surface, and all structures and appurtenances (i.e., inspection, clean-out, surface rock replacement, and repair of drainage structures). No mud blading would be allowed on roads. An RUP will be required to authorize long term snow removal to the five wellpads and compressor site so that water trucks can access the wellsites daily.

The Proposed Action is consistent with the established travel plans and interim travel restrictions for the project area. The consistency determination is based on the following factors: the principal access routes are established classified routes on the NFRS; the travel management plans allow for development of new roads to meet the access needs of permit holders; such access road needs are independent of general public access, and the proposed new access roads would not be open to public access. In addition, the seasonal Forest Closure Order for NFSR 265 would remain in effect for the general public. The operator would be allowed year-round access per the terms of their Road Use Permit and will need to provide traffic control at the closure point.

The major access roads to the project area are open to ATV use. Recreationists may encounter drilling and fracing vehicles and trucks hauling heavy equipment and pipe sections. Large truck traffic in conjunction with ATV use can create a safety issue related to decreased visibility from the increase in generated dust, the size difference of vehicles using the same roads and condition of the roads if not maintained in conjunction with the construction and hauling phases of the project. The potential of encountering large trucks coming from the opposite direction would likely require increased attention to driving and a willingness to yield on the part of the recreational driver. Slow moving vehicles may be encountered. Passing opportunities are limited on NFSRs, including those within this project area.

Information related to indirect effects for traffic related conflicts and potential for accidents is typically reported in terms of numbers of accidents per roadway section and by the accident rate (the number of accidents per million miles of vehicle travel on a particular roadway). The statewide average accident rate for rural state highways is approximately 1.22 accidents per million miles of travel (CDOT 2007). The development phase of Alternative 2 would generate approximately 5,800 miles of vehicle traffic daily on the highways and roads serving the project area. Assuming the Colorado accident rate for rural highways also applies to roads serving the project area, just under three additional traffic accidents would be expected over the approximate 16 month development phase as a result of the Proposed Action. This would be considered a minor affect to traffic safety.

As previously discussed, operations phase traffic on NFSRs over approximately 30 years (or more) would average about six vehicle trips per day. This modest additional traffic volume would have a negligible affect on accident rates on project area roads.

Cumulative Effects: This project adds to the increased traffic volume over the past five years resulting from an increase in energy development in the Plateau Valley to the west of the project area, as well as on the White River National Forest to the east. Increased wear and tear on roads, more congestion, reduced travel speeds, higher risk of accidents and more road maintenance are all associated effects from these activities.

Current and future timber harvest activities could affect transportation in the region, as it would involve the use of NFSRs in the project area. Maintenance of utilities, motorized recreational use of the NFSRs and other special uses also contribute to the cumulative effects on transportation.

Long-term effects to recreation activities, local users and wildlife should remain minimal. Road improvements would affect change in traditional uses in the area over time and could result in an increase in recreational use in addition to the increase of natural gas related use. Traffic counts are projected to increase as commercial and recreational uses continue in this area.

3.12.2.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

Alternative 3 is similar to the Proposed Action, except that all pipelines are buried and water lines would be installed to transport produced water from the well sites to a central facility (see Figure 2.4). The addition of water lines reduces the amount of access needed to service the wellsites for water disposal during the production phase as compared to Alternative 2.

Direct effects for the construction, drilling and completion traffic under Alternative 3 would be similar to that described in Section 3.12.2.2 for Alternative 2. However, there would be an increase in pipeline construction traffic due to additional construction of buried pipelines including an additional 7,819 feet of pipeline from the 21-2 to the central facility, plus the addition of 30,533 feet of waterline. Based on the additional pipeline construction that would be required, it is estimated that pipeline traffic will increase by approximately 50%. Other than the increase in pipeline construction traffic, the overall percent increases in average daily traffic on the project roads are unchanged from Alternative 2.

Direct effects for the production operations phase traffic would differ from that under Alternative 2. The number of water hauling trucks would remain the same at 4 per day, however, there would be a reduction in distance traveled on NFSRs to haul water, since the water pipelines would transport produced water from the well pads to the central facility. Travel on NFSRs 265 and 266 would be reduced from approximately 4.7 miles to 0.5 miles on a daily basis. This will reduce traffic through the forest in the project area, and reduce snowplowing to 0.5 miles to the central facility versus the 4.7 miles of plowing required under Alternative 2.

Snowplowing during the drilling phase of operations would negatively affect snowmobilers during the short term (drilling and completion phase). Snowplowing to the drilling locations would cease once the wells are brought into production. Over the long term, there would be no effect on the snowmobilers. A parking area will be plowed by the operator south of the central facility, providing access to the S-P trail.

In summary, direct effects to road conditions during construction, drilling and completion activities for Alternative 3 are similar to those under Alternative 2. Traffic levels during project development would be essentially equivalent to that for Alternative 2, and therefore short-term effects to existing roads would be similar. Direct effects to roads differs between the two alternatives during the production phase in the form of a) less water hauling travel distances on NFSRs 265 and 266, and b) less snowplowing distance required.

The indirect effects and cumulative effects for traffic related conflicts and potential for accidents under Alternative 3 is expected to be similar as previously described in Section 3.12.2 for Alternative 2.

3.13 Visual Resources

The effects analysis area for direct and indirect effects is the Hightower MDP project area in Sections 16, 17, 20 and 21. The cumulative effects area is the lower Buzzard Creek watershed.

Landscape character expresses the visual image of a geographic area and is a combination of basic terrain, geologic features, water features, vegetative patterns and land use that makes each landscape identifiable or unique. The FS manages NFS lands to attain the highest possible quality of landscape aesthetics and scenery commensurate with other appropriate public uses, costs, and benefits.

3.13.1 Regulatory Framework

Forest Service Manuals and Handbooks:

Forest Service Manual 2300, Chapter 2380 describes the Forest Service Policy for Landscape Management (USFS 2003).The Forest Service Visual Management System is described in the Department of Agriculture Handbook 462, The Visual Management System (FS 1974).

Policy and Law:

National Environmental Policy Act, 1970. This Act sets forth a national policy for the environment that provides for the enhancement of environmental quality, "which will ensure that scenery and other unquantified environmental amenities and values be given appropriate consideration."

National Forest Management Act, 1976. This Act directs that the preservation of aesthetic values be analyzed at all planning levels. Part 219.21 requires visual resources to be inventoried and elevated as an integral part of evaluating alternatives in the forest planning process, addressing both the landscape's visual attractiveness and the public's visual expectations.

National Environmental Policy Act, 1969. This policy states that it is the "continuing responsibility of the federal government to use all practicable means to assure for all Americans, aesthetically and culturally pleasing surroundings." NEPA directs agencies to develop practicable methodologies for scenery management of aesthetically and culturally pleasing surroundings. It also requires a "systematic and interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the environmental design arts into planning and decision-making which may have an effect on man's environment."

The Council on Environmental Quality (CEQ) regulations require agencies to "ensure that presently unqualified environmental amenities and values be given appropriate consideration in decision making along with economic and technical considerations. (CEQ 102 (2)(B). This analysis is based on visual resource qualities and characteristics as they relate to the human environment and fulfills this direction.

3.13.2 Affected Environment

The proposed Hightower MDP is located in an area on the GMUG with designated LRMP as Management Area 5A (Big Game Winter Range), Management Area 6B (Livestock Grazing) and 9A (Riparian Area Management). These management prescriptions are described in Section 1.6, Forest Plan Consistency.

The project area is located approximately 11 miles east of Collbran, Colorado, and is frequented by hunters and grazing permittees. Drilling locations and facilities will be visible from NFSR 265 and NFSR 266. The natural landscape in the project area has been altered by construction of the two roads, as well as the presence of a FS guard building, two shut-in gas wells along NFSR 265 near Hightower Creek, a historic natural gas well with a plugged and abandoned well at the 20-6 drilling location, the Hells Gulch to Buzzard interconnect pipeline and Source Gas pipeline corridor to the north of the project area, the WAPA powerline immediately east of the project area, and a campground (Buzzard Creek Campground) near the confluence of Buzzard and Beaver creeks. In terms of general visual appearance to observers, the project area is vegetated with sagebrush/gambel oak/mesic mountain shrub communities in the lower elevations and aspen at the higher elevations. Riparian communities are found along Hightower and Buzzard Creeks. The mountain terrain in the area is hummocky from the slumping of the surficial geological deposits and scattered with basalt boulders from glaciation of the basalt cap rock of the Grand Mesa.

GMUG Visual Management System

The Forest Service Visual Management System was described first in the Department of Agriculture Handbook 462, The Visual Management System (FS 1974). This provided the basis for the Scenery Management System (SMS) used by GMUG. The Visual Quality Objectives (VQOs), established by the SMS are described in Table 3.13.2a. Under this system, VQO categories are: Preservation, Retention, Partial Retention, Modification and Maximum Modification. VQOs are established based on an evaluation of (1) sensitivity level (the public's concern for scenic quality—high, moderate, and low); (2) variety class (the diversity of natural features-distinctive, pleasing but common, and dull or monotonous) (Table 3.14-2); and (3) distance zones (subject's placement in the landscape relative to the viewer—foreground, middle-ground, and background). By comparing the sensitivity levels, landscape variety classes, and distance zones, VQOs for a specific land area can be determined. VQOs can be characterized as indicating the desired level of scenic quality and diversity of natural features, based on physical and sociological characteristics of an area.

Table 3.13.2a. Visual Quality Objectives

Visual Quality Objective	Scenic Integrity Objective	Definition	Acceptable Landscape Alteration	Locations in the Project Area
Preservation (P)	Very High	Valued landscape character is intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level	Ecological change only here. Management activities, except for very low visual impact recreation facilities, are prohibited. This objective applies to wilderness areas, primitive areas, other special classified areas, areas awaiting classification, and some unique management units that do not justify special classification.	None; there are no areas considered as preservation in the entire cumulative area.
Retention (R)	High Appears	Unaltered- Landscapes where the valued landscape character appears intake. Deviations may be present, but must repeat the form, line color, texture and pattern common to the landscape character so completely and at such scale that they are not evident.	Human activities should not be evident to the casual Forest Visitor. Only management activities that are not visually evident area allowed. Under Retention, activities may only repeat form, line, color, and texture that are frequently found in the characteristic landscape. Changes in their qualities of size, amount, intensity, direction, pattern, etc. should not be evident. Immediate reduction in visual contrast (form, line, color, and texture) should be accomplished either during construction or immediately after.	None; some retention areas exist over 10 miles to the southwest of the project area.
Partial Retention (PR)	Moderate	Appears Slightly Altered – Noticeable deviations must remain visually subordinate to the landscape character being viewed.	Human activity may be evident, but must remain subordinate to the characteristic landscape. Management activities are to remain visually subordinate to the characteristic landscape when managed according to the Partial Retention VQO. Activities may repeat form, line, color, or texture common to the characteristic landscape,	Southwest to southern borders of project area along Buzzard Creek

Visual Quality Objective	Scenic Integrity Objective	Definition	Acceptable Landscape Alteration	Locations in the Project Area
			but changes in their qualities of size, amount, intensity, direction, pattern, etc, remain subordinate to the characteristic landscape. Reduction of visual contrast to meet Partial Retention should be accomplished as soon after project completion as possible, or at a minimum, within the first year.	
Modification (M)	Low Appears	Moderately Altered – Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect and pattern of natural opening, vegetative type changes or architectural styles outside	Human activity may dominate the characteristic landscape, but must, at the same time, flow naturally established form, line, color and texture. It should appear as a natural occurrence when viewed in foreground or middle ground	Small area in the northeast portion of the project area
Maximum Modification (MM)	Very Low	Appears Heavily Altered- Deviations may strongly dominate the valued landscape character.	Human activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background	The majority of the area lying in the central project area where previous gas well, campground, roads and guard station reside.

Table 3.13.2b. Visual Variety Classes – The Degree of Visual Variety in the Natural Characteristic Landscape.

Class A - Distinctive	Class B - Common	Class C - Minimal
Refers to those areas where features of landform, vegetation and water form are of unusual or outstanding visual quality. They are usually not common in the character subtype.	Refers to those areas where features contain variety in form, line color and texture or combinations thereof, but which tend to be common throughout the subtype and are not outstanding in visual quality.	Refers to those areas whose features have little change in form, line, color or texture. Includes all areas not found in Classes A and B.

The VQO in the project area is primarily Partial Retention or Modification, with some Maximum Modification occurring in the northwest project area (Table 3.14-1; Figure 3.14-1). The Visual Variety Class is considered Class B-Common, with some Class C-Minimal Areas to the north and south of the project area (Figures 3.13.3.2a and 3.13.3.2b).

3.13.3 Environmental Consequences

3.13.3.1 Alternative 1 – No Action

No environmental consequences are associated with the No Action Alternative. Existing disturbances to visual character would be expected to continue.

3.13.3.2 Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

Visual alterations caused by construction of drilling locations, access roads, pipelines, and aspen harvest units can affect visual quality due to the contrast between natural landscapes and managed landscapes.

When considering effects to visual resources, it is important to understand the limited discretion (i.e., regulations limit relocation of proposed locations to no more than 660 feet) that the Forest Service has in where drilling locations and roads (dictated by pad location) are located. Therefore, the project has been designed (see Design Criteria) to minimize or avoid scenery effects (e.g., aggressive re-vegetation efforts, minimizing disturbance, minimizing cut and fill operations etc.) to the extent possible. Other Design Criteria (see Table 2.2.15) including proper selection of color and profile for facilities and lighting suggestions (if lighting is necessary at compressor) will further reduce effects to visual resources. The Proposed Action has been designed to be consistent with the Visual Resource Protection Plan (VRPP) and has been designed to minimize effects on visual resources.

Direct effects for construction of drilling locations, with their associated access roads and gathering pipelines, and a trunk pipeline along NFSR 265 and NFSR 266 would alter the landscape by removing vegetation and cutting into sideslopes. Facilities with the most visibility are the 20-6 drilling location and the compressor site. The 20-11 pad is located on a hill above 266 and is not likely to be visible. The 21-2, 21-10 and 21-12 pads are screened from NFSR 265 by aspen. The alteration would be most noticeable in the short term (about three years) until interim reclamation was in place and had reduced the contrast between the areas of disturbance and the surrounding vegetation. In the long term (30 years), the 20-6 drilling location and compressor site would remain visible in the foreground and from several points on the roads because of the proximity to NFSR 266, the extent of the sideslope cuts and the amount of un-vegetated area. In addition, the production equipment located on the drilling locations would draw the eye of anyone located in the foreground. The pipeline would be highly evident to the casual observer for the short term because of its proximity to the roads, because of the linear nature of the disturbance and because of the contrast between short-stature vegetation in the pipeline corridor and the mature vegetation adjacent to the corridor. Within a few years, revegetation will reduce the visibility of the pipeline. Overall, the project alterations diminish against the scale of the Hightower Mountain landscape and would be compatible with the *low* scenic integrity level, which permits the natural landscape to be moderately altered and even to begin to dominate the landscape.

Because of this, the VQO of Partial Retention might change in the short-term to that of Modification or Maximum Modification. Scenic effects would be diminished to the extent that reclamation was timely and successful. Painting above-ground gas production facilities a non-reflective color compatible with surrounding terrain, and the use of vegetation or berms to screen facilities would further limit scenery effects, as stated in Table 2.2.15, Design Criteria. In the area of the compressor

and 20-6 drilling location the area will be changed from partial retention to modification due to the long term disturbance of these areas. This change requires a minor forest plan amendment for this site-specific location. The intent to focus the analysis in this manner was made because visual and landscape characteristics are based on landscape scale patterns in geographical contexts, which are unique to this region and are contained within the units as a study area. The past events in this area include the construction of the existing NFSR 265 and NFSR 266, timber harvest, the campground and guard station, which diminished the existing visual quality and landscape characteristics of the area. Other natural gas wells, the WAPA power line, the Hells Gulch to Buzzard Interconnect Pipeline and Source Gas pipeline corridor, and associated infrastructure also exist on the GMUG adjacent to the project area. Therefore, making this minor plan amendment is not expected to affect VQO outside the immediate project area, and will not create effects that are out of place in the area given other adjacent activity.

Because the Proposed Action has pipelines routed adjacent or parallel to an existing road corridor for much of their length in an already disturbed visual landscape, it is unlikely that the effects of pipeline construction would generate additional visual effects elsewhere in the area except where the pipeline is buried cross country.

Harvesting aspen in the regeneration clearcuts is expected to have a minor effect on visual quality because these areas are in places where there is low duration of viewing and where there are vegetative strips that would help conceal the areas (USDA-FS, 2001). There are few opportunities to view these areas from NFSR 265 due to the closed canopy nature of the area.

Cumulative Effects : For the cumulative effects of Alternative 2, the natural landscape of the Buzzard Creek drainage down to its intersection with Plateau Creek has been heavily altered on private lands in the lower portion by farming and ranching activity (Figure 3.7.1). More recently, the area has begun to experience natural gas development activity. The landscape alterations of the Proposed Action would amount to a small increment to the overall landscape alteration that has occurred in the cumulative effects area or that is likely to occur in the near future.

3.13.3.3 Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

The direct affects of Alternative 3 would be the same as those of Alternative 2, except that the pipelines would all be buried, and therefore, no surface pipeline would be visible to the observer. However, until full reclamation and maturity of vegetation that matches the surrounding landscape occurs, the pipeline corridor disturbance will result in an increase in visual disturbance over Alternative 2. However, there could be fewer pieces of production equipment on each drilling location, which would reduce the overall visual effect. The indirect and cumulative effects are the same as those of Alternative 2.

Figure 3.13.3.2a. Visual Quality Objectives in Hightower MDP.

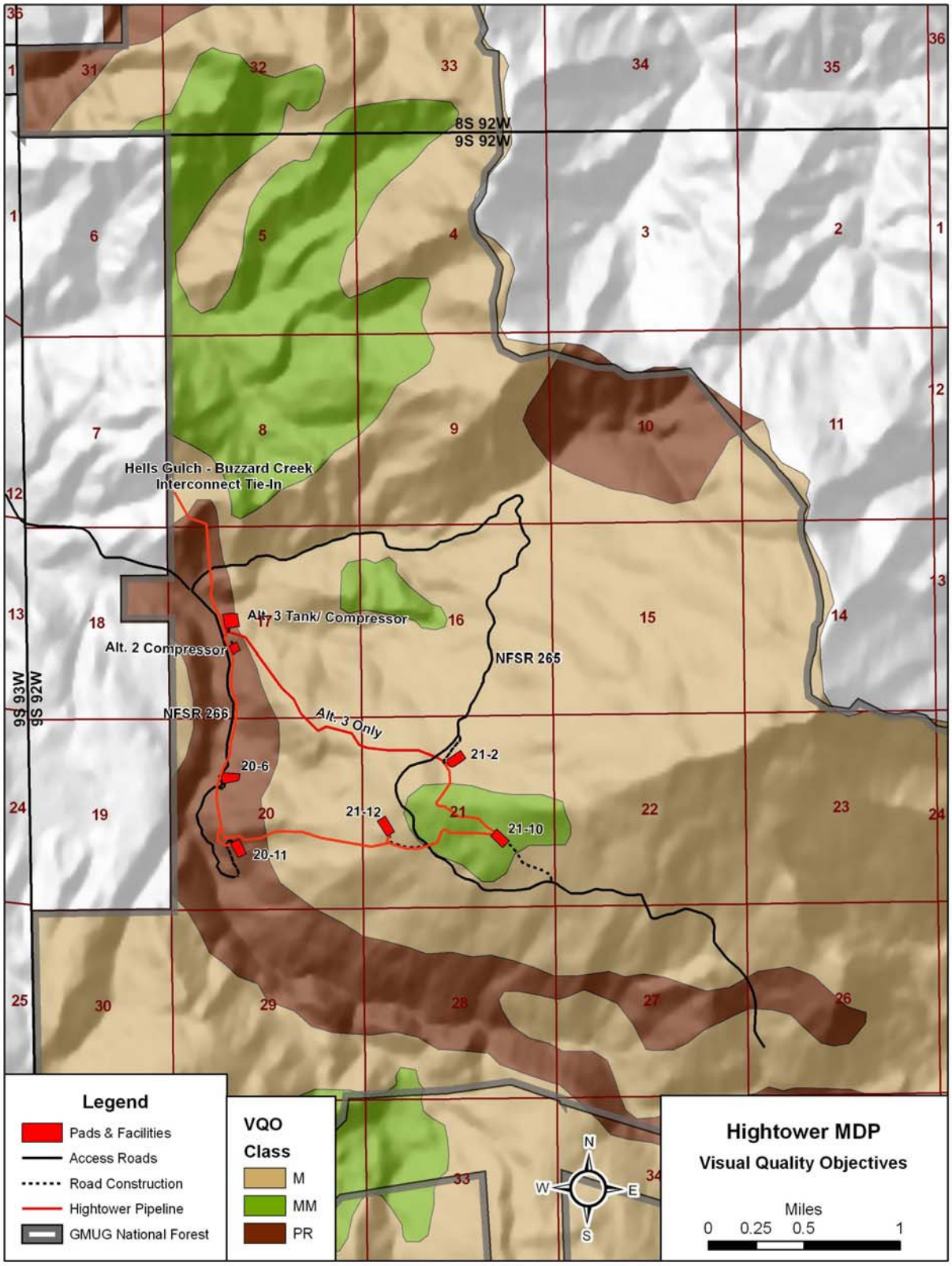
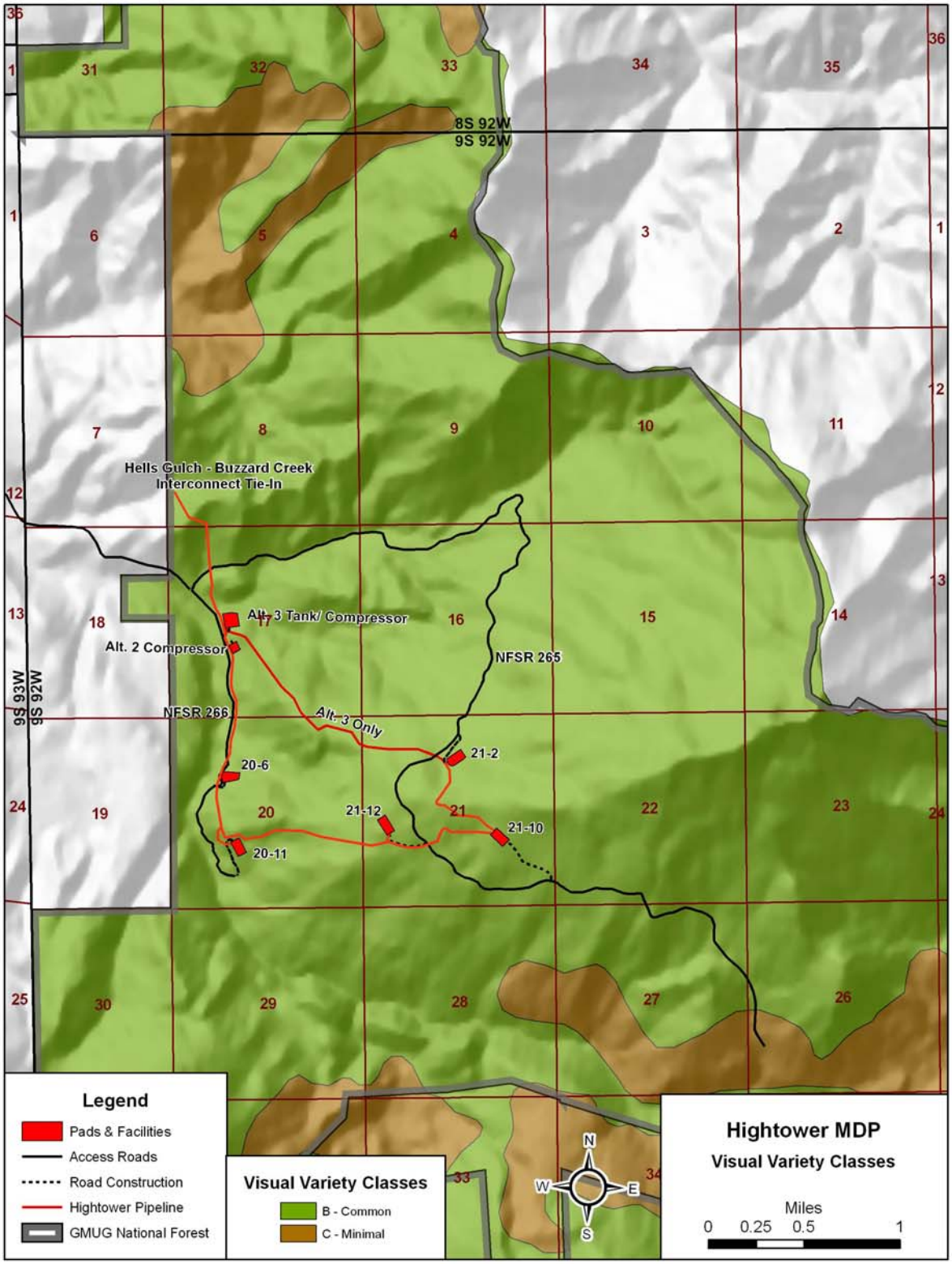


Figure 3.13.3.2b. Visual Variety Classes in Hightower MDP



3.14 Socioeconomics

3.14.1 Affected Environment

The project area, including all proposed facilities, is located in Mesa County. However, there may be limited access to the project site from Garfield County (see Transportation Section). The labor and equipment for construction, drilling and support would be drawn from the labor and equipment pools found in Mesa County and from Garfield County. Portions of both counties are in the Piceance Basin, which has seen ongoing natural gas development for past 15 years with increased intensity over the last five years.

Demographics

The 2006 US Census Bureau estimated the population of Mesa County at 134,189 and Garfield County at 51,908. The county seat of Mesa County is Grand Junction which is also the largest city in western Colorado. Glenwood Springs is the county seat of Garfield County.

Mesa County minority population was estimated at 18% (including Latinos) and Garfield County was estimated at 23% (including Latinos) in 2004.

The rate of population growth in both counties has been well above the average for the state. Both counties are in the top 10% nationwide for population change. Between 1996 and 2006 the population of Mesa County has increased 24.1% and Garfield County has increased 37.2%. Mesa County population is expected to nearly double from the 2000 population by 2025. Similar trends are expected in Garfield County.

The median age for residents of Mesa County is 38 years and Garfield County is 34 years.

Income, Labor and Employment

The number of jobs in Mesa County in April 2007, is estimated at 73,416 and Garfield County is at 34,828 (Colorado Department of Labor and Employment 2007). Both counties have significantly lower than State average rates of unemployment. In 2004 median household wages were $40,045 in Mesa County and $50,119 in Garfield County (both of which are below the state median income of $50,886) with 10.2% of people living below the poverty line in Mesa County and 7 1/2 % in Garfield County. During the 2nd quarter of 2007 weekly wages for natural resource extraction and mining sectors were $1199 in Mesa County and $1223 in Garfield County, which places this economic sector above the median household income.

Principal economic sectors in both Mesa and Garfield Counties are services, wholesale and retail trade, and construction. The total number of workers employed in oil and gas development is difficult to define since development-related occupations show up in a variety of economic sectors. However, oil and gas drilling and production have been one of the strongest forces driving recent economic growth in both Mesa and Garfield Counties with a total of 300 businesses between the two counties providing services to the industry. Mesa County, additionally, estimated that 9000 individuals were employed in the oil and gas sector (Dec 2007) which would be approximately 12% of the employed population. Similar data for Garfield County is not available. With increased oil and gas development this sector is expected to grow.

Currently, according to data posted COGCC's website, Garfield County is generating about 40% of new APDs (mostly on private land) in Colorado and Mesa County approximately 5%. Garfield County is second only to Weld County in Colorado for the number of producing wells in operation.

All other employment sectors are also expected to grow with the increase in population. Other than natural gas exploration and development, livestock grazing and FS timber sales are the only other economic activity that currently takes place within the project area.

Environmental Justice
Executive Order 12898 established a requirement for Environmental Justice review on all Federal projects. The environmental analysis is to include identification of disproportionately high and adverse human health or environmental effects on minority and low-income populations. The minority population of note in either Mesa or Garfield County is the Latino population as described above. Populations described as "low income" on the basis of participation in county assistance programs that are based on a Federally-determined poverty threshold. Neither population group is located in the immediate vicinity of the Proposed Action.

3.14.2 Environmental Consequences

3.14.2.1 Alternative 1 – No Action

No increase in revenue derived and or other economic benefits are associated with the No Action Alternative.

3.14.2.2 Environmental Consequences Alternative 2 – The Proposed Action – 32 Gas Wells Directionally Drilled from Five Pads with Surface and Buried Pipelines and a Compressor Facility

Construction of five drilling locations, access roads and collocated gathering pipelines would require a workforce that varied at times from 20 to 40 workers. Drilling and well completion would also require 20 to 40 workers at different times (assuming only one drill rig were in operation). The duration of construction and drilling activity is estimated to be one and one half years depending on the pace of the drilling. Because the Proposed Action is of limited duration and because the oil and gas industry in Mesa and Garfield Counties is relatively large and developed, the likelihood is that all or most of the labor and equipment used would be drawn from existing local sources. This means that little or no change would be produced in the size of local workforce or in the local population.

The natural gas produced would become a source of revenue to Federal, State, and local governments because it would be extracted under a Federal lease. Half of the revenues generated by the 12.5 percent royalty rate would go to the U.S. Treasury. The other half would go to the State of Colorado for distribution to various state agencies and local governments. The value of the natural gas produced and the gas production and transportation facilities would become part of the property tax base for Mesa County, generating property tax revenues for the life of the project. Rentals or fees associated with oil and gas development (such as pipelines) would be divided between the U.S. Treasury and the counties. As this field is exploratory, there is no specific production with which to further define projected revenues associated with this project.

Because no minority or low-income populations are located in the vicinity of the Proposed Action and none of the project effects are expected to fall on any such population elsewhere, minority or low-income populations would not be affected more or less than any other population segment.

Cumulative Effects : Cumulative socioeconomic effects produced by the Proposed Action would amount to small incremental additions to ongoing socioeconomic change primarily though increased revenue available to Mesa and Garfield Counties.

3.14.2.3 Environmental Consequences Alternative 3 – 32 Gas Wells Directionally Drilled from Five Pads with All Buried Pipelines (including produced water lines)

Consequences and cumulative effects from Alternatives 3 are anticipated to be similar to that described for Alternative 2.

3.15 Short-term Use of Human Environment Versus Long-term Productivity

CEQ regulations specify that the description of effects should identify how short-term uses of the environment would affect long-term productivity of resources. During the life of the project, the construction and drilling and completion phase would represent the period of greatest short-term effect to the physical environment. The short-term and long-term effects relative to each resource are described in Chapter 3.

Short-term is defined as the about 2 year period in which drilling locations and new access roads would be constructed, existing roads would be upgraded or maintained, wells would be drilled and completed and, if producible quantities of gas are found, compression facilities and pipeline would be be installed. Long-term is defined as the future beyond the end of gas production and final reclamation (about 20 to 30 years). Most of the effects identified in this EA would be short-term and would cease or diminish substantially after construction, well drilling and completion was completed and interim reclamation was carried out. Long-term productivity refers to the basic capability of the land to produce according to desired future levels (e.g., vegetation, wildlife habitat, and rangeland). It is anticipated that productivity for soils, vegetation, wildlife habitat, timber, and rangeland would be restored following successful reclamation of disturbed lands. It is acknowledged that once disturbed, soils never return completely to their undisturbed productivity levels. There would be some site specific loss of soil productivity, however the limited amount of soil disturbance in the project area is not excepted to adversely affect productivity in the area as a whole. There would be loss of aspen forest capable of current timber production levels at the 21-2, 21-10 and 21-12 drilling locations after final reclamation. Other resources would return to productivity over the long term.

3.16 Irreversible/Irretrievable Commitment of Resources

Irreversible is a term that describes the loss of future options. It applies primarily to the effects of using of nonrenewable resources such as minerals, cultural resources, or soil productivity. The irreversible commitment of resources for this project could include the consumption of non-renewable energy or materials, such as diesel fuel, gasoline, and natural gas, and any unidentified cultural resources. Fossil fuels used during construction and exploration drilling and testing would result in irreversible commitments. Gas consumed or venting during testing would be an irreversible use of natural gas. If gas is produced from the project and used, it would result in an irreversible commitment of the gas resource. Any disturbance to unidentified cultural sites could result in an irreversible commitment. However, research values could be recovered prior to any physical loss.

Irretrievable is a term that applies to the loss of production, harvest, or use of renewable natural resources. The following irretrievable impacts would occur for the Action alternatives:

• Loss of between 68 and 98 acres of vegetation (aspen, mountain shrub, sage, grass forb) from construction of the drilling locations, new access roads, pipelines, and aspen clearcuts (13 acres). Reclamation would return vegetation to pre-existing conditions through reseeding and natural reestablishment of woody species on up to 85 acres. Aspen would regenerate in the clearcuts.

• Alteration of between 55 and 85 acres of wildlife habitat from drilling location, new access roads, compressor facility and pipeline construction.

• Minor loss of forage in grazing allotments prior to reclamation for rangeland.

• Use of water for drilling and completion operations and potential for produced water during testing.

• Long-term soil productivity on between 55 and 85 acres from construction of drilling locations, access roads, pipelines and compressor facility.

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Chapter 5 GLOSSARY

Access Routes – Accessing construction pipeline corridor for daily construction activities traffic, crew pick

Accidentals – Birds where only one to three sighting are recorded in a given area over history.

Acre-foot. A unit of volumetric measure that would cover one acre to a depth of one foot. It is equal to 43,560 cubic feet.

ADT – County yearly average daily traffic count reports.

Affected environment – In the NEPA process, the area that will be affected or created by the alternatives under consideration.

All-terrain vehicle (ATV) – A motorized recreational vehicle less than 50 inches in width and with more than two wheels, such as a 3-wheeler or 4-wheeler.

All weather access – road is open and passable year round by motorized vehicles.

Alluvial – Pertaining to material or processes associated with the transportation and deposition by concentrated running water.

Alluvium – Sediment deposited by water, including gravel, sand, silt, and clay, in various mixtures.

Alternative – In NEPA terms, one of several substitute or alternate proposals that a Federal agency is considering in an environmental analysis.

Aquatic – Living or growing in or on the water.

Aquifer – A layer of permeable rock, sand, or gravel that stores and transmits water in sufficient quantities for a specific use.

Best Management Practices – One or more practices designed to prevent or reduce pollution or another negative effect on a resource.

Big Game – Large Mammals, such as deer, that are hunted for sport.

Biological Assessment – Information prepared by, or under the direction of, a Federal agency to determine whether a Proposed Action is likely to affect listed species or designated critical habitat.

Biological Evaluation – A documented USDA Forest Service review to determine how an action may affect any sensitive species.

Code of Federal Regulations (CFR) - The codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government. The Code is divided into 50 titles that represent broad areas subject to regulation.

Colluvium - Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Compaction - Mechanical action that increases the density by reducing the voids in a material.

Compressor Station - A facility that is used to compress natural gas in order to create additional pressure to increase the amount of gas a pipeline can hold, help move it through a pipeline, or to move it into or from storage.

Cooperating Agency – An agency which has jurisdiction by law in an action being analyzed in an environmental document and who is requested to participate in the NEPA process by the agency that is responsible for preparing the environmental document.

Corrosion - Corrosion is the deterioration of a material, usually a metal, which results from a reaction with its environment. Common rust is an example of corrosion of iron. Steel pipe is subject to corrosion damage.

Cumulative impact or cumulative effect – Effect on the environmental that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Denning/Winter - Coniferous forest with lots of downed trees, hollow logs, and root wads providing den sites for Lynx.

Direct Impact – An impact caused by an action that occurs at the same time and place as the action (see 40 CFR 1508.8).

Discharge – Any of the ways that groundwater comes out of the surface, including through springs, creeks, or being pumped from a well.

Endangered Species – A plant or animal species that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior/Secretary of Commerce in accordance with the Endangered Species Act of 1973.

Environmental Impact Statement (EIS) - Environmental impact assessment document prepared in accordance with the National Environmental Policy Act.

Erosion – The wearing away of the land surface by running water, wind, ice or other geologic agents.

Finding of No Significant Impact (FONSI) - A Finding of No Significant Impact is a document prepared by a federal agency showing why a Proposed Action would not have a significant impact on the environment and thus would not require preparation of an environmental impact statement. An FONSI is based on the results of an environmental assessment.

Fluvial - inhabiting a river or stream.

Forage – Vegetation used for food by wildlife, particularly big game wildlife, and domestic livestock.

Fugitive dust – a non-point source of air pollution, such as from unpaved roads, agricultural croplands and construction sites.

Groundwater – Subsurface-water that fills available openings in rock or soil materials to the extent that they are considered water saturated.

Habitat – A place where a plant or animal naturally or normally lives and grows.

Haul Routes – Accessing the right-of-way to transport heavy equipment to use during construction of pipeline pipeline (mobilization and demobilization of heavy construction equipment).

Heritage Resources – The remains of sites, structures, or objects used by people in the past; this can be historical or pre-historic (see Cultural Resources)

Hydrology – The science dealing with the study of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.

Intermittent stream – A stream that does not flow year-round but has some association with groundwater for surface for subsurface flow.

Invasive species – A species that can move into an area and become dominant either numerically or in terms of covers, resource use, or other ecological effects. An invasive species may be native or nonnative.

Irretrievable impact – A category of impact in the NEPA to be analyzed in environmental impact statements. Refers to commitments that are lost for a period of time. For example, while an area is used a developed recreation site, some or all of the timber production there is irretrievable lost. If the recreation area closes, timber production could resume; the loss of timber production during the time that the area was devoted to developed recreation is irretrievable. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a recreation area. Contrast with irreversible impact.

Irreversible impact – A category of impact in the National Environmental Policy Act to be analyzed in environmental impact statements. Refers to commitments that cannot be reversed, except perhaps in the extreme long term. For example, once trees have been removed and inundated with water for a reservoir, they will not be replaced within any measurable time period. Contrast with irretrievable impact.

Landslide – 1. A general term for a mass movement landform. Types of landslides include creep, rock slides and falls, earthflows, debris flows, avalanches. 2. A process characterized by downslope movement or transport, by means of gravitational stresses, of a mass of soil, rock and other debris that may or may not be water saturated.

Lease (mineral) – A legal document executed between a mineral owner or lessor and another party of lessee which grants the lessee the right to extract minerals fro the tract of land for which the lease has been obtained {(see 43 CFR 3400.0-5(r)}

Listed Species – Refers to one or more species listed by the U.S. Fish and Wildlife Service as endangered (E), threatened (T) or proposed for Federal listing as threatened or endangered (P). Also referred to as PET species or a subset of the species defined as PETS species.

Lithology – The description of rocks on the basis of such characteristics as color, structure, mineral composition and gain size. Generally, the description of the physical character of a rock.

Livestock – Foraging animals of any kind that are kept or raised for use or pleasure.

Loam – Soil composed of a mixture of sand, clay, silt, and organic matter. Loam contains about 60% sand, 30% silt (particles between 0.002 and 0.02mm diameter) and 20% clay. Loam soils feel smooth and spongy when rolled into a ball.

Management Indicator Species (MIS) – 1. Representative species whose habitat conditions and/or population changes are used to assess the effects of management activities on species in similar habitats in a particular area; 2. A species whose population changes are believed to indicate the effects of management activities, and is monitored to track population numbers and habitat conditions, as a way of monitoring biodiversity.

Mass wasting – The down-slope movement of large masses of earth material by the force of gravity. Also referred to as Mass movement or a landslide.

Metering Station - A facility that measures and registers the amount and direction of natural gas or electricity that flows through the facility.

Midseral range conditions - The period in the life of a forest stand from crown closure to first merchantability. Brush, grass, or herbs rapidly decrease in the stand because of stand density.

Migrant – Birds that pass through a given area during the spring or fall migration seasons, but do not nest there.

Monitoring - The periodic evaluation of management activities to determine how well objectives were met and how management practices should be adjusted. See also, adaptive management.

National Forest System (NFS) lands - Federal lands designated by Executive Order or statute as National Forests, National Grasslands, or purchase units or other lands under the administration of the U.S.D.A. Forest Service.

Native species – Any species native to a given land or water area by natural occurrence.

NFSR-National Forest System Road – A road wholly or partly within, or adjacent to, and serving National Forest System land and necessary for the protection, administration and use of the National Forest System and the use and development of its resources.

Outcrop – A rock formation that appears at or near the surface; the intersection of a rock formation with the surface.

Outfitter/Guide - A special-use permit holder that provides all commercial outfitting operations involving services for accommodating guests, transporting persons, providing equipment, supplies,

and materials. The permit holder also provides guiding activities wherein the guide furnishes personal services or serves as a leader or teacher.

Perennial stream – A stream or part of a stream that flows continuously during the calendar year as a result of ground-water discharge or surface runoff.

Pipeline Corridor - A pipeline corridor is a linear area where two or more pipelines (either part of the same or different pipeline systems) are closely grouped in a single right-of-way.

Proposed Action - A proposal made by a federal agency to authorize, recommend, or implement an action on public lands to meet a specific purpose and need. The Proposed Action is subject to public notice and comment provisions.

Proposed species – Species proposed for Federal listing as threatened or endangered under provisions of the Endangered Species Act of 1973.

Raptor – Predatory bird, such as an eagle, falcon, hawk, owl, or vulture.

Reach – stream segment

Recharge – The processes by which groundwater is absorbed into a zone of saturation.

Reclamation – Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, emplacement of topsoil, re-vegetation and other work necessary to restore the disturbed area for post-action use.

Responsible official – The USDA Forest Service employee who has been delegated the authority to carry out a specific planning action.

Restoration – the process of modifying an ecosystem to achieve a desired, healthy, and function condition. Contrast with rehabilitation.

Revegetation – the re-establishment and development of a plan cover by either national or artificial means, such as re-seeding.

Riffle - A reach of stream that is characterized by shallow, fast moving water broken by the presence of rocks and boulders.

Right-of-Way (ROW) – as defined in 43 CFR 288 – a document authorizing a non-possessory, nonexclusive right to use specified federal lands for the limited purpose of construction, operation, maintenance and termination of a pipeline. Typically the grant includes agency stipulations, conditions imposed on the project as a result of the National Environmental Policy Act review, a complete plan of development and approvals from other federal agencies.

Riparian – the area adjacent to rivers and streams that lies between the stream channel and upland terrain and that supports specific vegetation included by perennial and/or intermittent water.

Rhizomes - A horizontal underground stem which can send out both shoots and roots, rhizomes sometimes have thickened areas that store starch. A horizontal plant stem with shoots above and roots

below serving as a reproductive structure. A type of storage organ in plants which situates itself in a horizontal fashion underground.

Road Maintenance Levels:
• Maintenance Level 1 is assigned to service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activates. Emphasis is normally given to maintain drainage facilities and runoff patterns. Appropriate traffic management strategies are "prohibit and eliminate". While being maintained at the **Level 1,** roads are closed to vehicular traffic, but may be open and suitable for non-motorized uses. Public access can be restricted (vs closed) on a **Level 1** road for a permittee who may have authorized access. These roads are open to authorized traffic only. (USDA Forest Service 1986).
• Maintenance Level 2 is assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Road objectives are usually for 12'-14' single lane for resource management, administrative, permitted, and dispersed recreation use. Log haul may occur at this level. The public is allowed to use Level 2 roads, but the Forest Service does not manager them as a public road. Appropriate traffic management strategies are either to (1) discourage or prohibit passenger cars or (2) accept or discourage high clearance vehicles. These roads are open to public use and can be restricted year-round or seasonally. (USDA Forest Service 1986). Maintenance is performed as needed to maintain drainage structures and a road surface passable by high clearance vehicles.
• Maintenance Level 3 is assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads are low speed, 12'-14' single lane roads with turnouts and spot surfacing (USDA) during the fall and summer months. Maintenance Level 3 roads come under the requirements of the Highway User Safety Act, Manual on Uniform Traffic Control Devices (MUTCD) standards and are managed as public roads. Appropriate traffic management strategies are either "encourage" or "accept." Commercial use required a permit.
• Maintenance Level 4 is assigned to roads open and maintained for travel in a standard passenger car that provides a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double-lane and aggregate surfaced. However, some roads may be single land with turnouts. Some roads maybe paved and/or dust abated. The most appropriate traffic management strategy is "encourage". On the other hand, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times. Commercial use required a permit.

Road Management Objective Worksheet – Forest Service policy states that each road shall have a permanent record document called a road management objective worksheet on file. The worksheet describes the present conditions and future intentions for the road. It takes into consideration environmental and resource management objectives.

Runoff – The portion of precipitation that flows over the land surface or open channels.

RUP – Road use permits are required to authorize the use of existing National Forest System roads. Permits include conditions for road use and for the protection and management of National Forest. RUP authorizes non-Federal commercial use of a National Forest System road. Included in the permit are appropriate investment sharing and maintenance requirements and rules of use as terms of the permit.

SADT – Forest Service seasonal average daily traffic count reports.

Scoping – A public information process required by NEPA to determine private and public concerns, scope of issues, and/or questions regarding a Proposed Action to be evaluated in an environmental impact analysis. The procedure by which a federal agency identifies important issues and determines the extent of analysis necessary for an informed decision on a Proposed Action. Scoping is an integral part of environmental analysis.

Sediment – Material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by water, wind, ice or mass-wasting and has come to rest on the earth's surface.

Seep – A wet area where a seasonal high water table intersects with the ground surface.

Sensitive Species – Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by (1) significant current or predicted downward trends in population numbers or density; or (2) significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution.

Significant Impact – A qualitative term used to describe the anticipated importance of effects to the human environment as a result of an action.

Slump – A mass movement process characterized by a landslide involving a shearing and rotary movement of a generally independent mass of rock and earth along a curved slip surface.

Talus - A sloping mass of rock debris at the base of a cliff

Temporary Roads - Roads authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the national forest transportation system and not necessary for long-term resource management. All temporary roads will be reclaimed.

Thermogenic Methane Gas – Methane gas generated in the subsurface from high temperature and pressure.

Thalweg - The deepest part of a stream's channel.

Threatened Species – A plant or animal species likely to become endangered throughout all or a specified portion of their range within the foreseeable future, or designed by the Secretary of the Interior or the Secretary of Commerce under the Endangered Species act of 1973.

Topography – Physical shape of the ground surface; the configuration of land surface including its relief, elevation, and the position of its natural and manmade features.

Trench - A trench is a long narrow ditch dug into the ground and embanked with its own soil and used for concealment and protection of line pipe. Trenches are usually dug by a backhoe or by a specialized digging machine.

µg/m3 - Millionths of a gram per cubic meter; a unit of concentration in liquids or gases. A

microgram is 1/1000000 of a gram, or 1/1000 of a milligram, is one of the smallest units of weight/mass commonly used.

Valve - A valve is a mechanical device installed in a pipeline and used to control the flow of gas or liquid.

Watershed – The registration or area drained by a river, stream, etc.; drainage area.

Wellhead - Wellhead refers to the point at which oil and natural gas is extracted from the ground.

Wetlands – Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient, under normal circumstances, to support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands include marshes, bogs, sloughs, potholes, river overflows, mud flats, wet meadows, seeps, and springs [see 33 CFR 328.3(a)(7)(b)]. Wetlands are generally highly productive environments with abundant fish, wildlife, and aesthetic and natural resource values.

Wilderness – A Congressionally designated area that is essentially unaltered and undisturbed by humans. Management of this area preserves and protects its physical and biological characteristics

Appendices

Appendix A – Agency Response to Comments

This table shows the comments received on the proposed action during the official opportunity to comment. It shows which comments were carried forward as issues to be analyzed in the EA, and which were not carried forward for analysis and the rationale for why they were not analyzed. The comments in the table were paraphrased from the comment letters received. Copies of the original comment letters are in the project file.

Letter – comment #	Source	Dated	Date Rec'd	Category	*Comment (in italics; summarized from comment letters and oral comments)* FS response follows
1-1	M. Brown	2/2/07	2/5/07	Tvl Mgt	*FS's travel mgmt decision restricts ATV travel routes but allows for construction vehicles to build new routes for gas activity. Double standards.* Response: The Grand Mesa Travel Management EA of December 1994 analyzed the affect of unmanaged ATV use on non-system routes and the decision included the possibility of closing off-route game retrieval in the Hightower area. That portion of the decision was implemented for the 2006 big game hunting season, after several years of monitoring in the area indicated unacceptable resource damage was occurring. The oil and gas operator will be required to abide by the Travel Management Decision. The federal oil and gas lease conveys the right to the holder to build roads on the lease. See Design Criteria 2.2.15 and Transportation section 3.12
1-2	M. Brown			Forest Plan/ Recreation	*FS has sold off public lands to energy company resulting in loss of recreational use and enjoyment of NFS land.* Response: The Forest Service acknowledges that mineral development is part of its multiple use mandate (EA, Authorizing Actions, section 1.5). The project is proposed on lands that were leased for oil and gas consistent with the GMUG Oil and Gas Leasing EIS (Forest Plan Consistency, Section 1.6). As a holder of a federal oil and gas lease, the company has the right to explore for and develop the oil and gas resources within the lease. See Recreation section 3.11 for analysis and for discussion of Design Criteria incorporated into the project to minimize effects on recreation.
2-1	J. Vidmar	2/5/07	2/6/07	Visuals/Recreation	*Drilling in the area ruins the scenic beauty and solitude.* Response Effects to visual resources are disclosed in Section 3.13 of EA. Section 3.11 discusses effects on

					Recreation. Design Criteria for Visuals and Recreation are given in Table 2.2.15.
2-2	J. Vidmar			Water	*Drilling activity causes water pollution* Response: See discussion in the Water Resources section 3.4 and Design Criteria to protect water in Table 2.2.15-
2-3	J. Vidmar			Noise	*Drilling activity causes noise pollution* Response: Noise is regulated by the state and the operator must comply with state requirements. See Design Criteria for noise, and the noise analysis in Recreation section 3.11.
2-4	J. Vidmar			Air	*Drilling activity causes air pollution* Response: Effects to air quality were identified as an issue to be addressed in the environmental analysis (Section 1.9). Effects on air quality are discussed in Section 3.1 of the EA. The project includes several Design Criteria to minimize air quality effects (see Table 2.2.15). .
3-1	J. Frederick		2/12/ 07	Winter Rec	*Provide an area for snowmobiles to park. Create a snowmobile parking area at the intersection of the 20-11 access rd and NFSR 266.* Response: Effects on snowmobile recreation were identified as an issue to be addressed in the environmental analysis (section 1.9). Effects of the proposed activities on winter recreation are disclosed in the Recreation section (3.11). Design Criteria (Table 2.2.15) call for maintaining a snowmobile parking area near the compressor site so that snowmobile access to the S-P trail will be maintained.
4-1	H and K Nored	2/13/ 07	2/13/ 07	Hunting	*Gas exploration activities will drive big game out of area and ruin the hun*t Response: Effects of the proposed activities on wildlife and recreation (hunting) are disclosed in the Wildlife (3.9) and the Recreation (3.11) sections of the EA. Table 2.2.15 include Design Criteria to reduce effects on hunting recreation.
4-2	H and K Nored			Tvl Mgt	*FS's travel mgmt decision restricts ATV travel routes but allows for construction vehicles to build new routes for gas activity. Double standards.* Response: see response to comment 1-1.
5-1	Buzzard Ck range	2/13/ 07	2/13/ 07	Livestock Mgmt/Sug	*Increased traffic volume from drilling activities will cause people or cattle to get hurt or killed. Particular concern at NFSR 265 on the narrow, steep hill section. Ideas: widen NFSR 265 and knock down the steep*

	permittees			gested Mitigation	*pitch, or re-open trail 536 between NFSR 265 and 266 and create a one way loop.* Response: FS identified traffic volume as a key issue for the analysis (EA, Section 1.9). Several Design Criteria listed in Table 2.2.15 address traffic safety concerns: Effects of the proposed activities on current road use and transportation system are disclosed in the Rangeland Resources (3.7) and Transportation (3.12) sections of the EA. Creating a one-way loop was not considered because the FS decided to close portions of NFSR 266 due to the ongoing expense to keep the road open as a result of earth movements and slides south of the project area.
5-2	Buzzard Ck range permittees			Livestock Mgmt	*High volume drilling traffic during livestock turn-out and gathering times will cause accidents and road congestion. Idea: Halt well traffic during these dates, typically 6/13-6/20 and 10/5-10/15.* Response: See response to comment 5-1..
5-3	Buzzard Ck range permittees			Livestock Mgmt/ wildlife	*Lack of fencing around wellpad allows cattle to get into reserve pits and other things on the wellpad. Idea: Install perimeter fencing around entire wellpad and pit.* Response: The reserve pit will be surrounded by 8 foot tall fencing as required by Design Criteria (Table 2.2.15). The reserve pit is fenced on 3 sides during drilling, and then fenced on 4 sides after drilling operations cease until the pad is reclaimed.
5-4	Buzzard Ck range permittees			Wildlife	*Installing 8' high fencing will keep moose out of pits* Response: See response to comment 5-3.
5-5	Buzzard Ck range permittees s			Operations/ weeds	*Surface pipe will result in less ground disturbance and fewer weeds than buried pipe.* Response: Alternative Two in the EA considers using surface pipelines. Weed control is included as a Design Criteria (EA, Table 2.2.15).
5-6	Buzzard Ck range permittees			Water disposal	*Like the idea of collecting water near compressor station (tank battery)* Response: Alternative 3 includes this option (section 2.4).
6-1	R Bentley	2/13/ 07	2/14/ 07	Proposed Action	*Supports domestic natural resource development for national economy and national security.* Response: Comment gives position statement because it notes support of project.
7-1	DOW	2/16/ 07	2/21/ 07	Noise	*Compressor stations should be housed to reduce chronic impact from noise.* Response: The project Design Criteria (EA, Table 2.2.15) include that compressor will have hospital grade mufflers , and will be housed in a sound reducing building. Noise levels must meet COGCC standards.

7-2	DOW			Recreation	*Consideration will have to be given to hunting in the area during project development.* Response: See response to comment 4-1.
7-3	DOW			Wildlife	*Phasing drilling between one area and the other would reduce impacts to wildlife. DOW requests proponent cluster drilling activities as much as possible around adjacent pads. Place a timing restriction on pads 21-10 and 21-2 such that no drilling is done during elk calving. Prefer that drilling occur on the lower elevation pads , 20-6 and 20-11 during elk calving.* Response: The oil and gas lease does not identify a timing restriction stipulation for elk calving areas. Effects to wildlife are disclosed in the EA, Section 3.9.
7-4	DOW			Wildlife	*Drilling should occur closer to the road during sensitive time of the year such as fawning and calving.* Response: See response to 7-3
7-5	DOW			Future development	*The project is scoped on 40-acre downhole spacing. Full field development should be considered as early as possible.* Response: See response to comment 13-36.
7-6	DOW			Weeds/roads	*Gravel is discussed for road surfacing. This could reduce offsite mud tracking but should be weed free. Weed locations should be mapped early so those areas can be treated and monitored. Weed training for proponents's project supervisors suggested.* Response: On-going mapping and control of noxious weeds is done in the project area by FS range conservationists. See also response to comment 5-5.
7-7	DOW			Recreation/roads	*Roads not currently open to the public which are created as part of lease development should be closed to all non-authorized motorized traffic. Roads should be gated. Dispersed camping should be limited to pullouts along existing forest system roads to preserve habitat for wildlife between forest system roads.* Response: Design criteria (Table 2.2.15) require access roads are to be used for administrative access only and be gated. Further, at the time of final site abandonment, the access roads and pads will be re-contoured and revegetated per FS specifications.
7-8	DOW			Moose	*Hightower area is considered a moose concentration area. No information exists on moose impacts from development. Offsite mitigation or compensatory funding for monitoring may provide information to better understand this dynamic and document changes beyond baseline operations. Hightower area is a moose concentration zone with high level of public interest. Moose are mapped throughout the area in the aspen and in the oakbrush. There are no studies on the effects of energy development on moose behavior. DOW suggests the proponent could fund $20,000 for a 6 month seasonal employee to monitor moose.*

					Response: Effects to moose are in Section 3.9.6. The suggestion for the proponent to fund a study is not an issue considered in this analysis because it is not relevant to the decision.
7-9	DOW			Wildlife	*Potential habitat for boreal toad, even though they were not found during a 1999 survey of the area. Impacts to toads should be mitigated. The company should fund a more in-depth search of the area to identify the existence of any toads or habitat that could be significant to the presence of toads.* Response: A boreal toad survey was conducted in the project area in 2007 in ponds adjacent to proposed surface disturbances. The results of this survey were used in the wildlife analysis (EA, Section 3.9). Design Criteria (Table 2.2.15) require an additional survey prior to construction.
7-10	DOW			Operations	*Surface pipelines could reduce resource disturbance. Surface pipelines have pros and cons on unstable slopes. Pipelines transporting liquids likely need to be buried to reduce freezing potential.* Response: Alternative 2 considers using surface pipelines, whereas Alternative 3 assumes pipelines will be buried. (EA, Sections 2.2 to 2.4).
7-11	DOW			Water disposal	*Water disposal via injection wells may be the most beneficial option to reduce truck traffic within project area and thereby reduce impacts to wildlife over life of project.* Response: Disposal wells were an Alternative that was considered but dropped from further analysis. Any future proposal for a disposal well will require additional environmental analysis (section 2.5, Alternatives Not Considered in Detail). Alternative 3 was developed to reduce traffic in the project area (EA, Section 2.4).
7-12	DOW			Operations	*Surface disturbance and maximum depth/thickness of unstable soils should be accounted for when considering depth to set conductor pipe for wells.* Response: There are several design criteria listed in Table 2.2.15 for high and moderate geologic hazard areas and stabilization of steep slopes. Requirements for conductor pipe depths are under the responsibility of the BLM Petroleum Engineer who will perform site-specific reviews at the time and APD is filed. Further, conductor pipe specifications must also comply with COGCC regulations.
7-13	DOW			Operations	*Plan pipeline corridors when considering gas transportation from the project area to markets. Size the pipeline appropriately to carry maximum possible production during initial installation.* Response: The proposed action has been designed to enable transport of additional gas should future development occur in the project area (see Section 2.2 of the EA).
7-14	DOW			Recreation	*Construction, drilling and completion should be curtailed from muzzleloader through 3rd rifle season.* Response: See response to 7-2

7-15	DOW			Wildlife/operations	*Expeditious reclamation of reserve pit would be beneficial to reduce impacts to migratory birds. DOW has not seen evidence that web flagging works .Other reserve protections for wildlife include netting to keep birds off the water. This is the best although it has maintenance issues during snowfall events. "Bird balls" can be placed across entire surface of pit to disguise the water. Very costly and reduces evaporation from the pit. Protect small mammals by installing chain link fence "ladder" on edge of pit. Require proponent to install fence sufficient to exclude wildlife. Could use 6" tall metal strip, similar to flashing, around pit perimeter to keep boreal toads out of the pit.* Response: There are several Design Criteria in place concerning reserve pits to protect wildlife (Table 2.2.15).
7-16	DOW			Wildlife	*Impacts to bears should be reduced by not allowing garbage to be retained on site for extended amount of time. Bear-proof trash receptacles may be necessary at drill sites. Workers should be warned of bear impacts and discouraged from feeding them.* Response: Design Criteria (Table 2.2.15) include minimizing garbage accumulation, use of bear-proof trash receptacles and frequent removal to land fill facilities.
7-17	DOW			Wildlife	*Reserve pits should be fenced with 8-foot high woven wire fences with barbed wire at the top to reduce moose entrapment hazards. Secure h-braces would also ensure the integrity of the reserve pit fence in general. Closed or fully contained systems would further reduce potential wildlife hazard.* Response: See response to comment 7-15..
7-18	DOW			Wildlife	*Constructing wellpads in clearcuts may reduce impacts to raptors, but moose should also be considered. Moose occasionally forage on juvenile aspen saplings. This consideration could be explored further if offsite or compensatory mitigation is developed.* Response: The aspen harvest previously completed in the project area were not cut for moose, rather to diversify aspen stand age classes. Because approximately 13 acres of regenerating aspen would be cut at the 21-2 and 21-12 locations, the proposed action includes replacing the aspen regeneration clearcut for forest health reasons. Effects of this are given in Chapter 3.
7-19	DOW			Wildlife	*Project is located next to mapped elk calving areas. This area in general is used for elk calving and project activity timing should be considered.* Response: See response to comment 7-3.
7-20	DOW			Wildlife/roads	*Project design criteria should endeavor to reduce impacts to wildlife from traffic. Self-imposed speed restrictions should be considered by the proponent to address wildlife deaths due to collision. Speed restrictions should be applied to all related development traffic.* Response: Traffic and safety along forest roads was identified as a key issue (Section 1.9) for this analysis.

					Design Criteria, Table 2.2.15 include designing roads for safe speeds and traffic control.
7-21	DOW			Wildlife	*Visiting a central area daily as proposed in Alternative 3 would be less disruptive to wildlife over the 20 to 30 year life of the project. However, the disturbance acres in Alternative 2 are less, which could be advantageous to wildlife as well. It was challenging to evaluate alternatives as outlined in the EA.* Response*:* The effects analysis by resource and by alternative is documented in Chapter 3 of the EA, which provides a discussion of differences in effects between the various alternatives.
7-22	DOW			Wetlands	*Wetlands and springs should be identified and mapped prior to project commencement and proper permits obtained.* Response: A wetlands and water resource survey was conducted in Summer 2007, these results were used in the effects analysis for water resources and wetlands (see Chapter 3). A list of other potential permits needed for the project is given in Table 2.2.16.
7-23	DOW			Poaching	*Employees should be prohibited against carrying firearms and archery equipment. Recent poaching cases have noted that industry workers have cimcumvented company regulations by use of archery equipment. The applicant should educate all staff and subcontractors on the impacts of taking wildlife out of season/illegally. Participation in Operation Game Thief could reduce potential for poaching.* Response: Design Criteria (Table 2.2.15) address this concern.
7-24	DOW			Weeds	*An integrated weed management program should be instituted for weed mitigation. The program should also consider options for treatment using herbicides-both spot as well as large area application. Disturbances commonly spread and exacerbate existing weed problems and can degrade the health and wildlife habitat and cumulatively the potential for the carrying capacity of the landscape.* Response: See response to comment 5-5.
7-25	DOW			Operations	*It would be acceptable to have a pipeline not collocated within the road way (for gravity feed purposes) if the pipeline would reduce truck trips to individual wellpads to haul water and condensate for the life of the project. This would consequently reduce habitat fragmentation and disturbance effects on wildlife.* Response: Alternative 3 addresses the issue of long term heavy truck traffic to haul off produced water from each of the wellpads by adding water gathering lines (see Section 2.4).
7-26	DOW			Reclamation	*Interim reclamation involving re-contouring up to the rig anchors should begin as expeditiously as practicable.* Response: Design Criteria address interim reclamation, including that pit and interim reclamation to be completed within 60 days after well completion or as soon as possible based on the season (Table 2.2.15).
7-27	DOW			Reclamati	*Topsoil should be stored no deeper than four feet and should be seeded to prevent weed see germination and*

				on	*to protect topsoil microorganisms and their viability.* Response: Per Design Criteria, topsoil is to be segregated and stored separately, no deeper than six feet. It shall be seeded and mulched until needed for reclamation (Table 2.2.15).
7-28	DOW			Wildlife	*Migratory birds should be excluded from reserve pits.* Response: See response to comment 7-15
7-29	DOW			Spills	*DOW should be contacted if a spill has potential to impact terrestrial or aquatic wildlife.* Response: A Spill Prevention Control and Countermeasures Plan is part of the Design Criteria (Table 2.2.15) that would include this type of information.
7-30	DOW			BMPs	*DOW included a general list of BMP's that were developed to mitigate effects to wildlife by DOW scientists.* Response: Many of the BMP's pertinent to the project location have been incorporated into the project design (Table 2.2.15).
7-31	DOW			Operations	*Phased development approach and simultaneous completions, or other efficient development which expedites the drilling process will be more beneficial to wildlife than a less organized development approach.* Response: The project incorporates this concept, for example up to 3 drilling rigs and 2-3 completion rigs to complete the drilling and completion phases as quickly as possible would be used (Section 2.2).
7-32	DOW			Future development	*It is more beneficial to wildlife to assess the maximum development scenario along with interconnecting pipelines early in the planning process.* Response: The Hightower MDP was developed to take a comprehensive look at possible activities. See response to comment 13-36 and 7-13.
7-33	DOW			Wildlife/roads	*It would benefit wildlife more if no new public access were allowed via newly constructed lease roads.* Response: See response to comment 7-7.
7-34	DOW			Wildlife/roads	*Fresh water is preferred for road watering/dust suppression rather than magnesium chloride for protection of fisheries and boreal toad habitat.* Response: Design Criteria include dust abatement using water. Mesa County and the FS have an agreement to apply magnesium chloride to portions of NFSR 265; the operator could become a partner in that agreement but the county would apply the magnesium chloride treatment (Table 2.2.15).
7-35	DOW			Roads/wat	*Roadways should be constructed to minimize sedimentation into all waterways in this area, including*

				erways	*installation of culverts on all perennial and ephemeral stream crossings. Every possible means should be used to control run off from well pads and disturbed locations.* Response: The Design Criteria of the project that provide for erosion control and stabilization, drainage crossings, along with the development and adherence to a Stormwater Management Plan (Table 2.2.15). No perennial streams will be crossed by access roads; some ephemeral drainages would be crossed by the project (see Section 3.4).
8-1a	A. Kelley	N/A	2/26/ 07	Noise	*Better description of expected noise levels from compressor needed.* Response: Noise resulting from project activities was identified as an issue to be addressed in the analysis (Table 1.9.2 and Section 3.11). See also response to comment 2-3.
8-1b	A. Kelley			Noise/ recreation	*Compressor location as proposed will drive campers up Buzzard Creek and result in more camping pressure at Buzzard Creek and Porter Creek dispersed sites as well as near their inholding. Suggest moving compressor east, up drainage to better screen it, or use existing compressor at Hwy 330 and Harrison Creek.* Response: The effects of the project on recreation are included in Section 3.10 of the EA. The analysis included the effects of noise on recreationists.
8-2	A. Kelley			Winter rec	*Road plowing will result in snowmobile trailers being hauled into the project area. They will need a parking area. Suggest building a parking area near the 20-11 pad.* Response: See response to comment 3-1.
8-3	A. Kelley			Future developm ent	*Even though Laramie's proposal is for 40 acre downhole spacing, COGCC is permitting 10 acre downhole spacing. Proponent should submit a plan for 10 acre spacing.* Response: See response to comment 13-36.
8-4	A. Kelley			Property value	*Drilling and development activities could harm private property inholding value.* Response: This issue is was not carried forward into the analysis because effects would be speculative or conjectural.
9-1	Mesa Cty Planning	2/28/ 07	3/2/0 7	Permits	*Copies of APD's shall be submitted to the county.* Response: The FS understanding is that since Mesa County has a Local Government Designee (LGD) appointed through the COGCC rules, that any APDs filed in the county will automatically be sent to that individual via the State. Note that APDs on Federal lands are filed with BLM and the surface managing agency, however copies are also filed with the COGCC. Discussions with the local BLM office indicate

					they forward APD's to the county for wells proposed on BLM land or fee surface, but not for lands covered by other jurisdictions. The BLM is required by regulation to post APD filings for 30 days for public review. The FS will post APD's for locations on NFS lands for 30 days as per terms of a BLM/FS MOU.
9-2	Mesa Cty Planning			Permits	*Conditional Use Permits required for major support infrastructure*. Response: All facilities (compressor station, tank battery, gas and water lines) in the proposal fall within the Grand Mesa National Forest and as such are authorized by the federal government. The company is responsible for obtaining any required permits under jurisdiction of the county or state. See section 2.2.16 for a list of possible permits and plans required.
9-3	Mesa Cty Planning			Permits	*County should be consulted to review proposed siting of compressor station, staging areas, offices, etc.* Response: FS authorizes all facilities and infrastructure located on NFS land. Proponent is responsible for contacting county to ensure county codes and agreements are adhered to for infrastructure located off NFS land.
9-4	Mesa Cty Planning			Permits	*Access and use of county roads by proponent should be reviewed/approved by Mesa County to ensure compliance with county's Land Development Code.* Response: The proponent is responsible to obtain any other local, state and federal permits as required by law. See section 2.2.16 for a list of possible permits and plan required.
9-5	Mesa Cty Planning			Permits	*Disturbance of one or more acres requires a Stormwater Construction Permit from the Colorado Dept of Public Health and Environment.* Response: Design Criteria (Table 2.2.15) requires development and implementation of a Stormwater Management Plan (SWMP). The proponent is responsible to abide by all local, state and federal laws and obtain other required permits (table 2.2.16).
9-6	Mesa Cty Planning			Weeds	*Weed management will be coordinated with the county.* Response: See response to comment 5-5 concerning several Design Criteria pertaining to weed control. .
9-7	Mesa Cty Planning			Law enforcement	*Coordinate law enforcement with appropriate local and state agencies.* Response: This offers a general position statement which does not require analysis.
10-1	Dave Shishim	3/07/07		Administration	*Exactly how will the Forest Service ensure the integrity of the plan and verify that all of Laramie's proposed methodologies described in their plan are indeed being followed should the plan be executed?* Response: The Forest Service and BLM have various roles and responsibilities in administering activities approved in the oil and gas program (see 36 CFR 228, Subpart E for the FS, and 43 CFR part 3100 for

					BLM). The FS is responsible for administration of the surface resources while the BLM is responsible for the down-hole, and petroleum engineering aspects of the proposal. Additionally, the FS will be implementing EMS to ensure effectiveness of Design Criteria (Table 2.2.15).
10-2	Dave Shishim			Roads	*Will the entrance to any new roads constructed for this project be gated and locked?* Response: Design Criteria (Table 2.2.15) call for all access roads to be gated and used for administrative access only.
10-3	Dave Shishim			wildlife	*Exactly what does "Construction activities should be scheduled to minimize disturbance to migrating Elk and nesting birds" mean? How will this policy be policed? Who will police it and at what intervals? What penalties will exist for non-compliance*? Response: To clarify, migrating elk is not a concern. Elk winter range is not in the lease area but lies to the northeast. The project has been designed to have the least disturbance to wildlife, and to make the period of disturbance as short as possible. Protections for wildlife (including nesting birds) are part of Design Criteria (Table 2.2.15). The FS and BLM have policy and protocols for inspections on natural gas operations. These procedures will be followed which include initially working with the operator to correct items when necessary, shut down of operations, or issuing formal notices of non-compliance and levying fines. See response to comment 10-1.
11-1	WSERC			Cumulative effects	*WSERC's primary interests lie in seeing that environmental health is maintained and that cumulative impacts from activities on public lands do not degrade or overwhelm their ecological integrity nor threaten public health and safety.* Response: The EA, Chapter 3, Affected Environment and Environmental Consequences, discusses effects to the environment and the cumulative effects for each resource.
11-2	WSERC			Analysis	*Many of the Hightower EA's conclusions are problematic and/or fail to meet the standards required to manage GMUG for multiple uses, while also protecting important biological, water and air resources, as well as protecting public health and safety.* Response: To clarify, the GMUG exercised an option under current NEPA regulations that allows for the project scoping period to be the official opportunity to comment on the project (36 CFR 215). With this approach, the GMUG provided information on the proposed action, preliminary issues, proposed alternatives, design criteria, authorizing actions, etc. during the scoping period in order to give respondents enough information to make comments. At the time of scoping, the EA analysis had not been performed.

					The completed EA meets the requirements of laws, including NEPA, and is consistent with the GMUG Forest Plan and other legal requirments.
11-2a	WSERC			Oil and Gas Leasing EIS	*FS and BLM have failed to acknowledge and rectify deficiencies in existing (pre- and post-leasing) environmental analyses. The 1993 Oil and Gas EIS states that on GMUG, drilling activity will continue at the conservative levels of 1986 to 1990. "Of the 47 wells predicted to be drilled over the next 15 years, 40 are expected on existing leases. Only 7 wells are predicted to be drilled on new leases." (EIS II-4) The 2004 BLM GMUG RFD forecasts do not materially deviate from the 1993 Oil and Gas EIS forecasts regarding drilling activity: "Drilling on the GMUG will escalate linearly with gas prices at about 2% per year or 2 wells per year or 30 wells over the analysis period of 15 years. "Of the 45 forecasted wells, it is anticipated that 27 would be drilled on the GMNF…." (RFD p. 46) Of particular concern is RFD Figure 10 (p. 24) showing oil and gas occurrence potential on the GMUG. Nearly the entire GMNF is rated as high potential. This assessment appears to directly contradict the forecast for the total number of wells drilled on GM over the next 15 years. WSERC therefore believes that FS must take a broader and more long-range view regarding the potential for the number of gas wells to far exceed the 45 forecast for GMNF over that period of time. Waiting until the next proposal is presented could well mean that future analysis will be largely based on previous analysis and fail to take into account the cumulative impacts of connected actions, which is required by the Council on Environmental Quality (CEQ). A new EIS should be required before approval is given to a project as big as the one Laramie Energy is proposing at Hightower. The 1993 EIS is clearly inadequate given that the entire future gas inventory projected by the 1993 EIS would be surpassed just by Laramie's proposal to drill 32 wells on 5 pads and the already approved Spaulding Peak project.* Response: This is outside the scope of the proposed action, because the 1993 GMUG Oil and Gas Leasing EIS and Record of Decision pertains to making lands within the forest available and authorized for oil and gas leasing, and assigned conditions (stipulations) for surface use, and is a decision that has already been decided. The GMUG Forest Plan, as amended by the Oil and Gas Leasing Final EIS and Record of Decision (USDA-FS, 1993), evaluated potential impacts of oil and gas leasing at a programmatic level. Subsequent NEPA analyses, including this EA for the Hightower MDP, are prepared for site-specific proposals regarding exploration and development. The Forest Plan, including the 1993 Oil and Gas EIS, does not make project-level decisions. The Forest Plan and its amendments provide the framework within which project decisions can be made on a case-by-case and site-specific basis. The Hightower activities are being documented according to the 'Staged Decision Process" for oil and gas activities on federal lands. This process has been upheld by the courts in the *Robertson v. Methow Valley Citizens Council* {US Supreme Court 1989] (104 L.Ed.2d 351 (1989) (GMUG Oil and Gas Leasing EIS, 1993, page 1-17)). According to this process, public disclosure through the NEPA process occurs at the leasing stage (which was fulfilled by the GMUG with the 1993 EIS and ROD), and at the surface operation approval stage. This EA satisfies the NEPA disclosure point for surface operations stage.

					The 1993 GMUG Oil and Gas Leasing EIS assumed a Reasonable Foreseeable Development Scenario (RFDS) as required by regulation (36 CFR 228.102) for leasing analyses. It is important to understand what an RFDS does and what it does not do. The RFDS is simply an analysis tool for the leasing analysis that provides information necessary to adequately address potential effects from oil and gas activity that could occur as a result of leasing, it does not place restrictions on the amount of development that can occur (Rocky Mountain Federal Leadership Forum, 2002). The RFD is speculative, not site-specific, and activities cannot be located in time or space. An RFD is a vital and necessary tool used for 1) determining the extent to which a land management plan might need to be updated, 2) providing technical information for a cumulative effects analysis that could result from a leasing decision, 3) serving as a context for more localized site-specific oil and gas project decisions, and 4) making informed planning (i.e. leasing) decision for management of oil and gas resources (Ibid). More germane to the comment on RFD, is the amount of surface disturbance rather than specific number of wells. The GMUG RFD from 1993 projected that just over 500 acres of surface disturbance might occur as a result of oil and gas development activity over the period assessed (GMUG Oil and Gas EIS, page II-5). Since 1993, oil and gas project approvals have been given on about 56 acres forest-wide, however actual on-the-ground development activity on the GMUG has resulted in about 5 acres of new surface disturbance. Hence, oil and gas activity on the GMUG is within the disturbance estimates and therefore the existing analysis remains valid. See also response to comment 12-1a. With regard to cumulative effects, each project that proposes site-specific activities takes into account past, present and reasonably foreseeable future actions germane to the specific project area. Cumulative effects related to the Hightower project are disclosed in Chapter 3 of the EA.
11-3				Out of scope	*BLM's decision to grant Hightower leases in critical elk habitat and correspondingly high hunter satisfaction …seems an anomaly since BLM has protected critical wildlife habitat in Moffat, Las Animas and Logan Counties.* Response: Elk winter range is discussed in the analysis in Wildlife section 3.9. According to CDOW habitat classifications, this area is not "critical" or "severe" winter range. The proponent plans to drill year-round which will minimize overall disturbance to wildlife by shortening the overall timeframe of high levels of activities.
11-4	WSERC			Design criteria	*The EA refers to "Best Practices," but references lack specificity regarding the level of mitigation or elimination of potentially adverse and long-term impacts of drilling and production. Model "best practices"*

					requirements are described and referenced in The New Mexico Model County Oil and Gas Regulations (Oil and Gas Accountability Project, 10/2004). The New Mexico model regulations define "best practices" and require a description of the engineering techniques and equipment to be used. The Hightower EA fails in many instances to reference and identify the requirements of applicable state and federal regulations regarding air and water quality regulations as well as noise levels. Response: The Design Criteria incorporated into the proposed action (Table 2.2.15) consist of regulations, Forest Service manual requirements, species conservation plans, Forest Plan standards and Best Management Practices (BMPs) (among other sources), and include Colorado recommended BMPs for oil and gas operations, as well as site specific recommendations.
11-5				Air/Noise	*Regarding noise levels, New Mexico model regulations stipulate that "all motors should be anchored/mounted on vibration dampeners" and "all facilities that have compressors, engines or motors which generate sound and are located . . . 400 feet of known wildlife habitat and/or migration routes. . . must be placed behind a maintained, acoustically insulated housing or have a cover enclosing the motor or engine to further reduce sound and lessen visual impact. (OGAP, p. 21) The model regulations further recommend that "Under certain circumstances additional noise abatement measures may be required. These measures may include…A noise management plan identifying hours of maximum noise emissions, the type, frequency and level of noise to be emitted and proposed mitigation measures." (OGAP, p.21)* Response: Noise is an issue addressed in the analysis (Sections 1.9 and 3.11). Design Criteria (Table 2.2.15) are in included to reduce noise levels to ensure consistency with Colorado noise standards. See response to comment 2-3.
11-6	WSERC			Roads/Water quality	*Access Roads: The use of magnesium chloride can lead to high levels of magnesium in nearby surface water resources, domestic wells, and groundwater resulting in possible effects to humans. Weekly power washing of vehicles requires water (hot preferred) plus a toxic alkyl-phenolic detergent which at extremely low concentrations in aquatic systems causes feminization of invertebrates and fish. Both the source and quantity of the water for watering roads and high-power washing should be provided. The fate of the power washing water should be provided as well.* Response: See discussion of Magnesium Chloride application under comment 7-34. Section 2.2.6 of the EA discusses water quantities required for drilling, dust abatement and hydrostatic testing of pipelines. Power washing of equipment (with detergents) will occur at a commercial facility (i.e. car wash). No power washing will occur on the forest.
11-7	WSERC			Water	*Well Drilling and Completion: The EA provides no data concerning the products that will be used to drill*

				quality	*the wells. The complete composition of the drilling muds must be made available to the public as well as the total volume and concentration of each chemical in the products used. Even if a large part of the drilling material is recovered, in the case of accidents, which do occur, it is imperative that those dealing with the problem know how to handle the situation. In addition, the local public health authorities and medical providers must know what is in the products in order to determine how to treat patients who are directly exposed or referred to them because of a health problem(s).* Response: Water quality issues are addressed in the EA (Sections 1.9 and 3.4). A summary of products used in the drilling, completion and cementing processes are included in the EA Appendix B. MSDS sheets will be included in the Fire and Emergency/Health and Safety Plan, and are in the project file. Copies of the Fire and Emergency/Health and Safety Plan will be at each construction and drilling location.
11-8	WSERC			Water Quality	*<u>Fracturing chemicals</u>: The EA provides only the names of three products that the developer intends to use during hydraulically fracturing. With one exception, no data are available about the ingredients in these products. The name of one ingredient (methanol) was located in 19N from a New Mexico Tier II report. No Material Data Safety Sheets are provided for any of the products so there is no way to ascertain the toxicity of the products nor their ingredients. Laramie Energy claims that it will measure recovery of the fracing fluids by using a flow back tank. It is imperative that the flow back fluids are assayed for their chemical content in order to determine the amount of the toxic compounds left underground, and also to determine how much contamination was released into the fluid from the highly toxic underground environment.* Response: MSDS Sheets are available in the project record. Appendix B of the EA contains a list of products used in fracing. Section 2.2.4 discusses the fracing process.
11-9	WSERC				*<u>Well pad construction on unstable ground</u>: Geological hazards may be encountered on drill pad 20-11 due to an historic landslide feature. The determination that this feature "appears to have stabilized" (EA p. 18) requires more careful examination. It is likely that the water handling characteristics of the slide material will be different than that in the underlying substrate and thus lead to it being more prone to saturation and subject to the instability of saturated regolith. Importantly, the contact between the underlying substrate and the slide material will form a conduit for water to move along it and down slope to enter ephemeral drainages mentioned in the pad description. Thus, any overflow from a waste pit or accidental spills would be quickly introduced into the surface drainages.* Response: Effects on slope stability are in the EA, Section 3.2.
11-10	WSERC			Air quality	*Air Quality needs to be analyzed including volatile organic contaminants (from venting storage tanks, compressor station(s) and evaporation from waste pits), nitrogen oxides (NOXs) diesel exhaust, vehicle emissions, fugitive dust (construction, traffic, smoke and internal combustion engine emissions, and disclose*

					effects on Class 1 airsheds within 50 miles of the project area (Maroon Bells-Snowmass Wilderness Area, West Elk Wilderness Area and Black Canyon of the Gunnison National Park). Hightower EA does not adequately document current air quality within the region and describe how air quality would be monitored to measure potential adverse impacts from the proposed development and connected actions, including steps to minimize impacts to regional air quality particularly in Class 1 airsheds. Response: See response to comment 2-4.
11-11	WSERC			Wildlife/Cumulative effects	*Hightower project and every other project that fragments habitat should be evaluated in terms of their collective cumulative effects on the overall viability of the GMNF species.* Response: Viability, population trends and cumulative effects to wildlife are summarized in EA, Section 3.9.
11-12	WSERC			Wildlife	*Hightower area deserves special protection and consideration of its diversity of native plant and animal species because it contains critical wildlife habitat.* Response: The Hightower area does not have any CDOW or USFWS "critical" wildlife habitat. Design Criteria (Table 2.2.15) were included in the project design to protect wildlife and wildlife habitats.
11-13	WSERC			Wildlife/Recreation	*Development and operation of the Hightower project has the potential to significantly impact wildlife use of and movement in the area and the substantial numbers of hunters using the area annually.* Response: see response to comments 4-1 and 7-2.
11-14	WSERC			Wildlife/Recreation	*Potential negative impacts to habitat, animal populations and hunting should be monitored to measure overall reductions in wildlife populations and health as well as habitat degradation.* Response: The Forest Service does not manage individual wildlife populations nor does it authorize hunting. Those are functions of the Colorado Division of Wildlife. The Forest Service addresses effects to habitat and species in sections 3.8 (Aquatic Wildlife) and 3.9(Terrestrial Wildlife). Design Criteria provide for surveys for certain species. The CDOW may conduct moose monitoring studies in the project area.
11-15	WSERC			Roads/Recreation/Noise	*Proposed Hightower project activities will result in significant impacts to hunting success and recreational use of the forest such as increased traffic, surface disturbance and noise from construction and operations.* Response: Safety on forest roads was identified as a key issue (Section 1.9). Noise and disruptions during hunting season are non-key issues (section 1.9). For traffic, see response to comment 5-1. For noise, see response to comment 2-3. For hunting, see comments 4-1 and 7-2.
11-16	WSERC			Cumulative	*Timing stipulations and the use of electronic telemetry monitoring systems, locating well pads .5 miles away from known nesting sites, restricting well site and access activity during the nesting season, and other*

				effects/wildlife/EMS	*similar actions are potentially effective mitigation measures. However, because cumulative adverse impacts to wildlife populations and habitat resulting from gas development can only be measured over time, monitoring and wildlife studies should be initiated now to measure the effectiveness of the proposed mitigation measures.* Response: Baseline information on habitat and populations was collected on TES, raptor nests, wetlands, and locations of plant communities during the summer and fall of 2006 and the summer of 2007. Pre-construction surveys for raptor nests will be conducted if construction is planned during the nesting season (see Design Criteria, Table 2.2.15). Cumulative effects to wildlife is addressed in section 3.8 and 3.9 for wildlife and any mitigation measures as need for this project will be identified.
11-17				Cumulative effects/Connected Actions	*Though not within the scope of the Hightower EA, WSERC believes that reasonably foreseeable cumulative impacts resulting from connected actions are critical issues that need to be addressed at this stage of gas development on Grand Mesa. WSERC contends that many of the conclusions in the Hightower EA predicated on analysis predicting small-scale impacts of short duration are problematic, but of greater importance is the very real likelihood of adverse cumulative impacts resulting from connected actions over the entire project area and the reasonable likelihood of gas development on a much larger scale on Grand Mesa. WSERC is greatly concerned about cumulative impacts stemming from FS connected actions that WSERC believes will lead to gas drilling throughout most of the proposed project area and across much of the northern flank and large swaths of the southern slopes of Grand Mesa.* Response: Cumulative effects from energy development is addressed for each resource in Chapter 3 of the EA. See also response to comment 12-2.
11-18	WSERC			Out of scope	*GMUG Oil & Gas Leasing Analysis of 1993 failed to anticipate the present level of gas activity expressed by levels of acres leased for gas drilling on the GMUG Forest. The number of acres under lease has grown exponentially, setting the stage for a widespread expansion of gas drilling. This scale of development, involving the leasing of more than 100,000 acres on the GMUG within the past 4 years, was contemplated but rejected in the 1993 Analysis as untenable. In fact, the trend forecast curve of cumulative drilling activity within the GMUG in the 1993 analysis shows the growth of drilling reaching a plateau soon after the year 2000. Clearly the 1993 analysis was wrong (1993 Analysis: E-5, E-22 and Section: Reasonably Foreseeable Development Scenario).* See Response to Comment 11-2a.
11-19	WSERC			Out of Scope	*CEQ regulations implementing NEPA explicitly recognize that circumstances may arise following the completion of an EIS that create an obligation for supplemental review. According to 40 CFR.1502.9(c)(1), a supplemental EIS is required when "there are significant new concerns bearing on the proposed action or its impacts."… Clearly, in the case of GMNF, there are circumstances contemplated but rejected in the 1993*

					EIS and new information now available that warrant environmental analysis well beyond that presented in the Hightower EA. Response: The "EIS" WSERC is referring to applies to leasing. Leasing analysis is outside the scope of this project as lands have already been made available for leasing and have been leased. See also response to comment 11-2a.
11-20	WSERC			Long term planning	*WSERC believes that within a decade, or sooner, highly intensive industrial activity will be occurring at a level heretofore unknown on GMNF. To avoid significant adverse environmental impacts as well as serious adverse impacts to human health, decisions need to be made now. These critical decisions will begin a process involving government, NGOs, and other affected stakeholders, leading to development scenarios that significantly reduce the level of impacts. Only such a process will enable FS to continue managing GMNF in ways that enhance biological diversity and provide a wide variety of recreational opportunities, as well as facilitate resource extraction.* Response: This is a position statement that does not require analysis.
11-21	WSERC			Out of Scope	*A new EIS should be written to replace the outdated and insufficient 1993 GMUG Oil and Gas EIS. (It is assumed that a new GMUG Resource Management Plan will be written following the final adoption of the new Forest Plan.)* Response: The "EIS" WSERC is referring to applies to leasing. Leasing analysis is outside the scope of this project as lands have already been made available for leasing and have been leased. See also response to comment 11-2a.
11-22	WSERC			Out of scope	*Following the precedent established by federal agencies in Utah and New Mexico, FS should exercise its post-leasing authority to attach No Surface Occupancy stipulations, where none currently exist, to leases that pose a risk to streams, wetlands, fens and critical wildlife habitat.* Response: This is not a issue considered in this analysis because it involves something that has already been decided. The federal oil and gas lease involved in the Hightower project (COC- 68792) was issued with stipulations consistent with the GMUG 1993 Oil and Gas leasing EIS and Record of Decision, and which includes a no surface occupancy stipulation for wetlands, riparian areas and flood plains. A lease is a contract between the federal government and the lessee, the terms of which cannot be changed after it is let.
11-23	WSERC			Operations/locations/vegetation	*Pad 21-12 should be eliminated to protect an aspen forest in addition to providing significant savings in disturbance from gathering pipelines and access roads. (Laramie Energy should easily be able to contact the same formation 21-12 would have drained by directional drilling from nearby pads 21-10 and/or 20-11.)* Response: The minimum number of well pads has already been considered (EA, Section 2.5). From a

					technically feasible perspective, the 21-12 pad is needed to reach the distances between down-hole required spacing of wells.
11-24	WSERC			Alternatives/operations	*FS should require Laramie Energy to bury water disposal lines in the same trench as the gathering lines to reduce truck traffic and eliminate the possibility of spills, as described in proposed Alternative 3.* Response: Alternative 3 responds to this issue (section 2.4).
11-25	WSERC			Operations/Frac Fluids/water quality	*BLM should require the use of Best Available Technology, which would include, but not be limited to, closed loop (pitless) drilling, product substitution (using non-toxic or the least toxic chemical mix in drilling and fracing), and the use of state-of-the-art control valves and pumps.* Response: The use of well designed, lined reserve pits (see Table 2.2.15) will result in similar protections to the surface as would a pitless drilling system. The design of fracing and completion fluids is usually held proprietary by the industry with regard to the percentage of chemicals used in a particular fluid. The BLM is able to require a complete list of all chemicals that are used with in the drilling and completion operations. See Appendix B for list of chemicals used in drilling, fracing and cementing.
11-26	WSERC			Air quality	*FS should require Laramie Energy to provide an estimate of the tonnage of VOC off-gassing for each of the facilities to be built.* Response: Effects to air quality are documented in Section 3.1. See also response to comment 2-4.
11-27	WSERC			Drilling Fluids/water	*FS should require Laramie Energy to provide the complete composition of the drilling muds, as well as the total volume and concentration of each chemical in the products used, and that this list be made available to the public.* Response: See response to comment 11-7.
11-28	WSERC			Operations	*FS should stipulate that infrastructure construction for Location 3 not commence until drilling is completed on Location 1 and a determination has been made regarding the quantities of producible gas, and that construction on Location 4 not commence until drilling is completed on Location 2.* Response: Section 2.2.4, Well Drilling and Completion discloses potential sequencing of project activities. If the company determines that a certain location does not hold potential, they may choose to de-mob from the pad and move to another drilling location in order to determine the extent of the reservoir and to provide the data needed by the company to determine the producible quantities of gas.
11-29	WSERC			Administr	*BLM inspectors should be present at each fracing operation.*

				ation	Response: There is no regulatory requirement for BLM to be present during fracing operations. See 43 CFR 3160 (Onshore Orders) and Federal Oil and Gas Royalty Management Act of 1982 Section 108 for inspection requirements. The BLM's policy is that, the Petroleum Engineering Technician will be present to to witness the running and cementing of surface casing, inspection of the well control equipment, once during drilling and again during completion operations. More or different types of inspections may occur depending on the well and resources involved.
11-30	WSERC			EMS	*A comprehensive peer reviewed monitoring system should be in place prior to any surface disturbance or drilling activity. The system would monitor impacts from gas drilling and production to surface and ground water, air quality, and pay particular attention to how chemicals are transported, stored, used, reclaimed and disposed.* Response: Per the Design Criteria (Table 2.2.15), EMS will be implemented which is a peer-reviewed monitoring system for some of the resources specified Baseline water, soil and noise measurements in the vicinity of the project area were collected in 2007 (project file). The Forest Service and BLM have various roles in administering activities approved in the oil and gas program (see 36 CFR 228, Subpart E for the FS, and 43 CFR part 3100 for BLM, and Federal Oil and Gas Royalty Management Act of 1982 Section 108). The FS inspects surface conditions to ensure that design criteria and mitigations identified in the EA and incorporated into the proponent's Surface Use Plan of Operations are a) implemented and b) effective. The BLM is responsible for petroleum engineering aspects of the project.
11-31	WSERC			Wildlife/EMS	*Wildlife monitoring should be initiated to measure the effectiveness of the proposed mitigation measures.* Response: See response to comments 11-14 and 11-30.
11-32	WSERC			Standards	*The Surface Operating Standards for Oil and Gas Exploration and Development (Gold Book) for reclamation should be incorporated into each APD.* Response: The Design Criteria (Table 2.2.15) includes Gold Book Standards, which are followed for all Oil and Gas Projects on FS or BLM land.
11-33	WSERC			Bonding	*Real performance-based bonds, taking into account direct and indirect costs, should replace blanket bonding as financial assurance to ensure complete surface restoration.* Response: For this project the FS is exercising its right to require a Surface Reclamation Bond (Section 2.2.13. See also response #13-31.
11-34	WSERC			Out of Scope	*FS and BLM should convene a stakeholders consortium that regularly meets to discuss and make recommendations regarding the various phases of gas development on GMNF.*

					Response: This is a statement of position that does not require analysis.

12-1	High County Citizens Alliance (HCCA) et al	3/8/07	3/8/07	Leasing analysis	*1993 Oil and Gas EIS and Forest Plan EIS fail to adequately analyze reasonably foreseeable, connected and cumulative impacts of actions proposed for Hightower project. Gas boom occurring in western Colorado results in the number of wells already approved, together with this proposal, to double the level of development anticipated in the 1993 Oil and Gas Leasing EIS, and therefore use of this EIS underestimates the cumulative impacts of leasing and development. This is in violation of NEPA and NFMA due to a failure to analyze the impacts of this project and cumulative impacts in context with other regional development. We request the forest to complete a new Oil and Gas Leasing EIS prior to considering any further leasing or APD approval.* Response: See response to comments 11-2a, 13-10 and 13-19.
12-1a	HCCA et al			RFD	*The addition of 32 more wells would far exceed the number of wells forecast for the GMUG. Using this outdated forecast as a basis for the Hightower EA causes the required Oil and Gas EIS programmatic analysis to underestimate the cumulative impacts of leasing and development. Should the GMUG choose to employ the 1993 RFD and Oil and Gas EIS as the basis for a decision to approve the Hightower MDP, NEPA and NFMA will have been violated through a failure to adequately analyze the impacts of the project and cumulative impacts of the project in context with other regional development.* Response: See response 11-2a. This is an issues that does not require analysis because it involves an issue that has already been decided. The Table 1 at the end of these responses is an excerpt from HCCAs letter, with updated GMUG oil and gas APD and project approval activity, and disturbance estimations from each of the approved projects or activities. These data demonstrate that existing approvals for oil and gas exploration/development amount to about 10% of the disturbance estimated in the oil and gas leasing EIS. Further, actual on-the-ground disturbance to date is less than 1% of the estimate in the Oil and Gas leasing EIS. Therefore, the cumulative effects from a programmatic standpoint is still within the levels estimated in the leasing EIS. This project NEPA and documentation, including cumulative effects fulfill the agencies obligation under various laws.
12-2	HCCA et al			Cumulative Impacts/ Connected actions	*We request the impacts analysis for this project analyze impacts resulting from the connected Hightower and Hells Gulch projects on the GMUG and White River National Forests, the pipeline connecting them, and other connected and cumulative actions in the area. Hells Gulch and Hightower projects are 3 miles apart, are located in the same forest and vegetation types, provide habitat for the same game and on-game animal species, recreationists travel roads and trails within sight and sound of both project areas, and resources such as air quality and soundscapes link these two projects. The pipeline proposed to connect the Hells Gulch and Hightower wells further states the connectedness of these actions.*

					Response: By definition, connected actions are those that automatically trigger other actions, cannot or will not proceed unless other actions are taken previously or simultaneously, are interdependent parts of a larger action and depend on the larger action for their justification. Based on this definition, the GMUG has not identified that the Hightower and Hell's Gulch 2 proposed action on the White River NF are connected actions because they do not automatically trigger one another, they could proceed independently of one another regardless of the timing of implementation of the other, and they are not interdependent on each other in order to be individually viable. The GMUG has ascertained that should the Hightower project not be approved, that operations in Hells Gulch 2 would proceed, and vice versa. In addition, based on knowledge of the gas resource, the GMUG does not believe connected actions are present for the following reasons: 1. Natural gas activity in this area of the GMUG is at the outset exploratory, as the Hightower project is not proposed in a recognized gas field and ultimate production may or may not occur (dependent on the outcome of exploration and initial testing). 2. Our knowledge of gas occurrence in this portion of the Piceance Basin supports that the gas is in stratigraphic accumulations (which are types of geologic units (also called reservoirs) capable of trapping oil or gas due to changes in porosity and permeability, or to the termination of the reservoir bed by thinning or tapering out ("pinching out"). These accumulations are usually limited laterally by the discontinuous nature of the rock layers, therefore it cannot be assumed that the two exploration/development proposals are accessing the same gas accumulation, or if they will find gas in producible quantities at all. 3. The projects are occurring in different watersheds and present differing ecological conditions. The effects analysis in Chapter 3 of the EA covers direct, indirect and cumulative effects by resource as applicable to the Hightower project.
12-3	HCCA et al			Cumulative Impacts	*Large areas of the GMUG National Forest, White River National Forest, Bureau of Land Management and private lands in the region are being actively leased and developed for natural gas development and exploration. The scoping notice does not sufficiently discuss this regional energy boom nor does it identify the cumulative impact analysis area. This CIAA must be sufficiently large to capture the combined effects of the Hightower project with other regional development.* Response: See response to comment 12-2. Cumulative effects analysis areas vary by resource; there is no

					Cumulative Effects Area (CEA) that works for all resource areas. See Chapter 3 of the EA for the CEA for individual resources.
12-4	HCCA et al			Effects Analysis	*We request that any impact analysis include greater detail on all affected resources and resource uses within and surrounding the proposed project area.* Response: See response to comment 11-2. Chapter 3 of the EA covers effects analysis by resource area as applicable to the Hightower project.
12-4a	HCCA et al			Forest Plan	*The EA should detail how this proposal is in compliance with management area direction and all prescriptions of the 1983 GMUG Land and Resource Management Plan.* Response: Please refer to Section 1.6 of the EA.
12-4b	HCCA et al			Wildlife/ recreation	*The EA should describe and analyze effects to habitat, animal populations and hunting. Large numbers of hunters in Unit 421 points to significant impact to hunting success and recreational use of the forest from project activities. EA should examine traffic, surface disturbance and noise from construction and operations and provide evidence that proposed mitigations will protect habitat and hunting opportunities.* Response: See Section 2.2.15 of the EA for Project Design Criteria, Section 3.9 for effecst to wildlife, Transportation Section 3.12. See also responses to comments 4-1 and 7-2 for hunting and 5-1 for traffic.
12-4c	HCCA et al			Wildlife	*EA should completely describe and analyze effects to habitat, including elk winter range. We recommend the EA analyze timing and access requirements that would prohibit all oil and gas related activities in elk winter range and concentration areas between the close of the last hunting season and April 30.* Response: See Wildlife Section 3.9.
12-4d	HCCA et al			Roads	*We request that new road access be limited to administrative use only* Response: See response to comment 7-7
12-4e	HCCA etal			Wildlife	*EA should provide quantitative and geographic distribution of the magnitude and location of the impacts to deer and elk associated with oil and gas development, including population level consequences in regards to direct and cumulative impacts. It should also include projections on future levels of impact to deer and elk population and habitats, and a spatial analysis The analysis should include disturbance buffers around roads and well sites and show the overlap of these buffers with various types of big game habitat.* Response: See Section 3.9, Wildlife.
12-4f	HCCA et			Wildlife	*EA should describe habitat and use of the Hightower area by moose and potential impacts to this species*

	al				*from the proposed action* Response: See Section 3.9, Wildlife.
12-4g	HCCA et al			Wildlife	*A thorough analysis of cumulative impacts is necessary to determine the project's potential impact on lynx viability. The analysis must be spatially explicit and conducted on a landscape scale. The GMUG should include actions recommended under the Lynx Conservation Assessment and Strategy (LCAS) including:.* *-Map oil and gas production and transmission facilities,…..to assess cumulative effects* *-Develop, implement a plan to protect linkage areas…from activities that would create barriers to movement* *-Evaluate importance of shrub-steppe habitat in providing connectivity between habitat blocks* *-Develop, implement mgmt prescriptions to protect/enhance key linkage areas* *-Map mid to late seral shrub habitats and assess landscape level habitat fragmentation* *-Determine where high road densities coincide with lynx habitat and prioritize seasonal road restrictions or reclamation in these areas* *-Minimize road building on ridgetops or area identified as important for lynx habitat connectivity.* *-Locate trails and roads away from forested stringers* *-Limit public use on temporary roads constructed for timber sales. Design new roads…for effective closure* *-Minimize snow compaction in lynx habitat.* -Map and monitor location and intensity of snow compacting activities that coincide with lynx habitat… Response: The project area is not located in lynx habitat, however it is a lynx linkage area and the LCAS measures pertaining to lynx linkage areas are addressed in the Biological Assessment (project file), and discussed in Section 3.9 of the EA.
12-4h	HCCA et al			Wildlife	*Nests have been observed in section 21 for purple martin. Drilling should not be allowed in section 21 from May 20 through August 20. Flammulated owl nesting has been observed 3 miles north of the project area. Raptor monitoring/buffering should include flammulated owls and American kestrel.* Response: Design Criteria (EA Table 2.2.15) display the applicable wildlife surveys needed. Section 3.9, Wildlife inlcudes disussion of applicable avian species. American kestrel are not special status species.
12-4i	HCCA et al			Wildlife	*Describe the habitat and potential impacts to all management indicator species identified in the 1983 GMUG LRMP present in the Hightower area. Describe the habitat and potential impacts to other species including black bear, mountain lion, turkey and Colorado River Cutthroat Trout.* Response: Effects to MIS as currently identified in the Forest Plan in the Hightower project area are summarized from the MIS report, and found in the EA, Sections 3.8 and 3.9.
12-4j	HCCA et al			Roadless	*The RARE II Hightower Inventoried Roadless Area sits just east of the lease. Analysis of roadless area characteristics should be included in the EA and project activities designed to preclude the possibility of*

					impacts to this roadless area. Response: Analysis of roadless area characteristics are outside the scope of the proposed action because no activities are proposed in the IRA. Further, the Forest Service is currently managing IRAs according to the Roadless Area Conservation Rule of 2001 (RACR) which prohibits road construction or reconstruction on mineral leases issued after January 12, 2001. The lease involved in the Hightower project was issued in 2006, and would therefore be subject to this prohibition.
12-4k	HCCA et al			Water	*EA should identify all uses of ground and surface waters within the potentially affected drainages and potential effects to water quality and water uses from project activities. EA should identify site specific BMPs employed to control runoff and sedimentation caused by construction and/or operations as well as how ground water quality will be protected.* Response: Effects to surface and ground water were identified as issues to be addressed in the analysis (Section 1.9). Design Criteria (Table 2.2.15) include BLM and COGCC rules for protecting ground water, as well as control of surface runoff and sedimentation. Effects to water resources are discussed in the Water Resources section of the EA (3.4).
12-4l	HCCA et al			Wetlands	*EA should provide detailed maps and descriptions of wetlands and riparian areas within the proposed project area and how development activities might impact these resources. The proposed waivers of NSO stipulation is contrary to protection of resources and the EA should consider alternatives that would not require a waiver.* Response: To clarify, the proposed action includes granting an exception (a one time, case-by-case relief from a lease stipulation) as described in Section 2.2.17, rather than a waiver (permanent removal of a lease stipulation). Figures 2.3 and 2.4 show the locations of stipulations for NSO on wetland/floodplain/riparian areas under Alternatives 2 and 3, respectively. Design Criteria (Table 2.2.15) include the FS Watershed Conservation Practices Handbook BMPs.
12-4m	HCCA et al			Water Disposal	*EA should include explanation of the quantities of water to be used and disposed of during all phases of exploration, development and operations. Include discussion of the source of the water to be used. A full range of alternatives for the disposal of produced water should be presented and analyzed.* Response: See response to 12-4k and Section 2.2.6 for water source used for drilling, dust abatement and hydrostatic testing of pipelines. Alternative 2 includes storing water produced water at each well site, and hauling from each drilling location, while Alternative 3 includes transporting water via buried pipeline to a central facility close to the forest boundary and hauling water to a commercial disposal facility from that point. Use of a disposal well was also considered as an alternative but dropped from further analysis (section 2.5).
12-4n	HCCA et			Livestoc	*EA should identify effects on livestock movement on/off the allotment, removal of forage, and impacts on*

	al			k mgmt	*water sources used by livestock.* Response: Livestock movement was identified as an issue to address in the analysis (Section 1.9). Design Criteria include on/off dates and mob/de-mob activities. Section 3.7 discusses rangeland resources.
12-4o	HCCA et al			Recreation	*EA should identify the levels of use for all forms of dispersed and developed recreation opportunities including hiking, mountain bike riding, horseback riding, snowmobiling, skiing, vehicular use and camping. The EA must analyze the effects to all forms of recreation from gas development and ongoing operations due to noise, dust, traffic in particular. The EA should discuss how recreation will be effected and how it can continue to take place in this area without undue impacts.* Response: Effects on recreation are disclosed in Section 3.11 based on current recreational opportunities in the project area, and comparative use levels. It also includes analysis of noise for various phases of project activities. Effects on road use are in the transportation section 3.12.
12-4p	HCCA et al			Air Quality	*EA should describe baseline air quality within the region and describe how air quality will be monitored from this and connected actions. EA should detail how project activities will be designed to minimize adverse impacts to regional air quality with particular emphasis on preventing significant deterioration to visibility in nearby Class I areas.* Response: See response to comment 2-4. Section 3.1 discusses effects to air quality.
12-4q	HCCA et al			Air Quality	*EA should describe and analyze how the Hightower project will comply with requirements for the Prevention of Significant Deterioration under the Clean Air Act. EA should ensure that emissions from the proposed wells are aggregated with interrelated and adjacent compressor stations and/or other developments owned and or under common control by Laramie Energy to ensure compliance with PSD regulations.* Response: See response to comment 2-4 and 12-4p.
12-4r	HCCA et al			Noise	*EA should include baseline monitoring data on existing ambient noise levels and what methods will be used to monitor noise levels from the proposed project. The scope of this increased noise on the forest must be described in the EA and alternatives to minimize noise levels should be presented.* Response: See response to comment 2-3. Recreation section 3.11 discusses baseline noise sampling and levels of noise expected by project activity.
12-4s	HCCA et al			Timber/ vegetation	*EA must provide analysis of the impacts to wildlife, soils, water quality and other resources of removing or disturbing this amount of timber and vegetation, and as well as future vegetative removal associated with reasonably foreseeable future actions.* Response: Analysis of Wildlife is given in Section 3.9, Soils is preseented in Section 3.3, Vegetation in

					Section 3.6, Water Reosurces in Section 3.4. Each reosurce section contains a discussion of cumulative effects.
12-4t	HCCA et al			Soils/ geology	*Detailed soils and geologic baseline analyses should be conducted for all project areas proposed for disturbance or potentially affected by surface runoff. These baseline studies should be used to optimize infrastructure locations rather than determining what types of complex mitigations might be employed.* Response: During field layout, the Forest Service carefully review infrastructure locations (see Section 2.5) to locate facilities in optimal locations. Design Criteria (Table 2.2.15) were also inlcuded to address some site-specific issues. See Geology and Geologic Hazards section 3. 2 and Soils section 3.3 for a discussion on effects to these resources.
12-4u	HCCA et al			Heritage	*Cultural resource surveys should be used in advance to determine where development activity might be appropriate and the project should then be designed to protect any archaeological resources discovered in the course of the survey.* Response: Section 3.10 discloses effecst to cultural reosurces. Design Criteria (Table 2.2.15) require Class III cultural resources surveys prior to construction and a procedure to follow should a site be found.
13	Center for Water Advocacy (CWA)				**NOTE: The letter from the Center for Water Advocacy references several attachments that were not received by the Forest Service when the comment letter was received during the comment period.**
13-1	CWA	3/8/2007	3/8/07	Regulatory framework	*Concerns for compliance current land management plans, NEPA analysis complete lack of any analysis related to future oil and gas development, compliance with the ESA, NFMA, NEPA, and related laws.* Response: The regulatory framework under which this project is being evaluated is in Chapter 1 of the EA. ESA compliance is documented in Aquatic Wildlife section 3.8 and Wildlife section 3.9. This EA process fulfills the NEPA obligation.
13-2	CWA			NEPA process	*FS must satisfy its independent duty under NEPA to prepare a site-specific analysis of the environmental impacts of the Project. The Scoping Document, however, does not address how many wells or where they may be, so it is unclear if this is attempting to truly analyze the impacts FS assumes would be built.* Response: The scoping document detailed the number of wells, and included the legal description of facilities along with location maps (project file). The scoping effort is part of the NEPA process. Chapter 3 contains a description of the affected environment and environmental consequences for all alternative, by resource. This EA analysis fulfills the FS obligation under NEPA.
13-3	CWA			NEPA	*Agencies must conduct a sufficiently site-specific NEPA analysis before leasing.* Response: This comment is outside the scope of the proposed action, which is to approve activities on an

					existing lease. This is not a leasing analysis, it is an analysis that evaluates a site-specific project proposal. See also response to comment 11- 2a.
13-4	CWA			Leasing analysis	*Take a "hard look" at the environmental impacts of reasonably foreseeable post-leasing oil and gas development <u>before</u> any action, that will lead to leasing.* Response: This comment is outside the scope of the proposed action, which is to approve activities on an existing lease. This is not a leasing analysis. See also response to comment 11-2a and 12-1a.
13-5	CWA			Direct, indirect and cumulative effects	*NEPA requires the Forest Service to consider cumulative environmental impacts in its environmental analyses.* Response: The effects analysis in Chapter 3 addreses direct, indirect and cumulative effects for each resource area.
13-6	CWA				*Comments about Bull Mountain Pipeline DEIS* Response: This comment is not directly related to the Proposed Action because it references a separate project.
13-7	CWA			Cumulative effects	*The FS must analyze the broader and long term impacts of the Project including future leasing, well construction and other oil and gas development in order to be consistent with the mandate of NEPA.* Response: See Table 3.0 which lists past, present and foreseeable actions in or near the project area. Each reosurce section in Chapter 3 documents cumulative effects of past, present and foreseeable activities relevant to that particular reosrce areas cumulative effects area.
13-8	CWA				*Agency's determination that there is no way it can predict whether the preferred alternative will result in the construction of additional wells because these are "business decisions" that Laramie Energy will make independent of the ability to remove gas, is arbitrary based on the agency's own statements that such development is, not only reasonably anticipated, but highly likely* Response: Chapter 1 of the EA acknowledges the basic exploratory nature of this project. To the extent reasonable assertions can be made, the analysis in Chapter 3 includes foreseeable development in the cumulative effects discussion.
13-9	CWA				*Comments about emissions from Bull Mountain pipeline project.* Response: This comment is not directly related to this Proposed Action and therefore does not require analysis.
13-10	CWA			Leasing analysis	*The GMUG forest plans and environmental impact statements never planned for or analyzed the proposed future leasing and related oil and gas development, the Forest Service is moving ahead with the Project, without first adequate completing the NEPA process.*

					Response: The GMUG completed an Oil and Gas Leasing EIS, and issued a Record of Decision in 1993 that amended the GMUG Forest Plan. This analysis and Decision identified lands to be made available for leasing, and the lease stipulations that apply to each lease. See Response to Comment 11-2a.
13-11	CWA				*Comment about Bull Mountain Pipeline DEIS* Response: This comment is not directly related to the Proposed Action and therefore does not require analysis.
13-12	CWA			Proposed Action	*Under the Preferred Alternative the FS would authorize the irretrievable commitment of resources that will lead to development of gas resources, including the development of wells upstream of the Project and throughout the GMUG National Forests. Under the NEPA documentation for the Project the Forest Service's analysis must examine the gas development that this project will have.* Response: This project is for a specific proposed action for exploration and potential production from a specific leasehold as described in Chapter 1 of the EA. As this project is exploratory in nature and uncertainty exists as to whether this area will have gas in producible quantities, it would be speculative to try to predict future levels of activity in the area. Table 3 displays past, present and foreseeable actions in the vicinity of the project, including energy related projects that have either undergone a recent environmental analysis or are currently being analyzed. The commitment of resources is disclosed in the EA, Chapter 3.
13-13	CWA			Irretrievable commitment of resources	*The construction of the infrastructure analyzed in the EA should include the irretrievable commitment of resources for oil and gas development of the entire GMUG National Forests.* Response: This is a project level decision. Hence the required disclosure of resource commitments in Chapter 3 will be germane and relative to the scope of this proposed action, and purpose and need.
3-14	CWA			Leasing analysis	*[B]ecause the GMUG forest plans and environmental impact statements never planned for or analyzed the currently experienced and anticipated leasing related activity, the Forest Service may not move ahead with the Project without first completing the NEPA process in a manner that sufficiently complies with federal law.* Response: Regarding leasing, see response 11-2a. The NEPA process for this proposed action is completed through preparation of this EA.
13-15	CWA			Cumulative effects	*Under the Project, therefore, the Forest Service may not commit resources in anticipation of additional oil and gas leases outside of those covered in the Project, it must study the impacts of the Project with all "reasonably foreseeable future" actions related to oil and gas on the Forests.* Response: This EA is prepared to address a specific a development proposal on a specific leasehold as described in Chapters 1 and 2. The effects analysis in Chapter 3 addresses cumulative effects in terms of all

					reasonably foreseeable future actions germane in the cumulative effects areas for each resource.
13-16	CWA				*Comment about a pipeline* Response: This comment is not directly related to the Proposed Action and therefore does not require analysis.
13-17	CWA				*GMUG Forest Plans and EISs never planned for or analyzed the development that would occur as a result of or in conjunction with, the Project. As a result, authorizing the pipeline without producing sufficiently analyzing the broader and future development that will result from the Project would violate both NFMA and NEPA. The current O&G GMUG Forest Plan fails to address recent changes taking place on the GMUG Forests due to anticipated and dramatic amounts of oil and gas development on both Forests.* Response: The comment appears to relate to a pipeline project, therefore this comment is not directly related to the Proposed Action. Regarding the part of the comment regarding oil and gas leasing analysis, see response 11-2a and 12-1a.
13-18	CWA			Leasing analysis	*Oil and gas leasing and development is blanketing the region around the GMUG National Forests. The BLM's geocommunicator database, shows that the Forest Service has already leased significant areas of the GMUG National Forests. Three hundred square miles of the GMUG National Forests have already been leased to oil companies, and proposals for more leasing continue to come in.* Response: This comment is not directly related to the Proposed Action because the decision to lease was already decided under the 1993 GMUG Oil and Gas Leasing Analysis EIS.
13-19	CWA			RFD	*Inadequacy of GMUG Oil and Gas Amendment and RFD will be exceeded.* Response: See response to comment 11-2a and 12-1a.
13-20	CWA			Leasing analysis	*NEPA similarly requires that the Forest Service prepare an EIS for that revision or amendment that takes a hard look at the indirect, direct, and cumulative effects that increased development would have on the forests' resources before allowing any further leasing to proceed. All gas leasing and development on the GMUG National Forest, for example, is subject to the agency's Oil and Gas Leasing EIS and tiered to the National Forest's Revised LRMP. The associated cumulative impacts analysis is based on a RFDS that predicted 23 gas wells (Forest-wide) between 1993 and 20081 The RFDS was based on obsolete drilling rates, estimates of geological potential, and economic analyses.* Response: See response 11-2a. To clarify, the comment does not accurately bring forward the RFD in the GMUG Oil and Gas Leasing EIS.
13-21	CWA			RFD	*The Forest Service must produce reasonable RFDS forecasts to incorporate current price data, technology, an*

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					exploration projections. Current RFDS forecasts are inaccurate and obsolete and basing management on such analyses breaches the Forest Service's fiduciary duty to the public and constitutes an arbitrary and capricious management decisions affecting these public lands. Response: See comment 11-2a.
13-22	CWA			BLM RMPA /EIS	*Comment providing information about BLM RMPA/EIS.* Response: This comment is not directly related to the Proposed Action and therefore does not require analysis.
13-23	CWA				*Comment providing information from Wilderness Society and BLM references (not provided).* Response: This is comment is of a gerneal nature and does not require analysis.
13-24	CWA			Roads	*Roads and Ecological Degradation: Roads introduce and provide an ongoing (usually permanent) vector for propagation and proliferation of noxious, invasive weeds, pathogens, and pests. They serve as mortality sinks for wildlife and serve as ongoing sources of sediment loading to water courses and can thus deteriorate and destroy riparian and aquatic habitat.* Response: Effects of using existing roads and constructing new roads are identified as issues (section 1.9). Several Design Criteria (Table 2.2.15) address noxious weed control, the requirement to include a traffic safety plan and structural design plans for road construction or re-construction, and measures to contain and stabilize sediment in disturbed areas. Effecst to Wildife are given in Section 3.9, and Transportation in Section 3.12.
13-25	CWA			Wildlife	*Roads fragment habitat, contribute to genetic deterioration of wildlife, demographic stochasity and threaten biological diversity.* Response: Road and associated traffic impacts are discussed in Wildlife, Section 3.9.
13-26	CWA			Wildlife	*Habitat fragmentation associated with the Project and other energy development projects is particularly deleterious in the context of rapid climate change. If organisms are prevented from migrating to track shifting climatic conditions, and cannot adapt quickly enough because of limited genetic variation, then chances for extinction increase.* Response: Climate change and extinction is not considered in this analysis because it is out of the scope of the Proposed Action.
13-27	CWA			Decision framework	*The preferred alternative must protect ecological values* Response: This is part of the Forest Service decision framework and legal obligation. See EA, Chapter 1.
13-28	CWA			IRA	*The Forest Service is building new roads including temporary roads as discussed above because the temporary roads listed in the preferred alternative are within the definition of prohibited roads in the 2001*

					Roadless Rule Repsonse: Neither the existing NFSRs or the proposed access roads lie within an IRA. A map showing location of IRA is located in the project file. See response to comment 12-4j.
13-29	CWA			Authorities	*NEPA procedures must be followed* Response: This EA process fulfills the FS obligation under NEPA. See EA, Chapter 1.
13-30	CWA			Road Use	*Roads generate ongoing maintenance costs, which Congress and the USFS Headquarters have proven unwilling and/or unable to fund. The Forest Service, therefore, must provide the present road maintenance backlog in the planning area and whether the public will pay ongoing direct and indirect costs of roads associated with this decades-long project.* Response: The proponent will be required to maintain the roads per the terms of a Road Use Permit, commensurate with their level of use (See the Design Criteria in Table. 2.2.15).
13-31	CWA			Bonding	*Identifies need for reclamation bond* Response: The need for a reclamation bond is included in the EA, Section 2.2.13.
13-32	CWA			General effects analysis	*Projects such as that proposed here cause permanent ecological damage and social costs that are typically unaccounted for—for which the public is rarely compensated. We respectfully request that the Forest Service study ecological and social costs to a higher degree than that which presently informs the Forest Service's oil and gas development projects (as evidenced by the absence of an updated and holistic cumulative impacts analysis for oil and gas development in the document). In addition, the document must be candid about the costs and benefits of this and other such projects, so that members of the public may provide informed comment to the agency.* Response: Effects of the project are disclosed in the Socioeconomics section of the EA (3.14).
13-33	CWA			Regulatory authority	*Asserts the project violates the Multiple Use Sustained Yield Act of 1960.* Response: Regulatory authorities for this project are discussed in Chapter 1. The referenced Act specifically states "Nothing herein shall be construed so as to affect the use or lands or administration of the mineral resources of National Forest lands …" (PL 86-517, 74 Stat. 215; 16 USC 528, Sec. 1).
13-34	CWA			Wildlife	*The scoping document fails to mention effects to moose habitat on GMNF.* Response: Effects to moose are addressed in Section 3.9.
13-35	CWA			Proposed Action	*Comment about 40 acres spacing in proposed action* Response: The Proposed Action (Chapter 1 and 2) describes that this project is initially exploratory, thus the downhole spacing was designed to reflect this exploratory nature.
13-36	CWA			Reasonably Forese	*[T]he COGCC generally believes that 10 acre downhole spacing is more practicable downhole spacing.* Response: The Forest Service acknowledges that the COGCC approved 10 acre downhole spacing for this

				eable Future Actions	lease (EA, Table 3), however the approval includes retaining surface occupancy at no less 40 acres. As this project is exploratory at the outset, it is speculative that infill drilling will occur. However, the Forest Service has included this action as a reasonably foreseeable future action (Table 3) for cumulative effects analysis (see Chapter 3). Further, as manager of the mineral estate, the BLM will have ultimate decision on what downhole spacing is appropriate to recover the mineral resource. At this point there are insufficient data to assess reservoir characteristics.
13-37	CWA			Cumulative effects	*Infill drilling details based on 10 acre downhole spacing are not discussed.* Response: See response to 13-36.
13-38	CWA			Mitigation Measures	*Forest Service must analyze mitigation measures Under NEPA* Response: The scoping document included a list of Design Criteria (Table 2.2.15) that are protective measures used in designing the project to minimize environmental effects. The effects analyses in Chapter 3 identify any mitigations that are needed to offset undesirable effects.
13-39	CWA			Wildlife	*Scoping Document completely fails to mention that the project will effect existing moose habitat on the Grand Mesa National Forest near Vega Reservoir which must be part of the NEPA documentation for the Project* Response: The scoping document identifies that affects to wildlife and their habitats are an issue to be addressed in the EA. See EA, Table 1, and the Wildlife section in Chapter 3.
13-40	CWA			Wildlife	*Impacts of Canada lynx and compliance with ESA* Response: The scoping document and EA identify effects to TES species as an issue to be addressed in the EA (section 1.9). The FS complied with the ESA by completing a Biological Assessment and has consulted with the FWS (see Section 3.9).
13-41	CWA			Wildlife	*United States Forest Service also has management responsibility and authority over conservation efforts for these [MIS] species.* Response: The scoping document and EA identify effects to MIS from project activities as an isue to be addressed in the EA (1.9). Several Design Criteria for wildlife protection are listed in Table 2.2.15. Refer to Aquatic Wildlife (section 3.8) and Wildlife (section 3.9) for a discussion of effects on MIS species.
13-42	CWA			Wildlife	*The Land and Resource Management Plans for the Forest Service were promulgated under the 1982 rules, such rules clearly apply to management of MIS in relation to the Project. Further, the 1982 rules require the Forest Service to monitor the "[p]opulation trends of the management indicator species" and determine "relationships to habitat changes.* Respons: MIS are analyzed in Sections 3.8 and 3.9 of the EA. The analysis follows current agency policy

13-43	CWA			Wildlife	*The MIS List Under the Project Must Designate MIS for Several Important Cover Types on the GMUG: The Forest Service must study MIS species including: ponderosa pine, mixed conifer, Engelmann spruce-subalpine fir (especially late successional stands in this community), aspen, snags/down wood, low and mid elevation grass/forb, low/mid/high elevation riparian area vegetation, Douglas fir, fen, and cliff communities.* Response: See response to comment 13-42
13-44	CWA			Wildlife/Roadless	*The Forest Service's Must Analyze Impacts on Core Habitat and Migration Corridors and Connectivity.* *The Forest Service must analyze the preferred alternative's planned road building, pipeline construction and utility corridor maintenance on the spatial and temporal significant ecological impacts of crossing three unique unroaded areas.* Response: The project area is not in an area that is considered unroaded. Connectivity is discussed in regards to Canada lynx in the BA (Wildlife section 3.9).
13-45	CWA			Wildlife	*This concern is best illustrated when one overlays maps from the DOW Natural Diversity Information Source Maps of Sage Grouse (Attachment 9) and Elk habitat (Attachment 10) with the map of oil and gas activity for the GMUG National Forests (Attachment 3) indicating the potential conflict that such development will have on such habitat.* Response: There is no sage grouse population in the Hightower project area. AS this comment is general in natuer, it does not require further analysis.
13-46	CWA			NEPA	*The Forest Service's mandate to provide adequate environmental analysis comes from the NEPA requirement that the Forest Service to take a "hard look" at the direct, indirect, and cumulative impacts of its decision on the wilderness resource.* Response: The preparation of the EA and the analysis therein fulfills the NEPA obligation. The project area is not within a designated wilderness area. See Section 1.6 of the EA.
13-47	CWA			Roads	*The Forest Service must adequately analyze the impacts of roads in the Preferred* Response: Effects from use and construction of roads were identified issues to be addressed in the EA (section 1.9). The Transportation section (3.12) describes existing use and condition of project area roads and existing traffic levels.
13-48	CWA			Water resources	*The EA fails to provide whether all of the aforementioned drainages contain intermittent or perennial streams . This ignores that fact that, where roads exist in watersheds, there will always be sediment loading to stream The Forest Service, however, fails to list what the harm will be to the greater Alkali and Divide Creek Watersheds including their aquatic and riparian components or on the downstream systems as a result of implementation of the preferred alternative. Similarly, the preferred alternative lacks adequate discussion of how the project will mitigate harm to these watersheds, systems and components.*

					Response: The geographic area referenced in the comment lies outside of the cumulative effects areas analyzed for water resources or soil for the Hightower project, therefore it is not relevant to this decision and does not require further analysis. Effects of the project on water resources in the Hightower project area are in Section 3.4
13-49	CWA			Water resources	*Forest Service must adequately address cumulative watershed impacts or how the preferred alternative and its direct and cumulative impacts will comply with watershed conservation standards including section 313 of the Clean Water Act which requires federal to comply with water quality standards in they are "engaged in any activity resulting, or which may result, in the discharge or runoff of pollutants.* Response: Ground water and surface water quality were identified as issues to address in the EA (section1.9). Several Design Criteria listed in Table 2.2.15 were built into the action alternatives to protect water quality. The Proposed Action was designed using guidance from the FS Region 2 Water Conservation Practices Handbook. Cumulative effects on watershed resources are discussed in the Water Resources section (3.4).
13-50	CWA			Water resources	*The Forest Service must Mitigate Impacts to Water Quality from Roads Under the Preferred Alternative* *The Forest Service admits that the planning area is already affected by impacts to water quality due, in part to oil and gas development that already exists there. The preferred alternative must not include activities that will exacerbate these impacts. The Forest Service also must list how it will mitigate the impacts of the preferred alternative on water quality impacts already taking place within the planning area.* Response: See response to comment 13-49.
13-51	CWA			Cumulative effects	*NEPA requires that the Forest Service take a "hard look" at the direct, indirect, and cumulative impacts of its decision on the wilderness resource* Response: See response 13-46.
13-52	CWA			Wetlands	*The Forest Service must Adequately Analyze the Impacts of Roads in the Preferred Alternative on Wetland's and Riparian areas. The preferred alternative in the EA must list how it will mitigate impacts to water quality and wetlands.* Response: See response to comments 13-4 and 13-49. Effects to water quality from roads is analyzed in Water Resources section 3.4
13-53	CWA				*In implementing the alternatives in the EA, the Forest Service must take an integrated, watershed approach in analyzing the significant values present in the planning area that are impacted by the Project and utility corridor. Given the widespread ecological problems the Forest Service has documented across this landscape, any new plan must be accompanied by a protective level of utilization and other mandatory, measurable use standards. This should include mandatory, quantifiable standards for riparian area use, such as bank damage/stability standards, width-to-depth ratios, and the use of these standards to mitigate pipeline and corridor construction and maintenance when sensitive areas are threatened.*

					Response: Content of comment is not relevant to the Proposed Action therefore does not require further analysis.
13-54	CWA			watershed	*The Forest Service is subject to the requirements of the Clean Water Act (CWA). The primary cause of water quality degradation on the public lands, including those within the planning area, is pollution from nonpoint sources. The evidence linking road building and maintenance to water quality problems is overwhelming and conclusive. The Forest Service must insure that its preferred alternative approach to listed water bodies without approved TMDLs does not lead to continuous violations of the CWA. In fact, State of Colorado and Forest Service have entered into a Memorandum of Understanding (04-MU-11020000-029 which develops the understanding between the State of Colorado and the Forest Service that provides for the cooperation on water quality issues and the use of agreed upon Best Management Practices to protect water quality and quantity on Forest Service lands. Road building and maintenance of existing roads adjacent to water quality limited streams may violate the CWA's requirement that federal agencies must adhere to state water quality standards to the same extent as nongovernmental entities.* Response: See responses to comments 13-48, 13-4, and 13-50. Many of the Design Criteria in Table 2.2.15 are for the purpose of minimizing erosion from both point and non-point (i.e., roads) sources, and have construction specifications for roads. See EA, Section 3.4.
13-55	CWA			Soils	*The Forest Service must provide how the Forest Service will prevent soil compaction in these soils types and, if compaction cannot be avoided, how permeability will immediately be restored. Where project-related compacted soils have yet to be restored and are exposed to any precipitation events, areas immediately downstream of compacted areas must be monitored for gully initiation and immediately restored to prevent further unraveling of soil horizons. Further, all gas development activity related to or induced by this project should comply with Storm Water Discharge permit requirements and best management practices as prescribed by the Forest Service.* Response: Effects to soils were identified as a non-key issue to be addressed (section 1.9). Design Criteria require topsoil stockpiling, re-seeding and mulching and maintaining in a vegetated condition until needed for reclamation. Design Criteria for reclamation include stabilizing disturbed areas during and after construction activity to control erosion and sedimentation, re-seeding as soon possible, controlling weeds and monitoring re-vegetation success. See also Soils section 3.3 of the EA.
13-56	CWA			Water rights	*The Forest Service lacks Information on Water Rights that will be Impacted under the Preferred Alternative* Response: See EA, Section 2.2.6.
13-57	CWA			Air quality	*The FS Must Sufficiently Analyze Air Quality Impacts Under NEPA, the CAA and State Air Quality Standards.* Response: See response to comment 2-4, and EA, Section 3.1.

13-58	CWA			IRA	*This is of particular concern in the proposed disturbance of 115 acres in the inventoried roadless areas.* Response: See response to comment 12-4j and 13-28.
13-59	CWA				*Past cumulative analyses have shown this area is very close to exceeding the NAAQS for NOx and CO. The Forest Service must, therefore, analyze compression requirements in this area to accommodate the Bull Mountain Project under NEPA's requirement that the agency take a "hard look" at the impacts of its actions.* Response: The comment references a different project not relevant to this proposed action therefore no additional analysis is required.
3-60	CWA			Cumulative effects	*The Forest Service must analyze [effects] of the preferred alternative.* Response: Chapter 3 of the EA discloses the direct, indirect and cumulative effects of this Proposed Action and alternatives. Cumulative effects are based on actions listed in Table 3.0, Past Present and Reasonably Foreseeable Future Actions.
13-61	CWA			Connected and Similar Actions	*The Forest Service must consider connected and similar actions.* Response: See response to comment 12-2.
13-62	CWA			Cumulative effects	*The FS must analyze cumulative effects in the context of past, present, and reasonably foreseeable future actions.* Response: See response 13-60.
13-63	CWA			RFD	*On the GMUG National Forest for example the Forest Service does not analyze much of the development it has already authorized in response to the recent natural gas boom. This leaves the GMUG National Forest Plan and EIS which incorporated the analysis provided in a 1993 Oil and Gas Leasing EIS as the only source of information for the potential future impacts of oil and gas leasing on the Forest. GMUG NF 1993 Oil and Gas Leasing EIS at S-1. The 1993 Oil & Gas EIS, however, predicted that only 23 gas wells would be drilled on the entire GMUG National Forest between n 1993 and 2008.* Response: See response 11-2a and 13- 20.
13 - 64	CWA				*Comment references leases in association with a pipeline project.* Response: This comment is not directly related to the proposed action and therefore does not require analysis.
13-65	CWA			Cumulative effects	*The Forest Service must Adequately Address Cumulative Impacts to Air Quality. (The comment references details of a proposed action out of the scope of this project).* Response: See response to comment 2-4. The Air Quality model analyzed cumulative impacts to Air Quality. See Air Quality section 3.1.

Letters received after close of the comment period					
14-1	Buzzard Creek permittees	3/4/07	3/9/07	Roads	*Inadequate roads for use by numerous large trucks. NFSR is narrow with limited places to pass large trucks, and many blind corners. Anticipate problems with both traffic accident and livestock being hit. The road needs to be significantly improve to handle the needed traffic. Better alternative is to reopen the old road (NFSR 266) between Porter Camp and Owens Creek, possibly making each of the roads one way, i.e. south on 266 and north on 265.* Response: See comment 5-1. This comment was received from the commenter in previous oral discussions with the District Range Conservationist.
14-2	Buzzard Creek permittees		*	Livestock mgmt	*Provisions should be made to compensate permittees for livestock injured or killed from Laramie's activities. This includes all activities including traffic related, physical hazards such as livestock entrapment, and chemical/hazardous material related issues. The burden of proof should not rest entirely on the permittee.* Response: Grazing on public lands and use of roads open to the public has inherent risks. The permittee acknowledges these risks when they sign a grazing permit to run their livestock on the National Forest. Traffic-related injury to animals along non-public roads may be subject to compensation. Cattle typically avoid wellpads during drilling, and after drilling activity ceases, products used during drilling are removed from the site. There is therefore little chance of loss to livestock due to chemical exposure. This comment is a statement of position, and does not require analysis.
14-3	Buzzard Creek permittees			Livestock mgmt	*Scoping document states mud pits will be fenced. This is not adequate as these fences are destroyed by trucks during drilling activities and toxic materials may be present in other areas of the drilling pad. We request that drilling pads be completely fenced.* Response: See comment 5-3. This comment was also received from the commenter in previous oral discussions with the dDstrict Range Conservationist.
14-4	Buzzard Creek permittees			Roads	*To avoid conflicts on roads, Laramie Energy should be limited to activity during the times cattle are moved on/off Hightower Mountain. Off date is Oct 5-10 and on-date is set in the Annual Operating Plan.* Response: See comment 5-1. This comment was also received from the commenter in previous oral discussions with the District Range Conservationist.
14-5	Buzzard Creek permittees		*	Weeds	*Laramie's contractors should be required to clean their equipment before moving onto the National Forest from other locations. Disturbed ground should be monitored for several years after the activity is completed to prevent establishment and spread of noxious weeds.*

					Response: See response to comment 5-5.
15-1	E. Chapman	3/14/07	3/14/07 *	Roads	*Heavy equipment use on NFSR 265, particularly the steep hill portion in section 16, is a problem from several aspects. 1. road will require several cuts to accommodate large trucks. Road tends to slump. For these reasons plus wear and tear by the heavy equipment, it will be costly to maintain the road.* *2. Road in section 16 is narrow and steep, and is used by cattleman on the allotment, as well as recreationists traveling through the area. He has a concern about safety to humans and cattle due to the increased traffic. 3. This is just the beginning of gas development on the forest. Need to think about long term, safe travel routes.* *For these reasons, Forest Service should re-open the closed route converted to trail #536. Heavy equipment and traffic associated with gas development should be routed through here to access the upper wellpads, while all other vehicles continue to use NFSR 265. This route would require fewer cuts and is drier than 265.* Repsonse: See Response to comment 5-1. Also see EA, Design Criteria (Table 2.2.15) and Transportation section 3.12.
15-2	E. Chapman			Mineral estate	*Place on the forest map called Gas Creek. Nothing grows there, and if you put a match on the ground, the ground will burn.* Response: Thank you for this information. Gas Creek is outside the Hightower Project area. Baseline water samples in the vicinity also surveyed Gas Creek. The sample was analyzed for dissolved methane gas, BTEX and MTBE. Results show below detectable levels for all of these.
16-1	Western Area Power Administration	March 16, 2007*	March 19, 2007*	Safety	*Properly ground all vehicles, equipment, machinery, cables and metallic pipe being used near transmission line.* Response: Nearest well location to transmission line is as stated, approximately ¼ mile away from line through heavy timber. No equipment or other things will be near the line.
16-2	Western Area Power Administration			Safety	*No landings or staging sites should occur near or beneath the transmission line to avoid static and induced electrical hazards.* Response: See response to comment 16-1.
	Western Area Power Administration			Roads	*Do not prevent access to transmission line. Maintain open, accessible roads.* Response: While no project activities are scheduled to occur along Trail 523 which provides access to the power line, there could be traffic delays during mob or de-mob activities, and during road re-construction along NFSR 265. The timing for these delays is unknown at this time. Contact the Grand Valley District Office for updates on potential traffic delays occurring in the area. See Transportation, Section 3.12.
	Western Area			Roads	*Western believes it has no obligation to maintain the road to the same standard as proponent's improvements, except as required by terms of Special Use Permit.*

	Power Administration				Response: This comment is not relevant to the decision because Western will only be required to abide by the terms of their existing permit.
	Western Area Power Administration			Gathering lines/Road	*Proponent shall ensure that pipeline [crossings] are designed and buried to withstand the weight of Westerns largest maintenance equipment used on the transmission line and access rights-of-way (D9 Cat on low-boy trailer).* Response: See section 2.2.5 for a list of the regulations the pipeline construction falls under and for a description of pipeline construction techniques. See also Design Criteria Table 2.2.15.
	Western Area Power Administration			Air quality/Safety	*Smoke from burning slash may cause damage to transmission lines. Burn only on windless days or when wind is blowing away from transmission lines.* Response: This comment is general in nature, and does not require analysis. Further, any burning would be done according to a Burn Plan that would account for climatic conditions.
	Western Area Power Administration			Soils	*Soils in area are prone to slumping and sliding, particularly under wet conditions, Western is concerned that drilling activities could cause damage to its transmission structures. Please ensure there is sufficient geologic and soils data information for this area such that the decision made by the Forest Supervisor will not result in other permitted uses of these same lands being disrupted by oil and gas activities.* Response: Geology and soils were analyzed during field visits for placement of well sites and addressed in Design Criteria (Table 2.2.15). No surface disturbance is planned near Western's transmission structures. See also Section 3.2.

Reference material for response to comment 12-1a.

From Comment 12- 1a HCCA etal. Table 1 - 1993 RFD Scenario as Compared to Actual Development and Proposals		GMUG Update		Acres of Disturbance	
		APDs Approved to Date	Wells drilled to date	**Approved [Proposed] by APD or Project**	**Occurred to date**
Wells Completed/APDs Approved on the GMUG since 1993 (Outside unitized areas)	10	10	1 new well approved in 2003, drilled in 2005. 4 redrills on existing locations 2006	6 APDs approved 2003 – 16.3 acres2 4 APDs3 approved – redrills on existing location -- 1.5 acres total	1.4 1.5
Applications for Permits to Drill Received by the GMUG (as of 3/8/07) (Outside unitized areas)	18	Assume commentor is referencing Spaulding Peak Area-Wide Plan. Project used Master SUPO.	0	Project approved 18 drilling locations under MSUPO – 27 (long term)	0

2 Six APDs approved through GEC Exploratory Gas Drilling Project EA and DN/FONSI, 8/2003. One well drilled, other APDs have expired with no drilling having taken place.

3 Four APDs approved using Energy Policy Act CEs in 2006.

		No APDs have been filed. 4 1 APD proposed for new well. Analysis in 2008.	0	[3]	0
Hightower EA - Number of Wells	32	NA	NA	Proposed in Hightower project 12.5 (long term)	NA
Total Number of Wells and APDs on the GMUG to date (incl. Hightower) (Outside unitized areas)	**60**	**10 APDs approved**	**5 wells drilled**	**Total acres of disturbance approved under <u>current</u> approvals: 44.8**[5]	**Disturbance to date: ~ 3 6**
Wells Forecast (outside unitized areas) in the GMUG 1993 RFD Scenario	*27*				
Number of wells in excess of the RFD caused by approving Hightower EA	**33**				

4 Eighteen drilling locations approved through Spaulding Peak EA and DN/FONSI, 2006.

5 Includes only current approvals. Does not include acreage from Hightower project or new proposed APD (could collectively represent 15.5 additonal acres). In addition, the 5 expired APDs would reduce acreage of <u>current</u> approvals by about 15 acres.

6 The GMUG Oil and Gas Leasing EIS assumed about 500 acres of disturbance associated with well development. Approved activities represent less than 10% of that estimation. Actual on-the-ground conditions represent less than 1% of the estimation.

Product Trade Name	MSDS provided?	Chemical(s)	Composition (from MSDS)	Amount on location (for one well)	Units of measure	Initial concentration	Units of measure	Amount left in wellbore	Units of measure	Residual concentration	Remarks on residual materials
Class G Cement	yes	Portland Cement and Crystalline Silica	<3% crystalline silica; 60 - 100% Portland cmt	37,812	lbs.	25-50%	by weight	100%	lbs.	0%	Used to isolate formations from each other and support steel casing
Type I/II Cement	yes	Portland Cement and Crystalline Silica	1-5% crystalline silica; 60 - 100% Portland cmt	22,936	lbs.	100%	by weight	100%	lbs.	0%	Used to isolate formations from each other and support steel casing
Type V Cement	yes	Portland Cement and Crystalline Silica	<3% crystalline silica; 60 - 100% Portland cmt	16,243	lbs.	80-100%	by weight	100%	lbs.	0%	Used to isolate formations from each other and support steel casing
Pozmix	yes	Crystalline Silica, Flyash	1-5% crystobalite, 5-10% quartz, 60-100% flyash	50,122	lbs.	20-75%	by weight	100%	lbs.	0%	When cement hardens the chemicals become inert
Gel / Bentonite	yes	Crystalline Silica, Bentonite	0-1% crystobalite, 0-1% tridymite, <3% quartz, 60-100% bentonite	4709	lbs.	2-8%	by weight	100%	lbs.	0%	Lightweight additive
Salt	yes	NaCl	60-100%	2148	lbs.	4-6%	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
Lime	yes	Calcium hydroxide	60-100%	4056	lbs.	10%	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
CalSeal	yes	Calcium sulfate	60-100%	459	lbs.	2%	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
Econolite	yes	Sodium Metasilicate	60-100%	459	lbs.	2%	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
Silicalite	yes	Amorphous Silica	60-100%	1617	lbs.	3 lb/sk	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
Versaset	yes	Sodium aluminate	60-100%	202	lbs.	0.30%	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
Halad-23	yes	Sulfonated organic salt, Hydroxyethyl cellulose	30-60%, 60-100%	266	lbs.	0.60%	by weight	100%	lbs.	0%	Fluid Loss Additive
Halad-322	yes	Sodium Formate, Cellulose derivative	1-5%, 10-30%	207	lbs.	0.30%	by weight	100%	lbs.	0%	Fluid Loss Additive
Super-CBL	yes	Aluminum	60-100%	89	lbs.	0.20%	by weight	100%	lbs.	0%	Flammable Hydrogen Gas, Metal Oxides
HR-601	yes	Modified Lignosulfonate	60-100%	155	lbs.	0.1-0.35%	by weight	100%	lbs.	0%	Increases thickening time
Poly-E-Flake	yes	Cellophane	60-100%	352	lbs.	0.125-0.25 lb/sk	by weight	100%	lbs.	0%	Lost circulation additive
Gilsonite	yes	Natural asphalt	60-100%	2695	lbs.	1-5 lb/sk	by weight	100%	lbs.	0%	Lost circulation additive
PhenoSeal	yes	Cellulose	60-100%	2695	lbs.	5 lb/sk	by weight	100%	lbs.	0%	Lost circulation additive
D-Air	yes	Alkenes, Diatomaceous Earth	10-30%, 60-100%	61	lbs.	0.25 lb/sk	by weight	100%	lbs.	0%	Defoamer
KCl	yes	Potassium Chloride	60-100%	1200	lbs.	10 lb/bbl	by weight	100%	lbs.	0%	No hazardous decompostion chemicals
MudFlush II	yes	Modified Lignosulfonate	60-100%	80	lbs.	1 sk/10 bbl	by weight	100%	lbs.	0%	Oxides of Sulfur