



U.S. Department of the Interior

Bureau of Land Management

Wyoming State Office

Rawlins Field Office

October 2003

**ENVIRONMENTAL ASSESSMENT for the
Atlantic Rim Interim Drilling Project,
Doty Mountain POD, Carbon County, Wyoming**

It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.

BLM/WY/PL-04/001+1310

WY-030-04-EA-027



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Rawlins Field Office
P.O. Box 2407 (1300 North Third Street)
Rawlins, Wyoming 82301-2407

In Reply Refer To:
1790

October 27, 2003

Re: Environmental Assessment for the
Atlantic Rim Interim Drilling
Project, Doty Mountain Pod

Dear Reader:

Enclosed for your review and comment is the Environmental Assessment (EA) for Warren E & P, Inc. (Warren), Double Eagle Petroleum Company (Double Eagle), and Anadarko E&P Company (AEPC), Doty Mountain Exploration Project. The project is located in one of nine areas proposed for exploration drilling for the purpose of providing information for use in the preparation of the Environmental Impact Statement for the Atlantic Rim Natural Gas Project. In order to satisfy the requirements of the National Environmental Policy Act, this EA was prepared to analyze impacts associated with the exploration of natural gas resources northeast of Baggs, in Carbon County, Wyoming.

Analysis of the environmental consequences has led to the determination that this proposed project, with the appropriate mitigating measures, will not have a significant effect on the human environment. Therefore, an environmental impact statement will not be required. Pending the results of a public review of this document, the Bureau of Land Management (BLM) will prepare a formal Decision Record.

Your comments should be as specific as possible. We will accept comments on the alternatives presented and on the adequacy of the impact analysis until November 30, 2003.

Comments may be submitted via regular mail to:

Larry Jackson, Project Manager
Bureau of Land Management
Rawlins Field Office
P.O. Box 2407
Rawlins, Wyoming 82301

Or they may be submitted electronically at the address shown below:

e-mail: rawlins_wymail@blm.gov

Please refer to the Doty Mountain Pod when submitting comments.

Please note that comments, including names, e-mail addresses, and street addresses of respondents, will be available for public review and disclosure at the above address during regular business hours (7:45 a.m. to 4:30 p.m.), Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to withhold your name, e-mail address, or street address from public review or from disclosure under the Freedom of Information Act, you must state this plainly at the beginning of your written comment. Such requirements will be honored to the extent allowed by law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Please retain this EA for future reference. A copy of the EA has been sent to affected government agencies and to those who responded to scoping or otherwise indicated that they wished to receive a copy of the EA. The EA may also be reviewed at the following locations:

Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, Wyoming 82009

Bureau of Land Management
Rawlins Field Office
1300 N. Third Street
Rawlins, Wyoming 82301

If you require additional information regarding this project, please contact Larry Jackson, Project Manager, at the address shown above or phone (307) 328-4231.

Sincerely,

A handwritten signature in black ink that reads "Kent J. Kottler". The signature is written in a cursive style with a large, prominent "K" and "K".

Field Manager

Enclosure

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| Appendix D – Water Management Plan | |
| Appendix E – Sensitive Plant, Wildlife, and Fish Species Potentially Present, Doty Mountain Project Area ¹ | |

1.0 PURPOSE AND NEED

1.1 INTRODUCTION

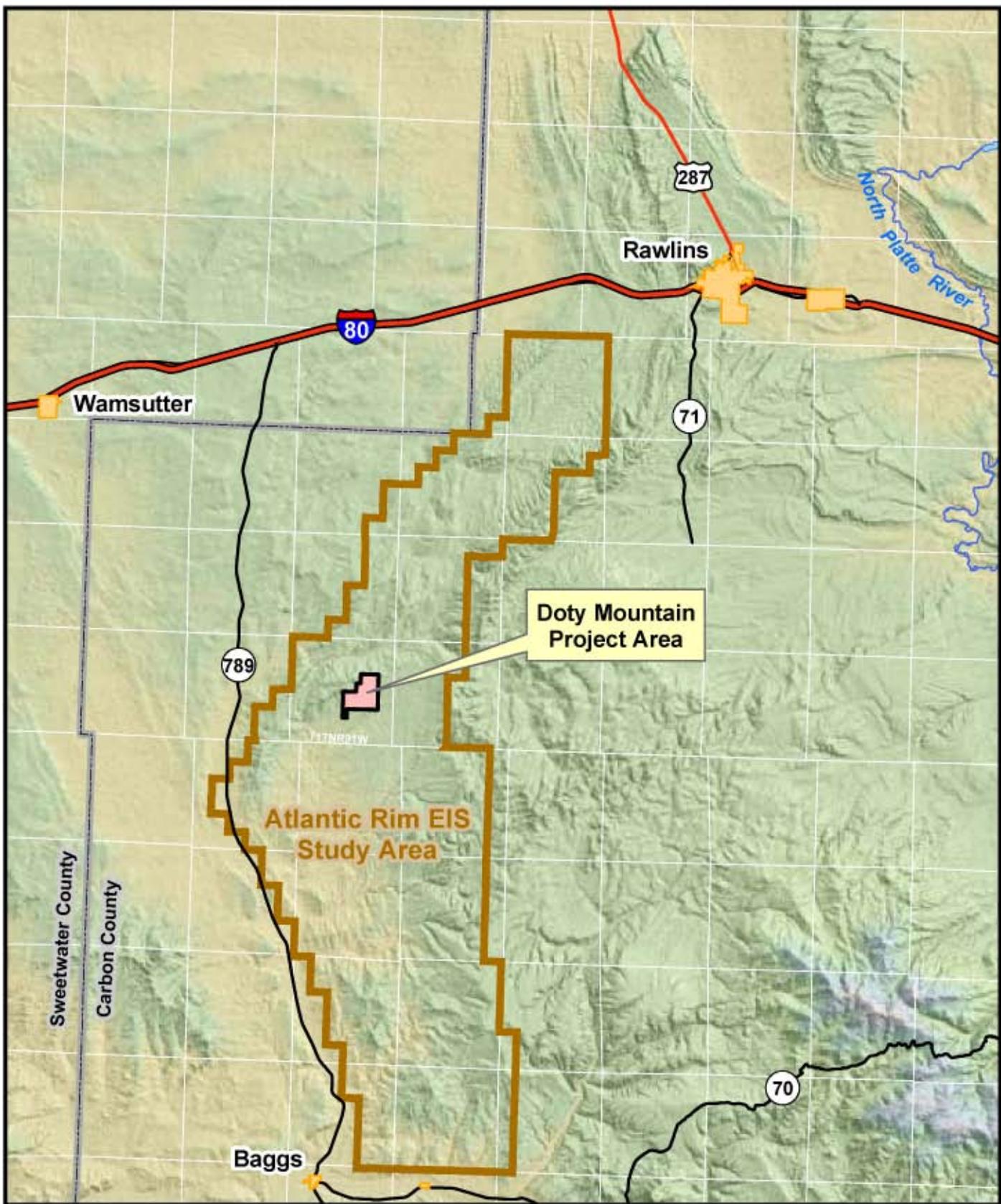
1.1.1. Description and Location

Warren E & P, Inc. (Warren), Double Eagle Petroleum Company (Double Eagle), and Anadarko E&P Company (AEPC), collectively referred to as the Companies, have notified the Bureau of Land Management (BLM), Rawlins Field Office (RFO), that they propose to explore for and potentially develop coal bed natural gas (CBNG) resources in the Doty Mountain area (Project Area). The Project Area lies within the Atlantic Rim Environmental Impact Statement (EIS) study area in south-central Wyoming ([Figure 1-1](#)). The Project Area is located within the administrative boundary of the RFO in T17N R91W within Carbon County, Wyoming, and is one of nine areas or well pods that make up the Atlantic Rim Interim Drilling Project. This proposal is a part of interim drilling activity that BLM may allow while an EIS is being prepared for the Atlantic Rim Natural Gas Project.

The Doty Mountain interim development project consists of constructing, drilling, completing, testing, operating, and reclaiming 24 exploratory wells and two deep injection wells to dispose of produced water, located on both private and federal leases. The proposed project also would include related access roads, utilities, flowlines, a market access line, production facilities, and a compressor station. The life of the project is estimated to be 10 to 20 years.

Of the 24 proposed well locations, 16 wells would be located on surface ownership lands administered by the RFO and would develop federal minerals. The remaining proposed wells (eight) would develop fee minerals on fee surface. One proposed deep injection well would be located on lands administered by RFO. The compressor station and one proposed deep injection well would be located on fee lands.

The Project Area, which encompasses approximately 1,920 acres, is located about 25 miles southwest of Rawlins, Wyoming, near the intersection of Wyoming State Highway (WY) 789 and Carbon County Road 608 (Wild Cow Road). A checkerboard land ownership pattern of federal and private lands is characteristic of the area. The Project Area is within the Upper Colorado River Basin.



Legend

-  Doty Mountain POD Boundary
-  Atlantic Rim EIS Study Area
-  County Boundary
-  Interstate
-  U.S. Highway
-  State Highway



| | | |
|--|--|---|
|  | | ANADARKO PETROLEUM CORPORATION |
| FIGURE 1-1 ATLANTIC RIM EIS STUDY AREA AND DOTY MTN. PROJECT AREA | | |
| <small>ANALYSIS AREA - CARBON COUNTY, WY</small> | | |
| <small>Date: 06/05</small> | <small>Access File: 1:1173_1x1x1.mxd; map_data_01.mxd</small> | |
|  | | <small>Prepared by: MSR</small> |

1.2 PURPOSE OF AND NEED FOR ACTION

1.2.1. Purpose and Need for the Proposed Project

The purpose of the Companies' proposal is to search for and test certain geologic formations for the presence of commercial quantities of natural gas. The proposed project would allow the Companies to evaluate through exploration and production whether larger-scale development is feasible. The primary objective of the exploration project is to evaluate the following in support of the larger Atlantic Rim Natural Gas Project EIS (Atlantic Rim EIS):

- Productivity of and reserves within the coals;
- Economics of drilling and completion techniques;
- Feasibility of dewatering the coals; and
- Depths or pressure windows that may be preferred as the target for economic gas production.

Exploration and development of federal oil and gas leases by private industry is an integral part of the BLM's oil and gas leasing program. Statutory authority for BLM's oil and gas program is derived from the Mineral Leasing Act of 1920, as amended; the Mining and Minerals Policy Act of 1970; the Federal Land Policy and Management Act of 1976; the National Materials and Minerals Policy, Research and Development Act of 1980; and the Federal On-shore Oil and Gas Leasing Reform Act of 1987.

The proposed development would exercise the leaseholders' existing rights within the Project Area to drill for, extract, remove, and market gas products. National mineral leasing policies recognize the statutory right of leaseholders to develop federal mineral resources to meet continuing national needs and economic demands so long as natural resource values and uses are sustained. Also included is the right of the leaseholders within the Project Area to build and maintain necessary improvements, for drilling, producing, and marketing the natural gas, in accordance with the appropriate authority.

Natural gas is an integral part of the U.S. energy future because of its availability, the presence of an existing infrastructure for market delivery, and the environmental advantages of clean-burning natural gas as compared with other fuels. In addition, development of abundant domestic reserves of natural gas would reduce the country's dependence on foreign sources of energy and maintain an adequate and stable supply of fuel for economic well-being, industrial production, power generation, and national security. The environmental advantage of natural gas combustion versus other conventional fuels is emphasized in the Clean Air Act Amendments of 1990.

1.2.2. Environmental Analysis Process

This environmental assessment (EA) documents the environmental analysis process BLM uses to make decisions in accordance with the National Environmental Policy Act (NEPA). This document provides the decision-makers with information needed to make a decision that is fully informed and that is based on factors relevant to the proposal. The decisions to

be made by BLM include which alternative to adopt, and whether the action adopted would be significant under NEPA. This EA also documents the analysis conducted on the proposal and alternatives and identifies environmental effects and mitigation measures. Finally, this document provides a vehicle for public review and comment on the proposal, the environmental analysis, and conclusions about the relevant issues.

This EA has been prepared to evaluate and disclose the potential environmental impacts associated with this project. The proposed exploration project would affect BLM lands managed by the RFO.

Factors considered during the environmental analysis for the exploratory project include the following:

- A determination of whether the proposal and alternatives conform to BLM policies, regulations, and the direction approved in the Resource Management Plan (RMP).
- A determination of whether the proposal and alternatives conform to policies and regulations of other agencies that are likely to be associated with the project.
- A determination of well pad locations, access roads, pipelines, and production facilities that best meet other resource management objectives and minimize impacts to surface resources while honoring the lease rights within the Project Area.
- A determination of impacts on the human environment that could result from the project and alternatives, and development of mitigation measures necessary to avoid or minimize these impacts.

1.3 RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

The EA is prepared in accordance with NEPA and complies with all applicable regulations and laws passed subsequent to the act. This EA assesses the environmental impacts of the project and no action alternative and guides the decision-making process.

1.3.1. Conformance with Great Divide Resource Area RMP

In accordance with Title 43 Code of Federal Regulations (CFR) Part 1610.5, the proposed project has been reviewed and conforms to the Great Divide RMP, approved on November 8, 1990.

The BLM's Great Divide RMP and Record of Decision (ROD) (BLM 1987, 1988a, 1990) direct management of BLM-administered lands within the Project Area. Management of oil and gas resources, as stated in the RMP, provides for leasing, exploration, and development of oil and gas while protecting other resource values. According to the RMP, all public lands in the resource area are suitable for leasing and development of oil and gas, subject to certain

stipulations on leases and site-specific conditions of approval (COAs) attached to applications for permits to drill (APDs).

The project is located outside areas where surface-disturbing activities would be restricted and intensively managed to maintain important resource values, such as the Baggs Elk Crucial Winter Range or areas of critical environmental concern (ACECs). All proposed roads, flowlines, and the delivery pipeline are located outside avoidance areas for utility and transportation systems.

1.3.2. Conformance with Interim Drilling Guidelines

The Proposed Action has been developed under the guidelines provided in the Interim Drilling Policy – “Development Authorized Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project” ([Appendix A](#)).

1.3.3. Relationship to Other Plans and Documents

The proposed project conforms with the State of Wyoming Land Use Plan (Wyoming State Land Use Commission 1979) and the Carbon County Land Use Plan (Pederson Planning Consultants 1997, 1998) and would comply with all relevant federal, state, and local laws and regulations. Development of this project would not affect attainment of the Wyoming Standards for Healthy Rangelands, originally produced in August 1977 then updated May 9, 2003, (BLM 2003a) or the July 1998 Wyoming Fire Management Implementation Plan.

The BLM is required to consult with the Wyoming State Historic Preservation Office (SHPO) and others, as necessary, regarding potential impacts of the proposed undertaking upon historic properties. This consultation is required as part of the process under Section 106 of the National Historic Preservation Act of 1966, as amended. The project lies within the general area that contains the historic Rawlins-Baggs Stage Road, that is eligible for inclusion in the National Register of Historic Places (NRHP), and prehistoric camps are evident (Hatcher 2003a).

1.3.4. Issues and Concerns

Environmental and social issues and management concerns associated with the proposed project are identified as follows:

Surface Water and Groundwater Resources

1. The proposed project could affect the quality of surface water in the Project Area and surrounding areas.
2. The proposed project could affect groundwater resources in the Project Area and surrounding areas.

Rangelands and Livestock Grazing

1. Watering facilities that are well planned could be used to improve distribution and timing of use by livestock, which would lead to better conditions in upland and riparian areas.
2. Livestock watering facilities should be contained and shut off when not in use.

Wildlife Resources

1. Wildlife habitats and populations within the Project Area and adjacent lands, primarily nesting areas, strutting grounds, and winter sites for greater sage grouse and crucial winter range for big game, may be affected by surface-disturbing activities, human presence, noise from the compressor station, or traffic.
2. The Baggs crucial winter range for elk, located just east of the Project Area, could be remotely affected by the proposed project.

Soil Resources

1. Soil resources in the Project Area and surrounding areas could be affected by the proposed project.
2. Disturbed areas associated with construction activities should be reclaimed.

Other Resources and Uses

1. The proposed project could affect the historic and cultural values that are currently unrecorded.
2. The proposed project (especially generators and the compressor station) could affect air quality or noise levels in the Project Area or surrounding areas.
3. Vegetation resources in the Project Area and surrounding areas could be affected by surface-disturbing activities. Invasive species or noxious weeds could increase in the Project Area.
4. The cumulative effects on all resources and uses should be addressed.

Monitoring

1. The measurements needed and methodology for monitoring surveys should be established in consultation with BLM and other affected stakeholders.
2. Monitoring requirements that would measure effects on groundwater resources should be established.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 ALTERNATIVE 1 – PROPOSED ACTION

The proposed project (Alternative 1 – Proposed Action) submitted jointly by Warren E & P, Inc. (Warren), Double Eagle Petroleum Company (Double Eagle), and Anadarko E&P Company (AEPC), collectively referred to as “the Companies,” consists of exploration and interim development of coal bed natural gas (CBNG) resources on existing federal, state, and fee leases in the Doty Mountain area (Project Area). The proposed project location is shown in [Figure 2-1](#). The proposed project will provide geologic and resource information needed by BLM for use in the Atlantic Rim Natural Gas Project EIS (Atlantic Rim EIS). Also, it will provide information to the Companies for use in evaluating the feasibility of economically developing the CBNG resources in the Atlantic Rim area.

The Proposed Action consists of constructing, drilling, completing, testing, operating, and reclaiming 24 exploratory gas wells and two deep injection wells to dispose of produced water that would be located on private and federal leases. The Proposed Action also would include related access roads, gathering lines for water and gas, buried electrical utilities, a market access line for gas, production facilities, a compressor station, and self-contained tanks that allow beneficial use of small quantities of produced water by livestock and wildlife without discharging to surface drainages. Table 2-1 summarizes the wells and facilities included in the project.

TABLE 2-1 DOTY MOUNTAIN PROJECT

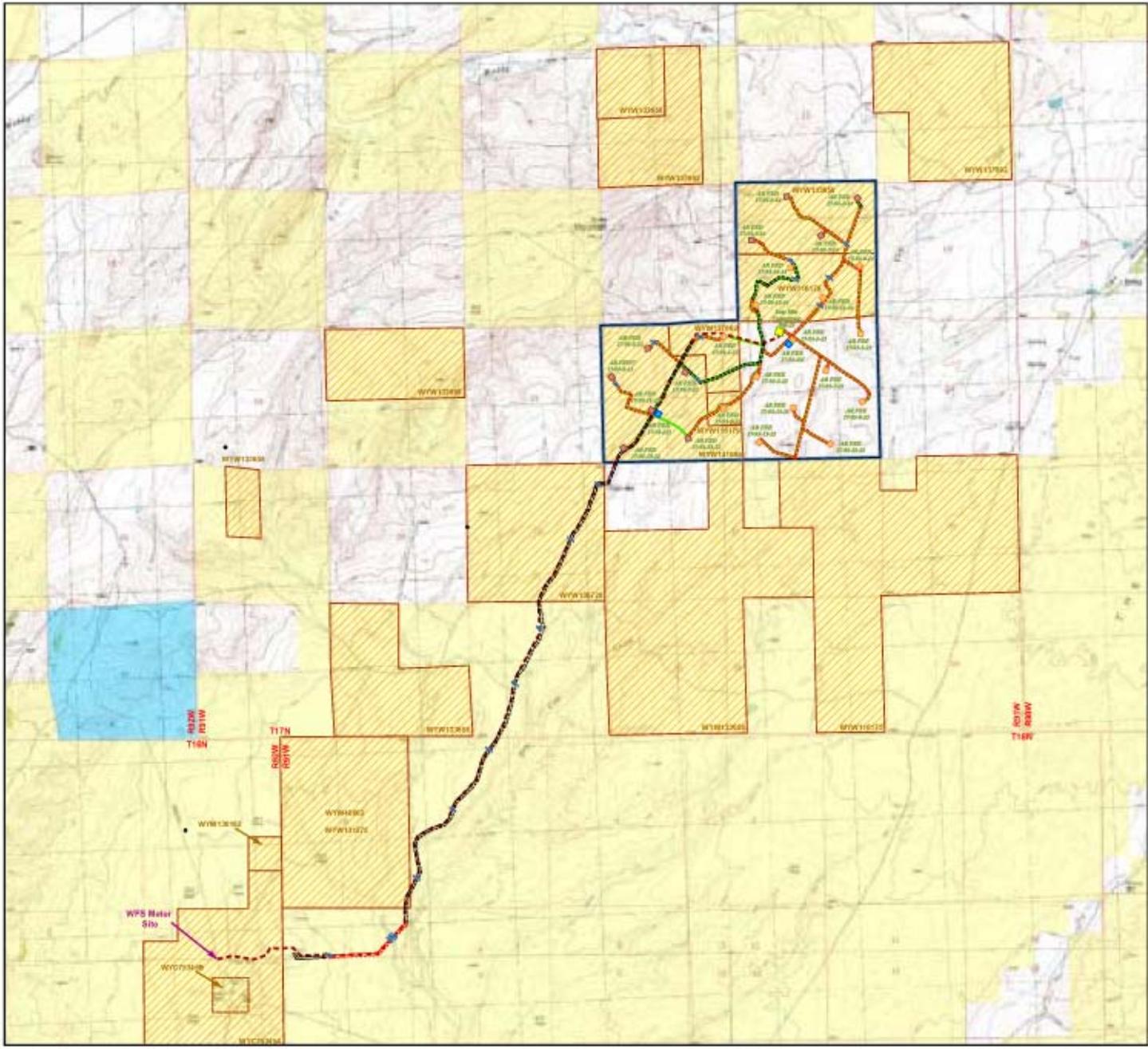
| Proposed Gas Wells | | | |
|--------------------------|------------|-------------|------------------------|
| Lease Number | Well Name | Well Number | Location |
| WYW116179 (Anadarko) | AR Federal | 17-91-9-14 | T17N R91W Sec. 14 NESE |
| | AR Federal | 17-91-11-14 | T17N R91W Sec. 14 NESW |
| | AR Federal | 17-91-13-14 | T17N R91W Sec. 14 SWSW |
| | AR Federal | 17-91-15-14 | T17N R91W Sec. 14 SWSE |
| | AR Federal | 17-91-9-22 | T17N R91W Sec. 22 NESE |
| WYW137692 (Anadarko) | AR Federal | 17-91-1-22 | T17N R91W Sec. 22 NENE |
| WYW141686 (Double Eagle) | AR Federal | 17-91-3-22 | T17N R91W Sec. 22 NENW |
| | AR Federal | 17-91-5-22 | T17N R91W Sec. 22 SWNW |
| | AR Federal | 17-91-7-22 | T17N R91W Sec. 22 SWNE |
| | AR Federal | 17-91-11-22 | T17N R91W Sec. 22 NESW |
| | AR Federal | 17-91-13-22 | T17N R91W Sec. 22 SWSW |
| WYW133658 (Double Eagle) | AR Federal | 17-91-15-22 | T17N R91W Sec. 22 SWSE |
| | AR Federal | 17-91-1-14 | T17N R91W Sec. 14 NENE |
| | AR Federal | 17-91-3-14 | T17N R91W Sec. 14 NENW |
| | AR Federal | 17-91-5-14 | T17N R91W Sec. 14 SWNW |
| | AR Federal | 17-91-7-14 | T17N R91W Sec. 14 SWNE |

TABLE 2-1 DOTY MOUNTAIN PROJECT

| Proposed Gas Wells, cont. | | | |
|----------------------------------|-------------------------------|--------------------|--|
| Lease Number | Well Name | Well Number | Location |
| Fee Lease | AR Fee | 17-91-1-23 | T17N R91W Sec. 23 NENE |
| | AR Fee | 17-91-3-23 | T17N R91W Sec. 23 NENW |
| | AR Fee | 17-91-5-23 | T17N R91W Sec. 23 SWNW |
| | AR Fee | 17-91-7-23 | T17N R91W Sec. 23 SWNE |
| | AR Fee | 17-91-9-23 | T17N R91W Sec. 23 NESE |
| | AR Fee | 17-91-11-23 | T17N R91W Sec. 23 NESW |
| | AR Fee | 17-91-13-23 | T17N R91W Sec. 23 SWSW |
| | AR Fee | 17-91-15-23 | T17N R91W Sec. 23 SWSE |
| Proposed Injection Wells | | | |
| Lease Number | Well Name | Well Number | Location |
| WYW141686 (Double Eagle) | AR Federal | 17-91-22I | T17N R91W Sec. 22 NESW |
| Fee Lease (Anadarko) | AR Fee | 17-91-23I | T17N R91W Sec. 23 NENW |
| Proposed Facilities | | | |
| Lease/ROW | Facility | Number | Location |
| Fee Lease | Compressor Station | DM-23 | T17N R91W Sec. 23 NENW |
| ROWs | Gathering Lines and Utilities | N/A | T17N R91W Secs. 14, 15, 22, 23 and 27 |
| ROW | Market Access Pipeline | N/A | T16N R91W Secs. 5, 6, 7 T16N R92W Sec. 12 T17N R91W Secs. 22, 27, 28, 33 |

The proposed project would be located 25 miles southwest of Rawlins, Wyoming, near the intersection of Wyoming State Highway (WY) 789 and Carbon County Road 608 (Wild Cow Road). The project is one of nine areas or well pods that make up the Atlantic Rim Interim Drilling Project. Of the 24 proposed well locations, 16 wells would be located on surface ownership lands administered by the Bureau of Land Management (BLM) Rawlins Field Office (RFO) and would develop federal minerals. The remaining proposed wells (eight) would develop fee minerals on fee surface. One proposed injection well would be located on lands administered by RFO. The remaining injection well and the compressor station would be located on fee lands.

The Companies' proposed activities within the Doty Mountain area have been subdivided by location to highlight water handling methods proposed in each area.



Legend

- ROD Boundary
- Proposed Anadarko Well Pad
- Proposed Double Eagle Well Pad
- Existing Road
- Proposed Upgraded Road
- Proposed New Road
- Proposed Water, Gas and/or Electric Conduit
- Proposed Doty Mountain Lateral Pipeline
- Proposed Culvert
- Proposed Compression Station
- Proposed Deep Injection Well
- Federal Lease Boundaries
- Bureau of Land Management
- State of Wyoming

Surface Ownership



Transverse Mercator Projection
1927 North American Datum
Zone 13

| | |
|----------------------------------|---|
| | ANADARKO PETROLEUM CORPORATION |
| | FIGURE 2-1 DOTY MOUNTAIN POD PROPOSED ACTION |
| ANADARKO AREA, CARRIS COUNTY, WY | |
| Date: 10/20/13 | Revision No: 01173 - Data_Mkt_ard |
| Prepared by: MBE | |

Northern Area - Section 14 (N^{1/2}) – Produced water from four proposed federal wells in this area would be injected at the injection well in Section 23 (AR Fee 17-91-23I).

Central Area – Section 14 (S^{1/2}), Section 22 (E^{1/2}E^{1/2}), and Section 23 (All) – Produced water from 14 proposed wells (eight fee wells and six federal wells) in this area would be injected at the AR Fee 17-91-23I well in Section 23 or the well in Section 22 (AR Fed 17-91-22I).

Western Area – Section 22 (W^{1/2} and W^{1/2}E^{1/2}) – Produced water from six proposed federal wells in this area would be injected at the AR Fed 17-91-22I well in Section 22.

The Proposed Action is a part of the interim drilling plan associated with the Atlantic Rim EIS in Carbon County, Wyoming. The Proposed Action complies with the cooperative plan established by BLM in the Interim Drilling Policy – “Development Authorized Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project” ([Appendix A](#)). The primary objective of interim drilling is to evaluate the following aspects of gas development in the Atlantic Rim area:

- Productivity of and reserves within the coals;
- Economics of drilling and completion techniques;
- Feasibility of dewatering the coals; and
- Depths or pressure windows that may be preferred as the target for economic gas production.

The BLM is preparing an EIS for the Atlantic Rim area. The RFO will allow up to 200 exploratory wells to be drilled during preparation of the EIS, provided that this activity complies with the criteria described in the Interim Drilling Policy ([Appendix A](#)). In addition, the RFO must determine through a NEPA analysis that no significant or adverse impacts would occur. Depletions to the Colorado River system would not be allowed under the Interim Drilling Policy. Testing for tritium, an indicator of young groundwater, is one component of the requirements associated with protection of groundwater resources. The RFO would monitor drilling to ensure that it does not significantly affect the environment or prejudice the decisions to be made as a result of the analysis conducted in the Atlantic Rim EIS.

The Wyoming Oil and Gas Conservation Commission (WOGCC) has established an 80-acre well spacing pattern for wells completed in the Mesaverde Group in the Doty Mountain area, including the Project Area. Spacing for this area was established under Cause No. 1, Order No. 1, Docket Nos. 157-2001 and 113-2002.

Interim drilling within the Doty Mountain area would develop over a 6- to 12-month period. Wells would be tested when completed; however, an estimated 6 to 12 months of continuous producing status in the Doty Mountain area would be needed to fully evaluate the economics of any additional development. The life of the project is estimated at between 10 and 20 years. The productive life of a shallow gas well completed coals in the Mesaverde Group is estimated to be 15 years.

Specific components of the project are shown in the Master Surface Use Program (MSUP) ([Appendix B](#)), Master Drilling Plan (MDP) ([Appendix C](#)), Water Management Plan (WMP) ([Appendix D](#)), and the project map ([Figure 2-1](#)). Project plans are summarized below in the section titled “Plan of Development.” Although the entire project is described in the Plan of Development, the proposed federal action is limited to the anticipated activities that would require a decision or authorization from BLM to proceed.

2.1.1. Plan of Development

The Companies would follow the procedures outlined below to gain approval for the activities proposed on BLM-administered lands or minerals within the Project Area. Development also would be approved, as required, by other agencies.

2.1.2. Preconstruction Planning and Site Layout

Before construction begins, the Companies would submit a federal Application for Permit to Drill (APD) and a Right-of-way (ROW) application along with a preliminary MSUP, MDP, WMP, and a project map to the RFO that shows the specific location of the proposed activity (such as individual drill sites, pipeline corridors, access roads, or other facilities). The application would include site-specific plans that describe the proposed development (drilling plans with casing/cementing program; surface use programs with construction details for roads and drill pads; a water management plan; and site-specific reclamation plans). Approval of all planned operations would be obtained in accordance with the applicable regulations and Onshore Oil and Gas Order No. 1 (Approval of Operations on Onshore Federal and Indian Oil and Gas Leases). Stormwater discharges during construction would be managed in accordance with a stormwater permit issued by WDEQ.

The proposed facilities would be staked by the Companies and inspected by an interdisciplinary team or an official from the BLM to verify consistency with the approved RMP, the Interim Drilling Policy ([Appendix A](#)), and stipulations contained in the oil and gas leases.

The Companies would submit detailed descriptions of the proposed activity or construction plans to the BLM, when required, for the proposed development. The plans would address concerns related to construction standards, required mitigation, and other issues. These plans would be reconciled between the Companies and the BLM, if necessary to resolve differences, based on findings of the field inspection and would take place either during or after the BLM onsite inspection.

The Companies or their contractors would revise the MSUP, MDP, or WMP, as needed, based on changes agreed to with BLM. The BLM would complete a project-specific environmental analysis that incorporates standards for construction and mitigation. The BLM would then approve the specific proposal and attach the Conditions of Approval (COAs) to the permit. The Companies must then commence the approved activity within 1 year.

A general discussion of proposed construction techniques to be used by the Companies follows. More detailed plans can be reviewed in [Appendix B](#). These construction techniques would apply to drill sites, pipelines, and access roads within the Project Area, and may vary among well sites.

2.1.3. Construction Phase

2.1.3.1.1. Construction of Access Roads

The primary access road to the the Project Area would be WY 789, which has an exit to Carbon County 608, an existing graveled road. An existing BLM road provides access from Carbon County 608 to Section 12 of T16N R92W. Access to drill locations would be provided by newly constructed road access along existing two-tracks that currently provide vehicle access and newly constructed road access. New and upgraded roads would be crowned, ditched, and surfaced (graveled) as specified by BLM. Existing BLM roads that provide access to the Project Area would be upgraded. The proposed road access to the Project Area has been surveyed and is shown in [Figure 2-1](#).

The Companies propose to construct new access roads across public lands in accordance with the standards in BLM Manual 9113 and applicable regulations. Roads would be located to minimize disturbance and maximize transportation efficiency. The Companies would close and reclaim the roads when they are no longer required for production operations, unless otherwise directed by the BLM or the affected surface owner.

Drainage crossings on the access routes within the Project Area either would be low-water crossings or would use culverts designed to allow fish to pass unrestricted, where applicable. Low-water crossings would be used in shallow channels. Crossings of larger channels within the Project Area would be accomplished by excavating an area approximately 4 feet deep under the travelway and filling it with rock and gravel to the level of the drainage bottom. Channel banks on either side of these deeper crossings would be cut down to reduce grade where necessary. Culverts would be installed on smaller, steeper channel crossings. Crossings of tributaries to Dry Cow Creek would be accomplished according to BLM specifications. Topsoil would be conserved before construction of the channel crossings occurs. In addition, the total area to be disturbed would be flagged on the ground before construction begins.

2.1.3.1.2. Well Pad Design and Construction

Sixteen of the proposed gas wells and one of the injection wells would be drilled on BLM surface ownership lands. A graded well pad would be constructed at each well site using cut and fill construction techniques. [Appendix B](#) contains a schematic drawing of the layout for a typical drill site. The dimensions of each well pad would be approximately 200 feet by 200 feet. Each well site would disturb an estimated 1.0 acre, including cut and fill slopes.

A temporary reserve pit would be constructed within the location of the well pad and would be reclaimed after well completion operations end. Topsoil would be removed and stockpiled as required by the BLM before the pit is excavated. The Companies estimate that the reserve pit would be open for 2 to 8 weeks to allow pit fluids to evaporate. During this time, the pit would be fenced on all sides to prevent wildlife or livestock from falling in.

In the event that drilling is non-productive at any site, all associated disturbed areas would be reclaimed to the approximate landform that existed before construction. Reclamation would encompass the drill location and new access road. Reclamation and site stabilization techniques would be applied as specified in the MSUP.

If drilling is productive, all access roads to the well site would remain in place for well servicing (such as maintenance and improvements). Portions of the drill location outside the well pad that are no longer needed would be reclaimed. Any portions of the ROW for the access road that are no longer needed also would be reclaimed. The outside ditch cuts also would be seeded and reclaimed.

2.1.4. Drilling and Completion Operations

A conventional drilling rig would be used to drill the gas wells and deep injection wells. Additional equipment and materials needed for drilling operations would be trucked to the drill location.

Water for use in drilling the wells would be obtained from existing gas wells completed in the coal seams of the Mesaverde Group. Approximately 700 barrels of water (almost 30,000 gallons) would be needed to drill each well. The actual volume of water used in drilling operations would depend on the depth of the well and any losses that might occur during drilling. The proposed project also would require almost 70,000 gallons of water per well, for preparation of cement and stimulation of the well (14,000 gallons) and control of dust (55,440 gallons). In all, nearly 100,000 gallons (about 0.3 acre-feet) of water per well would be used. Dust abatement would comply with all applicable WOGCC requirements. Only water suitable for livestock use would be used for dust abatement.

No oil or other oil-based drilling additives, chromium- or metals-based muds, or saline muds would be used during drilling of these wells. Only fresh water, biodegradable polymer soap, bentonite clay, and non-toxic additives would be used in the mud system.

Depending on the location of the coal seam, each producing well would be drilled to a depth of 2,275 feet to 3,100 feet or deeper. Natural gas in the coal seam would be produced through perforations in the casing. The well control system would be designed to meet the conditions likely to be encountered in the hole and would conform to BLM and State of Wyoming requirements. A completed well bore is shown in [Appendix C](#).

A mobile completion rig similar to the drill rig may be transported to the well site and used to complete each well. Completion operations are expected to average 2 to 5 days per well. When the applicable permits are received, methane gas may be vented or flared. Formation water may be temporarily contained in the reserve pit during drilling and well completion activities. All fracturing fluids will be contained in closed tanks on location. During the testing period, produced water from the Mesaverde aquifer will be contained in closed tanks on location or trucked to an authorized disposal well, pending the completion of flowlines for produced water. All closed tanks on location will be encompassed by a 3.5 foot berm that will contain the entire contents of the largest tank in use, plus 10 percent, with one foot of freeboard, as authorized by BLM.

The deep injection wells would be drilled with the same equipment and personnel used for the gas wells. Depth of the deep injection wells, which would be completed in the Cherokee or Deep Creek sands, is expected to be between 3,800 and 4,600 feet. Drilling and completing each deep injection well would require approximately 7 to 14 days; installing surface equipment, holding tanks, and pumping equipment may require an additional 14 days. A schematic of a typical injection well is shown in [Appendix B](#). Drilling plans are included in [Appendix C](#).

2.1.5. Production Operations

Roads, culverts, cattle guards, pipelines, stock water facilities, or other structures could be left in place at the end of the project for any beneficial use, as designated by the affected surface owners and BLM. Water wells and produced water would be available to the surface owners and BLM, provided that appropriations, diversions, and storage rights are properly filed with the Wyoming State Engineer's Office (WSEO). BLM surface ownership lands that contain disturbed areas or facilities that are no longer needed would be reclaimed in accordance with applicable regulations. Non-federal lands would be reclaimed in accordance with the requirements of the surface owner.

2.1.5.1.1. Well Production Facilities

Wellhead facilities would be installed if the wells are productive. A weatherproof covering would be installed over the wellhead facilities. A downhole pump would be used to produce water from the cased and perforated pay intervals. If the well is productive, natural gas and produced water would be collected and transported from the wellhead via buried pipelines. Gas and water would be measured as specified in the MSUP. Additionally, a vertical separator at some well sites would separate gas from the water stream.

The long-term surface disturbance at the location of each productive well would encompass approximately 0.25 acre, including cut and fill slopes. Typically, only the production facilities at the well site would be fenced or otherwise removed from existing uses. A loop road or a small, graveled pad area would provide a safe turnaround area for vehicles. The perimeter of the pad area would be fenced if adjacent cut and fill slopes represent a safety hazard for vehicles. A typical gas production well site is shown in [Appendix B](#).

2.1.5.1.2. Power Generation

Electricity would be used to power pumps during well development and to initiate and maintain production. Engines fired either by natural gas or propane would be used to run generators temporarily at individual wells until electric distribution lines are analyzed in the Atlantic Rim EIS and then constructed. The Companies may choose to use centrally located generation equipment at the central compressor station and an underground distribution system to provide power to well sites. Utility lines would be installed in the same trench as the gas gathering and water gathering lines to minimize surface disturbance. Electrical motors or natural gas-fired reciprocating or microturbine engines would power booster or blower units if they are required on the gas wells. Future compressors are anticipated to be powered by natural gas-fired engines or electric motors. All utility lines would be buried in accordance with the Interim Drilling Policy.

2.1.5.1.3. Summary of Pipelines and Related Facilities

Construction and installation of gathering lines for gas and water would occur at the same time as access roads are constructed or immediately after drilling has been completed. Construction and installation of the gas delivery pipeline would occur after the producibility of the wells has been confirmed. ROWs located in the same corridor will overlap each other to the maximum extent possible, while maintaining sound construction and installation practices. Where ROW corridors are located along a road, working space for installation of facilities will be along the road. Pipeline corridors would be reclaimed as soon as practical after construction of the pipeline is complete. Three types of pipelines would be constructed as part of the proposed project:

1. A gas-gathering pipeline system (low pressure) would be constructed from the wellheads to the central compressor station. This system would use high-density polyethylene (HDPE) pipe, starting with 4-inch diameter pipe at the wellhead and graduating up to 12-inch diameter pipe at the inlet to the compressor.
2. A produced water-gathering pipeline system (low pressure) would be constructed from the wellheads to the centralized facilities for injection. This network of water lines would use 4-inch through 12-inch diameter pipe made of HDPE.

3. A gas-delivery pipeline (high pressure) would be constructed from the compressor station to an existing transmission pipeline. This pipeline would be constructed of 8-inch diameter steel pipe.

Related facilities would include the compressor station and water management facilities. Water management would include deep injection wells.

Gathering Systems and Utilities

The rights of way for the gathering systems would typically follow access roads, except in a limited number of cases where topography dictates otherwise or as required by BLM. ROWs located in the same corridor will overlap each other to the maximum extent possible, while maintaining sound construction and installation practices. Where ROW corridors are located along a road, working space for installation of facilities will be along the road.

Trenches would be excavated to install the flowlines and electrical lines. Gas-gathering and produced water-gathering pipelines (as well as utility lines) would be laid together in the same trench when practical. Trenches excavated for well gathering lines and electrical lines (which would require ROWs of 30 feet in width for gas lines, 20 feet in width for water lines, and 10 feet in width for electrical lines) are expected to temporarily disturb 30-foot wide corridors, which would be reclaimed as soon as practical after construction is complete. An additional area, estimated to be 10 feet wide, would not be disturbed during construction, but would be used to transport machinery, personnel, and equipment along the corridor to install flowlines and electrical lines, wherever the gathering system would not follow an access road. This corridor is used to allow working room for the machinery, personnel, and equipment during the installation process. Corridors for the system of gathering lines in the Project Area would be 10.4 miles long. About 6.7 miles of corridors for gathering lines would be located on BLM surface ownership lands.

Separate gathering lines that are buried would transport natural gas from the wellheads to the compressor station and produced water to the injection wells. All water used to test the integrity of gathering lines would be injected. The alignments of the gathering lines are shown in [Figure 2-1](#).

Facilities for Injection

Produced water from individual wells would be gathered and piped to one of two injection wells. The gathering system would be interconnected to provide for the transfer of water between injection facilities, as needed ([Figure 2-1](#)). Produced water-gathering pipelines would be constructed along the well access road wherever feasible, from the wellhead to the injection facilities. The water lines would be installed together in the same trench or ditch as the gas gathering lines wherever practical, and buried. A typical water disposal facility is shown in [Appendix B](#). The deep injection wells would be approved by the BLM, WOGCC, and WDEQ, as required, and would be located in Sections 22 and 23 of T17N R91W.

A typical water disposal facility would consist of a pad of approximately 200 feet by 200 feet that would disturb an estimated 1.0 acre, including cut and fill slopes. Each facility would contain four 400-bbl water tanks, pump house, piping, and well house. An approximate 3.5-foot berm would be constructed around the perimeter of the water tanks, excluding the pump shed, at each disposal facility to contain any potential spills on the pad. The pump shed would be excluded from the berm area to minimize the potential for electrical or safety hazards that could occur if water entered the pump shed and caused electrical shorts. The berm would be constructed to contain the water from the largest tank, plus 10 percent, and maintain a freeboard (extra capacity) of 1 foot.

The approximate minimum injection capacity of the AR Federal 17-91-22I and the AR Fee 17-91-23I injection wells would be 5,000 barrels per day (bbls/day) for each well. The approximate maximum injection capacity for each well would be 20,000 bbls/day. The injection capacity would be determined by the permeability of the receiving reservoirs and limits on the injection pressure to preclude fracturing the formation, and would be established in the permit for each well.

Water transfer pumping stations may be used during production operations to transfer produced water from the gas wells to the injection facilities. The transfer pumping stations are needed in areas where differences in elevation require supplemental pumping to transfer the produced water. If transfer pumping stations are required, they will be identified in a Sundry Notice. Each pumping station would contain up to two 400-barrel water tanks, an inlet separation vessel, and a small centrifugal water pump. A small pump shed would be constructed to enclose the pump. Each pumping station would consist of a pad of approximately 125 feet by 125 feet that would disturb an estimated 0.4 acre, including cut and fill slopes. An approximate 3.5-foot berm would be constructed around the perimeter of the water tanks, excluding the pump shed, at each pumping station to contain any potential spills on the pad. The pump shed would be excluded from the berm area in order to minimize the potential for electrical or safety hazards that could occur if water entered the pump shed and caused electrical shorts. The berm would be constructed to contain the water from the largest tank, plus 10 percent, and maintain a freeboard (extra capacity) of one foot. A typical water transfer facility is shown in [Appendix B](#).

Gas-Delivery Pipelines and Compression

Produced natural gas under wellhead pressure would move through the low-pressure gas gathering system to the compressor station. Typical pressure in a gathering system line of the type proposed for this project is less than 100 pounds per square inch (psi). Gas arriving at the compressor station would be compressed from the pressure in the gathering line to higher pressure to facilitate delivery and introduction of the gas into an existing transmission pipeline located in Section 12, T16N R92W. Compression of the gas at a field compressor station would increase the pressure to an estimated 700 to 1,450 psi.

The compressor station will be sited to allow for the installation of one compressor initially, with the addition of up to two more compressors later in the life of the field. Each compressor would be sized to handle 5 MMCFD from 15 psi suction pressure to 1200 psi discharge pressure. Each compressor would be driven by a natural gas engine that would be designed to meet all specifications established by the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ–AQD). Generally, all engines used to drive compressors would have emissions of less than 1.5 g/bhp-hr, or less than 16.7 tons per year of nitrogen oxides (NO_x), and 0.5 hg/bhp-hr, or less than 5.6 tons per year of carbon monoxide (CO). Additional equipment at each compressor station would include a triethylene glycol (TEG) dehydration system, which would dry the gas to meet all pipeline-quality specifications of the market pipeline.

The pad at the compressor station would be 300 feet by 300 feet and would result in approximately 2.2 acres of disturbance, including cut and fill slopes. Compressors would be housed within structures designed in accordance with applicable regulations. A typical compressor station is shown in [Appendix B](#).

Should encouraging quantities of natural gas be discovered, a gas delivery pipeline would be required to move the gas to an existing system. All produced water used to test the integrity of the gas delivery pipeline (500 bbls or 21,000 gallons) would be injected. The alignment of the delivery line from the compressor station to the existing transmission pipeline is shown on [Figure 2-1](#). The Companies are applying for a ROW for the 8-inch diameter steel pipeline that would be buried 6 feet deep on a 50-foot wide ROW. This pipeline would be anchored at the compressor station and would proceed southwest to the existing pipeline in Section 12 of T16N R92W. This gas delivery pipeline would be 7.2 miles long, of which about 6.6 miles would be located on BLM surface ownership lands.

Construction and installation of this delivery pipeline would temporarily disturb a 50-foot wide corridor, which would be reclaimed as soon as practical after construction is completed. An area, estimated to be 25 feet wide, would not be disturbed during construction, but would be used to transport machinery, personnel, and equipment along the corridor to install the pipeline, wherever the delivery pipeline would not follow an access road. This corridor would allow working room for machinery, personnel, and equipment during the installation process.

The delivery pipeline will be constructed using open cut construction methods for upland areas, and dry ditch construction methods for water body crossings. The disturbed area will be kept to a minimum. In order to minimize surface disturbance, the operator will use wheel trenchers (ditchers) or ditch witches, where possible, to construct all pipeline trenches associated with this project. Trenches that are open for the installation of pipelines will have plugs placed no more than 1,000 feet apart to allow livestock and wildlife to cross the trench or walk out of it, if needed. Placement of plugs will be determined in consultation with BLM and any affected landowner.

The Companies would complete the pipeline during periods when key habitats are not occupied to limit human presence in and disturbance of key wildlife habitats during critical periods of use. The availability of adequate working space would accelerate construction. Surface disturbance would be reclaimed when the pipeline is complete.

2.1.6. Ancillary Facilities

The Companies would operate all wells, pipelines, and ancillary production facilities in a safe manner, as set forth in standard industry operating guidelines and procedures. Routine maintenance of producing wells would be necessary to maximize performance and detect potential difficulties with gas production operations. Each well location would be visited approximately every other day to ensure that operations are proceeding in an efficient and safe manner. The visits would include checking separators, gauges, valves, fittings, tanks, generators, and pumps. The equipment onsite also would be routinely maintained, as necessary. Additionally, all roads and well locations would be regularly inspected and maintained to minimize erosion and assure safe operating conditions.

2.1.7. Estimates of Traffic and Work Force

Estimated traffic requirements for drilling, completion, and field development operations are shown on Table 2-2. The “Trip Type” column lists the various service and supply vehicles that would travel to and from the well sites and production facilities. The “Round-Trip Frequency” column lists the number of trips, both external (to and from the Doty Mountain Project Area) and internal (within the Doty Mountain Project Area). The figures should be considered general estimates, based on an active drilling program. The level of drilling and production activity may vary over time in response to weather and other factors.

TABLE 2-2 TRAFFIC ESTIMATES

| Trip Type | Round-Trip Frequency | |
|------------------------------|---------------------------------|--------------------------------|
| | External (to/from Project Area) | Internal (within Project Area) |
| Rig supervisor | 4/day | Same |
| Rig crews | 4/day | Same |
| Engineers ^a | 2/week | 1/day/rig |
| Mechanics | 4/week | Same |
| Supply delivery ^b | 1/week | 2-4/day |
| Water truck ^c | 1/month | 2 round trips/day |
| Fuel trucks | 2 round trips/well | Same |
| Mud trucks ^d | 1/week | 2/day |
| Rig move ^e | 8 trucks/well | 8 trucks/well |
| Drill bit/tool delivery | 1 every 2 weeks | Same |

TABLE 2-2 TRAFFIC ESTIMATES

| Trip Type | Round-Trip Frequency | |
|--|--|---------------------------------------|
| | External (to/from Project Area) | Internal (within Project Area) |
| Drilling (2 rigs, 2 crews/rig) | External (to/from Project Area) | Internal (within Project Area) |
| Completion and Operations (2 rigs, 2 crews/rig) | External (to/from Project Area) | Internal (within Project Area) |
| Small rig/crew | 1/day | Same |
| Cement crew | 2 trips/well | Same |
| Consultant | 1/day | Same |
| Well loggers | 3 trips/well | Same |
| Gathering systems | 2/day | Same |
| Power systems | 2/day | Same |
| Compressor stations | 2/day | Same |
| Other field development | 2/day | Same |
| Testing and operations | 2/day | Same |

Notes:

- ^a Engineers travel to Project Area weekly and stay in a mobile home at the Project Area during the week.
- ^b Current plans are to establish a central supply area within the Project Area and deliver supplies weekly.
- ^c Water trucks would deliver water to rigs from a location within the Project Area and provide dust abatement for roads
- ^d Current plans are to establish a central mud location within the Project Area and deliver mud weekly.
- ^e Four trucks would be required to move each rig to the Project Area. When drilling is complete in a Project Area, each rig would move to the next Project Area.

2.1.8. Site Restoration and Abandonment

The Companies would completely reclaim all disturbed areas that are not needed for production. Reclamation would generally include: (1) cleaning up of the disturbed areas (drill sites and access roads, for example), (2) restoring the disturbed areas to the approximate ground contour that existed before construction, (3) replacing topsoil over all disturbed areas, (4) ripping disturbed areas to a depth of 12 to 18 inches, and (5) seeding recontoured areas with a BLM-approved, certified weed-free seed mixture.

2.1.9. Summary of Estimated Disturbances

Table 2-3 summarizes the estimated disturbances from implementing the project.

**TABLE 2-3 ESTIMATES OF DISTURBED AREAS –
DOTY MOUNTAIN PROJECT AREA**

| Facility | Evaluation Phase | | | | Operations |
|--|------------------|--------------|-------------------|-----------------|-----------------------|
| | Length (feet) | Width (feet) | Area, ea. (acres) | Temporary Acres | Life of Project Acres |
| New Roads | 41,500 | 20 | N/A | 19.1 | 19.1 |
| Existing Well Access Road ^a | 1,300 | 20 | N/A | N/A | N/A |
| Road Construction Along Existing Two-tracks | 35,500 | 20 | N/A | 16.3 | 16.3 |
| New Gathering Lines | 54,900 | 30 | N/A | 37.8 | 0 |
| New Market Access Line | 37,700 | 50 | N/A | 43.3 | 0 |
| New Drill Pads (24) | N/A | N/A | 1.0 | 24.0 | 6.0 |
| New Deep Injection Wells ^c (2) | N/A | N/A | 1.0 | 2.0 | 2.0 |
| Existing Drill Pad (0) | N/A | N/A | N/A | N/A | N/A |
| Compressor Station | N/A | N/A | 2.2 | 2.2 | 2.2 |
| Water Transfer Facility (0) | N/A | N/A | 0.4 | 0 | 0 |
| Total Disturbance | | | | 144.7 | 45.6 |
| Total New Disturbance (excluding existing disturbance) | | | | 128.4 | 29.3 |

a. Existing access road in T16N R91W Section 7.

b. Improvement of existing two-tracks from Section 7 in T16N R 91W to Section 14 in T17N R91W

c. Deep injection wells would be collocated with other facilities ([Figure 2-1](#)).

2.1.10. Project-Wide Mitigation Measures and Procedures

For this project, the Companies have voluntarily agreed to use and comply with the following measures and procedures to avoid or mitigate potential impacts to resources or other land uses, after consultation with BLM regarding agency requirements. These measures and procedures will be referred to as Best Management Practices (BMPs) throughout this document. These mitigation measures and procedures would be applied on privately owned surface unless the private surface owners involved specifically require alternative actions while still in compliance with laws and regulations. An exception to a mitigation measure or design feature may be approved on public land on a case-by-case basis when deemed appropriate by the BLM. An exception would be approved only after a thorough, site-specific analysis had concluded that the resource or land use that the measure was intended to mitigate is not present or would not be significantly affected in the absence of mitigation measures.

2.1.10.1.1. Preconstruction Planning, Design, and Compliance Measures

1. The Companies would designate a qualified representative to serve as compliance coordinator. This person will be responsible for ensuring that all requirements of the

APD and Plan of Development (MSUP, MDP, WMP, and Conditions of Approval) are followed.

2. The Companies and the BLM would make on-site inspections of each proposed and staked facility site (such as drill locations and other facilities), new access road, access road upgrades (two-track roads), and pipeline alignment projects to develop site-specific recommendations and mitigation measures.
3. New roads would be constructed and existing roads maintained in the Project Area in accordance with standards in BLM Manual 9113 and applicable regulations for resource roads and construction details outlined in the MSUP and Conditions of Approval. These standards would be followed on BLM surface ownership lands.
4. Prior to construction, the Companies would submit an APD package to BLM. This package would contain individual APDs for each drill site, as well as the MDP, MSUP, WMP, schematics of facilities, and ROW applications for pipelines, utilities, and access roads. APDs submitted by the Companies would show the layout of the drill pad over the existing topography, the dimensions of the pad, cross sections of the cuts and fills (when required), the location and dimensions of reserve pits, and locations of access roads.
5. The Companies would slope-stake construction when required by the BLM (for example, in steep or unstable slopes) and receive approval from the BLM before construction begins.
6. BLM would require roads to be crowned with a 0.3- to 0.5-foot crown, and ditched. The topsoil would be graded over the cut slope so no berm is left at the top of the cut slope.
7. BLM would require that culverts in roads be covered with a minimum of 12 inches of fill or one-half the diameter of the pipe, whichever is greater. The inlet and outlet will be set flush with existing ground and lined up in the center of the draw. Before the area is backfilled, the bottom of the pipe will be bedded on stable ground that does not contain expansive or clay soils, protruding rocks that would damage the pipe, or unevenly sized material that would not form a good seat for the pipe. The site would be backfilled with unfrozen material and rocks no larger than 2 inches in diameter. Care would be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill would be brought up evenly in 6-inch layers on both sides of the conduit.
8. Additional culverts would be installed in the existing access road as needed or as directed by BLM.
9. The access roads would be surfaced with an appropriate grade of aggregate or gravel to a depth of 4 inches before the drilling equipment or rig is moved onto the pad.

10. BLM would require that access roads be maintained in a safe and usable condition. A regular maintenance program would include, but is not limited to, blading, ditching, installing or cleaning culverts, and surfacing.
11. The written approval of the authorized officer will be obtained before snow removal outside the new and existing roadways is undertaken. If approval is given, equipment used for snow removal operations outside the road ditches will be equipped with shoes to keep the blade off the ground surface. Special precautions will be taken where the surface of the ground is uneven to ensure that equipment blades do not destroy the vegetation.
12. BLM would require that wing ditches be constructed, as necessary, to divert water from road ditches.
13. Trenches that are open for the installation of pipelines should have plugs placed no more than 1,000 feet apart to allow livestock and wildlife to cross the trench or walk out of it, if needed. Placement of plugs would be determined in consultation with BLM and any affected landowner.
14. Procedures would be implemented to prevent livestock or wildlife from falling into open excavations. Procedures could include temporary covers, fencing, or other means acceptable to BLM and any affected landowner.

2.1.10.1.2. Resource-Specific Requirements

The Companies propose to implement the following resource-specific mitigation measures, procedures, and BLM management requirements on public lands.

Geology, Minerals, and Paleontology

Mitigation measures presented in the sections of this EA on Soils and Water Resources would avoid or minimize many of the potential impacts to surface mineral resources. BLM and WOGCC policies on casing and cementing would protect subsurface mineral resources from adverse impacts.

Scientifically significant paleontological resources that may occur would be protected through the following mitigation measures:

1. If recommended by BLM, each proposed facility located in areas of known and potential vertebrate paleontological resources would be surveyed by a BLM-approved paleontologist before any surface disturbance is allowed (BLM 1987 and 1990).

2. Discovery. Project personnel would make contingency plans for the accidental discovery of significant fossils. If construction personnel discover fossils during implementation of the project, the BLM would be notified immediately. If the fossils could be adversely affected, construction would be redirected or halted until a qualified paleontologist had assessed the importance of the uncovered fossils, the extent of the fossiliferous deposits, and had made or implemented recommendations for further mitigation.
3. Field Survey. No specific data currently exist on deposits of high or undetermined paleontologic potential in Project Area. For that reason, field survey for paleontologic resources would be conducted on a case-by-case basis, as directed by the BLM. These resources would be surveyed in areas where surface exposures of the Browns Park, Green River, or Wasatch Formations occur. A field survey may result in the identification of additional mitigation measures needed to reduce adverse impacts to fossil resources. This mitigation may include collection of additional data or representative samples of fossil material, monitoring excavation, or avoidance. In some cases, no action beyond the measures taken during the field survey may be necessary.

A report would be submitted to the BLM after each field survey is complete. The report will describe in detail the results of the survey, with a list of fossils collected, if any, and may recommend additional mitigation measures. If scientifically significant fossils are collected, the report must document the curation of specimens into the collection of an acceptable museum repository and must contain appropriate geologic records for the specimens.

Air Quality

1. All activities conducted or authorized by BLM must comply with local, state, tribal, and federal air quality regulations and standards. The Companies would adhere to all applicable ambient air quality standards, permit requirements (including preconstruction, testing, and operating permits), standards for motorized equipment, and other regulations, as required by the WDEQ-AQD.
2. The Companies would not allow garbage or refuse to be burned at well locations or other facilities. Before any wells are vented or flared, WDEQ-AQD would be notified as required by Wyoming Air Quality Standards and Regulations, Chapter 1, Section 5 *Reporting Guidelines for Well Flaring and Venting*. Test periods longer than 15 days would require authorization by WOGCC, in accordance with Chapter 3, Section 40 *Authorization for Flaring and Venting of Gas*.

3. On federal land, the Companies would immediately abate fugitive dust (by application of water, chemical dust suppressants, or other measures) when air quality is impaired, soil is lost, or safety concerns are noticed by the Companies or identified by the BLM or the WDEQ-AQD. These concerns include, but are not limited to, actions that exceed applicable air quality standards. BLM would approve the control measure, location, and application rates. If watering is the approved control measure, the operator must obtain the water from state-approved sources in accordance with any applicable regulations.

Soils

1. The Companies would reduce the area of disturbance to the absolute minimum necessary for construction and production operations while providing for the safety of the operation.
2. Where feasible, the Companies would locate pipelines immediately adjacent to roads to avoid creating separate areas of disturbance and to reduce the total area of disturbance.
3. The Companies would avoid using frozen or saturated soils as construction material.
4. The Companies would minimize construction in areas of steep slopes.
5. Cut slopes would be designed in a manner that would retain topsoil, and facilitate use of surface treatment such as mulch and subsequent revegetation.
6. The Companies would selectively strip and salvage topsoil or the best suitable medium for plant growth from all disturbed areas. Topsoil would be removed and conserved to a minimum depth of 6 inches and a maximum of 12 inches from all drill locations, unless otherwise agreed by the BLM and the operator.
7. Where possible, disturbance to vegetated cuts and fills would be minimized on existing improved roads.
8. The Companies would install runoff and erosion control measures such as water bars, berms, and interceptor ditches if needed.
9. The Companies would install culverts for ephemeral and intermittent drainage crossings. In addition, drainage crossing structures would be designed to carry the 25-year discharge event, or as otherwise directed by the BLM.
10. Layout of the access roads may require minor variations in routing to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Where possible, the Companies would maintain a 100-foot wide buffer of natural vegetation (not including wetland vegetation) between construction and ephemeral and intermittent channels.

11. The Companies would include adequate drainage control devices and measures in the design of roads (for example, berms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipaters). These devices and measures would be located at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road to avoid erosive, concentrated flows. In conjunction with surface runoff or drainage control measures, the Companies would use erosion control devices and measures such as temporary barriers, ditch blocks, erosion stops, mattes, mulches, and vegetative covers. In addition, the Companies would implement a revegetation program as soon as possible to reestablish the soil protection afforded by vegetation.
12. When construction that is not specifically required for production operations is complete, the Companies would restore topography to near pre-existing contours at the well sites, along access roads and pipelines, and other facilities sites. The Companies also would scarify regraded surfaces and redistribute up to 6 inches of topsoil or suitable plant growth material, if available, over all disturbed surfaces; roughen the soil surface; apply fertilizer as required; seed; and mulch.

Water Resources

Other mitigation measures listed in the sections of this EA on Soils, and Vegetation and Wetlands would apply to Water Resources.

1. The Companies would limit construction of all drainage crossings to no-flow or low-flow periods.
2. The area of disturbance would be minimized within perennial, ephemeral, and intermittent drainage channels.
3. BLM would prohibit construction of well sites, access roads, and pipelines within 500 feet of surface water and riparian areas. Possible exceptions to this will be granted by BLM based on an environmental analysis and site-specific mitigation plans.
4. The Companies would design channel crossings to minimize changes in channel geometry and subsequent alterations in flow hydraulics.
5. Layouts of the access roads may require minor variations in routing to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Where possible, a 100-foot wide buffer of natural vegetation (not including wetland vegetation) would be maintained between construction and ephemeral and intermittent channels.
6. Interceptor ditches, sediment traps, water bars, silt fences, and other revegetation and soil stabilization measures would be designed and constructed, as needed.

7. The Companies would construct channel crossings by pipelines such that the pipe is buried a minimum of 4 to 6 feet below the channel bottom, as specified by BLM.
8. Disturbed channel beds would be regraded to the original geometric configuration and would contain the same or similar bed material.
9. Wells must be cased during drilling, and all wells cased and cemented in accordance with Onshore Order No. 2 to protect all high-quality aquifers. High-quality aquifers exhibit known water quality of 10,000 milligrams per liter total dissolved solids (TDS) or less. Well casing and welding must be of adequate integrity to contain all fluids under high pressure during drilling and well completion. Furthermore, wells would adhere to the appropriate BLM cementing policy.
10. The reserve pits would be constructed in cut rather than fill materials. Fill material must be compacted and stabilized, as needed. The subsoil material of the pit to be constructed should be inspected to assess stability and permeability and to evaluate whether reinforcement or lining is required. If lining is required, the reserve pit must be lined with a reinforced synthetic liner at least 12 mils thick and with a bursting strength of 175 by 175 pounds per inch (American Society for Testing and Materials [ASTM] Standard D 75179). Use of closed or semi-closed drilling systems should be considered in situations where a liner may be required.
11. Two feet of freeboard must be maintained on all reserve pits to ensure they are not in danger of overflowing. Drilling operations must be shut down if leakage is found outside the pit until the problem is corrected.
12. Hydrostatic test water used in conjunction with pipeline testing, and all water used during construction or dust abatement must be extracted from sources that contain sufficient quantities and with appropriation permits approved by the State of Wyoming.
13. Hydrostatic test water would be injected into an authorized deep injection well, in compliance with all applicable requirements.
14. All concentrated water flows must be discharged within the ROW for an access road onto or through an energy dissipater structure (such as riprapped aprons and discharge points) and into undisturbed vegetation.
15. If required by the applicable regulations, the Companies would develop and implement a pollution prevention plan (PPP) for storm water runoff at drill sites as required per WDEQ permit requirements under NPDES. All required WDEQ permits would be in place before stormwater is discharged.

16. The Companies would exercise stringent precautions against pipeline breaks and other potential accidental discharges of oil or hazardous chemicals into adjacent streams. If liquid petroleum products are stored on site in sufficient quantities (per the criteria contained in Title 40 CFR Part 112), a Spill Prevention Control and Countermeasures (SPCC) plan would be developed in accordance with 40 CFR Part 112.
17. The Companies would coordinate all crossings or encroachments of waters of the U.S. with the U.S. Army Corps of Engineers (COE).
18. BLM must approve in writing any changes in the method or location for disposal of produced water.

Vegetation, Wetlands, and Noxious Weeds

Other mitigation measures under the section on Soils and Water Resources of this EA would also apply to vegetation and wetlands.

1. The Companies must implement a BLM-approved weed control and eradication program.
2. The Companies would evaluate all project facility sites for occurrence and distribution of waters of the U.S., special aquatic sites, and jurisdictional wetlands. All project facilities would be located outside these sensitive areas. If complete avoidance is not possible, the Companies would minimize impacts through modification and minor relocations. The Companies will comply with applicable regulations for any activities that involve dredge or fill or wetlands.
3. An approved Pesticide Use Proposal would be obtained before herbicides or other pesticides are applied on BLM surface ownership lands to control noxious weeds.
4. Disturbed areas would be seeded and stabilized in accordance with BLM-approved reclamation guidelines.

Range Resources and Other Land Uses

Mitigation requirements listed under sections of this analysis on Soils, Vegetation, Wetlands, Noxious Weeds, and Wildlife also apply to Range Resources and Other Land Uses.

1. The Companies would coordinate with the affected livestock operators to ensure that livestock control structures remain functional (as directed by the livestock operator) during drilling and production operations, and to coordinate timing of activities planned.
2. When necessary, traffic control and speed limits would be used to limit potential conflicts.

Wildlife

1. During reclamation, the Companies would establish a variety of forage species that would return the land to a condition that approximates or is equal to its state before disturbance.
2. The Companies would prohibit unnecessary off-site activities of operational personnel near the drill sites. The Companies also would inform all project employees of applicable wildlife laws and the potential penalties associated with unlawful take and harassment.
3. The Companies would limit construction within crucial winter range for big game timing stipulations unless an exception is authorized by the BLM.
4. A raptor survey would be completed before construction begins to ensure that well sites are located away from potential conflict areas.
5. The Companies would survey and clear well sites within 1 mile of raptor nests identified in the raptor survey before construction or drilling can begin during the raptor nesting period (February 1 through July 31).
6. When an “active” raptor nest is located within 0.75 to 1 mile of a proposed well site (depending on species and line of sight), the Companies must restrict construction during the critical nesting season for the species. The distance would be increased to within 1 mile of a proposed well site for listed and BLM sensitive species (Chapter 3).
7. Raptor nests must be inventoried annually to evaluate potential nesting activity in areas where work may be occurring during the raptor nesting period from February 1 to July 31.
8. Construction and surface occupancy cannot occur any time within 0.25 mile of existing leks for greater sage grouse.
9. Construction, drilling, and other activities potentially disruptive to strutting and nesting greater sage-grouse are prohibited during the period of March 1 to June 30 for the protection of strutting and nesting areas.
10. Construction, drilling, or other activities that could disrupt nesting raptors or greater sage grouse are prohibited during the period from February 1 to July 31 (raptors) and from March 1 through June 30 (greater sage grouse) for the protection of nesting areas for these species. An exception would be approved only after a thorough, site-specific analysis concluded that a negative impact would not occur.

11. Surface occupancy or use within 0.25 mile of a greater sage grouse strutting or dancing ground will be restricted or prohibited unless the operator and BLM arrive at an acceptable plan for mitigation of anticipated impacts.
12. All pits and open cellars must be fenced for the protection of wildlife and livestock. Fencing must be in accordance with BLM specifications. Netting must be placed over all production pits to eliminate any hazard to migratory birds or other wildlife. Netting is also required over reserve pits that have been identified as containing oil or hazardous substances as these terms are defined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 101 (14), as determined by visual observation or testing. The mesh diameter will be no larger than 1 inch.
13. Construction, drilling, and other activities are prohibited during the reproductive period of April 10 to July 10 for the protection of mountain plover.

Fisheries

1. No mitigation for fisheries is needed beyond the measures indicated under Water Resources and Special Status Species.

Special Status Species

Special Status Plants

1. Clearance surveys must be performed for plant species of concern.

Recreation

Measures under the section of the EA on Wildlife, Transportation, Soils, Health and Safety, and Water Resources apply to Recreation.

1. The Companies must minimize conflicts between project vehicles and equipment and recreation traffic by posting warning signs, implementing operator safety training, and requiring project vehicles to adhere to low speed limits.

Visual Resources

1. Roads, pipeline corridors, drill rigs, wellheads, and production facilities must be screened to the extent possible, when specified by BLM.
2. The Companies must paint structures at wells and central facilities with flat colors (such as Carlsbad Canyon) that blend with the adjacent undisturbed terrain. This measure does not apply to structures that require safety coloration in accordance with the requirements of the Occupational Safety and Health Administration (OSHA).

Cultural Resources

1. A Class III inventory for cultural resources has been done, but if the area of potential effect were to change, additional inventory would be required.
2. Avoidance is the preferred method for mitigating adverse effects to a property that is considered eligible for, or is already on, the NRHP.
3. Adverse effects to cultural or historical properties that cannot be avoided would be mitigated by preparing and implementing a cultural resources mitigation plan. Mitigation plans would be developed as needed for eligible sites that would be impacted.
4. If cultural resources are discovered at any time during construction, all construction would halt and BLM would be immediately notified. Work would not resume until BLM issues a Notice to Proceed.

Socioeconomics

1. Project activities must be coordinated with ranching operations to minimize conflicts that involve movement of livestock or other ranch operations. Coordination would include scheduling project activities to minimize potential disturbance of large-scale livestock movements. The Companies would establish effective and frequent communication with affected ranchers to monitor and correct problems and coordinate scheduling.

Transportation

1. Existing roads, if any, would be used as collectors and local roads whenever possible. Standards for road design would be consistent with BLM Road Standards Manual Section 9113. The proposed access road would be constructed to the BLM standard for a local road.
2. All roads on public lands that are not required for routine operation and maintenance of producing wells, ancillary facilities, or field production would be permanently blocked, recontoured, reclaimed, and revegetated.
3. Areas with important resource values, steep slopes, and fragile soils would be avoided where possible in planning for new roads.
4. Permits are required from Carbon County for any access to or across a county road or for any pipeline that crosses a county road. These permits would be acquired before additional roads are built. Roads on private lands would be reclaimed in a like manner to those on public lands, depending on the desires of the landowner.

5. The Companies would be responsible for preventive and corrective maintenance of roads in the Project Area throughout the duration of the project. Maintenance may include blading, surfacing, cleaning ditches and drainage facilities, abating dust, controlling noxious weeds, or other requirements as directed by the BLM or the Carbon County Road and Bridge Department.
6. Except in emergencies, access would be limited to drier conditions to prevent severe rutting of the road surface. No construction or routine maintenance activities would be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of 4 inches deep, the soil would be considered too wet to adequately support construction equipment. Culverts would be installed where needed to allow drainage in all draws and areas of natural drainage. Low water crossings would be used where applicable. Onsite reviews would be conducted with BLM personnel for approval of proposed access before any construction begins.

Health and Safety

Measures listed under the section of the EA on Air Quality and Water Quality also apply to Health and Safety.

1. Sanitation facilities installed on the drill sites, and any resident camps would be approved by the WDEQ.
2. To minimize undue exposure to hazardous situations, the Companies would comply with all applicable rules and regulations (such as Onshore Orders and OSHA requirements) that would prevent the public from entering hazardous areas and would post warning signs to alert the public of truck traffic.
3. The Companies would haul all garbage from the drill site to a state-approved sanitary landfill for disposal. In addition, the Companies would collect and store any garbage or refuse on location in containers approved by the BLM until it can be transported.
4. During construction and when production operations begin, the Companies would maintain an inventory of chemicals or hazardous substances for all items that may be at the site. The Companies would institute a Hazard Communication Program for employees and would require subcontractors to establish programs in accordance with OSHA regulations at 29 CFR 1910.1200. These programs are designed to educate and protect employees and subcontractors with respect to any chemicals or hazardous substances that may be present in the work place. In addition, Material Safety Data Sheets (MSDS) would accompany every chemical or hazardous material that is brought on location and would become part of the file maintained at the Doty Mountain field office, as required by 29 CFR 1910.1200. All employees would receive proper training in storage, handling, and disposal of hazardous substances.

5. SPCC Plans would be written and implemented as necessary, in accordance with 40 CFR Part 112, to prevent discharge into navigable waters of the United States.
6. If quantities that exceed 10,000 pounds or the threshold planning quantity (TPQ) as designated by the RFO are to be produced or stored in association with the project, chemical and hazardous materials would be inventoried and reported in accordance with the toxic release inventory (TRI) requirements set forth in Title III of the Superfund Amendments and Reauthorization Act (SARA) and codified at 40 CFR Part 335. The required Section 311 and 312 forms would be submitted at the specified times to the state and county emergency management coordinators and the local fire departments.
7. Any hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA), would be transported and disposed of in accordance with all applicable federal, state, and local regulations.
8. All storage tanks and compressor facilities that are designed to contain oil, glycol, produced water, or other fluid that may constitute a hazard to public health or safety, must be surrounded by a secondary means of containment for the entire contents of the largest single tank in use, plus 1 foot of freeboard. The Companies would use 3.5-foot berms around affected storage tanks and facilities. The containment or diversionary structure must be impervious to any oil, glycol, produced water, or other hazardous fluid for 72 hours. In addition, it would be constructed so that any discharge from a primary containment system would not drain, infiltrate, or otherwise escape to groundwater, surface water, or navigable waters before cleanup is completed.

Noise

1. The Companies would muffle and maintain all motorized equipment according to manufacturer's specifications.
2. In any area of operations (such as a drill site or compressor station) where noise levels may exceed safe limits specified by OSHA, the Companies would provide and require that employees use proper personal protective equipment.
3. In addition to other restrictions on activities near leks, the BLM will require that noise levels be limited to no more than 10 decibels on the A-weighted scale (dBA) above background levels at leks for greater sage grouse that are located on public lands. This scale simulates human hearing by placing less emphasis on lower frequency noise. The BLM will require that compressor engines located on public lands be enclosed in a building and located at least 600 feet away from sensitive receptors or sensitive resource areas to comply with these limits on noise levels.

2.2 ALTERNATIVE 2 – NO ACTION ALTERNATIVE

Section 1502.14(d) of NEPA requires that the alternative analysis include the alternative of no action. Under the No Action alternative, ongoing natural gas production activities, if any exist, would be allowed to continue but the coordinated exploration and interim development described in the Doty Mountain Plan of Development (proposed project) would not be authorized by BLM. The Project Area has not been disturbed by existing CBNG exploration (**Table 2-3**). BLM would consider additional APDs and ROW actions for federal lands on a piecemeal or case-by-case basis outside the scope of this EA, consistent with the scope of existing environmental analysis. Additional gas development could occur on state and private lands within the Project Area under APDs approved by the WOGCC.

2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The proposed project has a limited scope and purpose, to obtain resource information in support of the Atlantic Rim EIS that is currently being prepared. A reasonable range of alternatives under NEPA for the interim drilling program would include actions under BLM's authority that could be implemented before the Atlantic Rim EIS is completed. Under the Interim Drilling Policy, the proposed project must not significantly affect the environment or prejudice the decisions that would be made as a result of the analysis conducted for the Atlantic Rim EIS. Therefore, construction of new linear features such as access roads or pipelines should occur parallel to existing roads to minimize disturbance. In addition, the integrity of important wildlife habitats and sensitive areas, such as areas of critical environmental concern (ACECs), should not be compromised.

The Proposed Action and No Action alternative are consistent with the guidance found in the Interim Drilling Policy ([Appendix A](#)). They address a reasonable range of alternatives for the limited scope and purpose of the proposed project.

Two other alternatives, described below, were identified but were not analyzed in detail because they did not comply with the Interim Drilling Policy. One alternative would have used an existing route along two-tracks located southwest of the Project Area for road access and the market access pipeline. A second alternative would have used the Willows Road (BLM Road 3305) for access to the Project Area. This alternative would have required construction of new access across Dry Cow Creek and would have included a route for a market access pipeline that would be parallel to the road. Only the road and pipeline route identified in the Proposed Action could be implemented, based on the terms of the Interim Drilling Policy, and were analyzed in detail. These two alternatives were not analyzed in detail for the reasons described below.

The alternative that considered construction of road and pipeline access parallel to existing two-tracks that are located southwest of the Project Area would have affected important greater sage grouse habitat. Severe winter-yearlong habitat areas (winter relief or concentration areas) for greater sage grouse were identified in Sections 28 and 29, T17N R91W (HWA 2003). In addition, active greater sage grouse leks were identified in Sections 28 and 32, T17N R91W, near the proposed pipeline route (HWA 2003). A Controlled Surface Use (CSO) stipulation applies to oil and gas lease operations within a ¼-mile buffer around active greater sage grouse leks. The route was modified near the winter concentration areas for greater sage grouse and within the ¼-mile buffer for the active leks, but could not be relocated to completely avoid important habitats.

An alternative was considered to construct the sales pipeline parallel to the Willows Road that is located southeast of the Project Area. However, multiple resource concerns are associated with this route. The Sand Hills ACEC and crucial winter ranges for elk and mule deer are located east of the existing road, and boundaries of these areas extend to the road. In addition, three greater sage grouse leks and one prairie dog town are located just west of the existing road. It would not be possible to identify a route through this area for a sales pipeline that would parallel the existing road without compromising one or more of the following resources: greater sage grouse leks; the prairie dog town; overlapping winter ranges; or the ACEC.

The Companies have entered into a sales agreement with a pipeline company that will purchase gas from the Project Area. The economic feasibility of alternative pipeline routes that would have ended at pipelines where the Companies have no sales agreement were not considered alternatives that could be implemented for an interim, exploratory project. An alternative that consists of a market access pipeline to a different interstate pipeline than the one already contracted by the Companies, would also represent uneconomic conditions.

Uneconomic routes would not be implemented and were not analyzed in detail. A person or company of ordinary prudence would consider as uneconomic any pipeline that would cost more to construct, operate, and maintain than the value of the gas, or that would not provide a reasonable rate of return on the Companies' investment in the infrastructure.

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

The Affected Environment for the proposed Doty Mountain project discusses environmental, social, and economic factors currently existing within the Doty Mountain Project Area (Project Area). The Project Area includes the Doty Mountain Plan of Development (POD) and the pipeline corridor, which extends southwest from the proposed well locations ([Figure 2-1](#)). The material presented here has been guided by management issues identified by the RFO, public scoping, and by interdisciplinary field analysis of the area. The critical elements, as listed in BLM’s NEPA Handbook H-1790-1 (BLM 1988b), and other resource elements of the human environment have been considered. The elements of the human environment, including critical elements, their status in the Project Area, and their potential to be affected by the proposed Project are listed in Table 3-1. Those items listed as “none present” would not be affected or impacted by the project or the No Action alternative and are not addressed further in this document.

**TABLE 3-1 ELEMENTS OF THE HUMAN ENVIRONMENT
ATLANTIC RIM INTERIM DRILLING PROGRAM 2003
DOTY MOUNTAIN PROJECT, CARBON COUNTY, WYOMING**

| Element | Project Area Status | Addressed in Text |
|---|----------------------|-------------------|
| Geology, Minerals and Paleontology | Potentially Affected | Yes |
| Climate and Air Quality | Potentially Affected | Yes |
| Soils | Potentially Affected | Yes |
| Water Resources (including surface and groundwater quantity and quality) | Potentially Affected | Yes |
| Vegetation, Wetlands, and Noxious Weeds (including riparian zones, invasive species, threatened and endangered species, and species of special concern) | Potentially Affected | Yes |
| Range Resources and Other Land Uses | Potentially Affected | Yes |
| Wildlife and Fisheries (including threatened and endangered species, and species of special concern) | Potentially Affected | Yes |
| Recreation | Potentially Affected | Yes |
| Visual Resources | Potentially Affected | Yes |
| Cultural Resources | Potentially Affected | Yes |
| Socioeconomics | Potentially Affected | Yes |
| Environmental Justice | Potentially Affected | Yes |
| Transportation | Potentially Affected | Yes |
| Health and Safety | Potentially Affected | Yes |
| Noise | Potentially Affected | Yes |
| Areas of Critical Environmental Concern | None present | No |
| Prime or Unique Farmlands | None present | No |
| Floodplains | None present | No |
| Native American Religious Concerns | Potentially Affected | Yes |
| Hazardous or Solid Wastes | Potentially Affected | Yes |
| Wild and Scenic Rivers | None Present | No |
| Wilderness | None Present | No |

3.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

3.2.1 Physiography, Topography, and Landforms

The Project Area occupies the southeastern portion of the Greater Green River Basin, a large intermontane structural and topographic basin that is part of the Wyoming Basin Physiographic Province. The Project Area is located in an area that has been heavily dissected by the tributary drainages of Dry Cow Creek and Muddy Creek. Landforms consist of ridges, finger ridges, knolls, and hills. Slopes are gentle to moderate. Elevations range from 6,700 feet to 7,300 feet. Wyoming State Highway (WY) 789 via WY 70 or Interstate-80 (I-80), Carbon County Road 608 (Wild Cow Road), upgraded BLM roads, and two-track trails provide access to the Project Area.

3.2.2 Geology

The Greater Green River Basin began developing about 70 million years ago and filled with sediments derived from the eroded Wind River Range to the north during the late Cretaceous and early Tertiary Periods. The Project Area lies within the northern part of the smaller Washakie Basin, where the Lewis Shale of Late Cretaceous age is exposed at the surface. This formation consists of a thick sequence of shale, siltstone, and sandstone that accumulated in deltaic, interdeltaic, and marginal marine environments within a shallow epicontinental sea that extended northward from the Gulf of Mexico to the Arctic Ocean in Maestrichtian time (Winn et al. 1985a, 1985b, 1985c). The Lewis Shale is underlain by 12,000 feet of sedimentary rock, which in turn lies on a basement complex of Precambrian metamorphics and intrusives. The configuration of the basement rock forms the Washakie Basin at depth. At the surface, structural features define the basin margins. These structural features include the Great Divide Basin to the north, the Rock Springs Uplift to the west, the Cherokee Arch to the south, and the Sierra Madre Mountains to the east.

By Late Cretaceous time, this seaway had retreated eastward and the marine deposits of the Lewis Shale were replaced progressively upward by beach, estuarine, and continental deposits of the Fox Hills Sandstone and Lance Formation that spread westward in response to the Sevier and Laramide orogenies. The Laramide orogeny resulted locally in the uplift of the Sierra Madre Mountains and the subsidence of the Washakie Basin. The basin was filled with Tertiary deposits of the Fort Union Formation during Paleocene time and with deposits from the Wasatch Formation during Eocene time.

In places atop modern terraces and buttes along the Muddy Creek and Cow Creek drainages, the Lewis Shale is overlain by a thin veneer of much younger, unconsolidated sediments of Quaternary age. The Muddy Creek drainage is located about 1.5 miles to the north, and the Cow Creek drainage is located about 3.2 miles southeast of the Doty Mountain area. The unconsolidated sediments include alluvium, colluvium, stream terrace gravels, and wind-blown sands that are Late Pleistocene to Holocene in age.

Underlying the Lewis Shale in the Project Area is the Mesaverde Group, which contains abundant sand, carbonaceous shale and coal. The Mesaverde Group is exposed at the surface along the western slope of the Sierra Madre Uplift and is more than 2,500 feet thick. Resistant sandstone beds of the Mesaverde Group form the Atlantic Rim escarpment located immediately north of the Project Area.

Numerous thin coal seams are present in the Allen Ridge, Pine Ridge and upper Almond Formations, which are members of the Mesaverde Group. These coal beds are targeted as exhibiting the greatest potential for gas production. The lateral continuity of the coal seams is variable (Hamilton 1993). Geophysical logs from test wells in the Atlantic Rim EIS study area indicate that the coal beds are somewhat laterally discontinuous; however, data to correlate the coal seams are limited.

Late Cretaceous rocks exposed at the surface and underlying the Project Area consist of a complex sequence of sedimentary units, including sandstone, shale, coal, and carbonaceous shale. These sediments were shed from the Sevier orogenic belt to the west and were deposited along the western edge of the interior Cretaceous sea (Roehler 1990). Deposition occurred predominantly during two major transgression-regression periods of the sea. Late Cretaceous and younger rocks at the surface are underlain by Phanerozoic sedimentary rocks that range from Cretaceous to Cambrian in age. The Phanerozoic sediments are underlain by Precambrian metamorphic bedrock that makes up part of the ancient North American shield.

3.2.3 Mineral and Energy Resources

The three primary mineral commodities that occur in Carbon County are coal, natural gas, and oil (Hoffman and Nunley 2000). Production of these mineral resources has occurred in the Project Area, with coal mining being the least significant production to date. Additional mineral resources within the Project Area include construction aggregate.

The Washakie Basin has been explored and developed for oil and gas resources for many years. A number of formations have been productive; however the Mesaverde Group and more specifically the Almond Formation, has produced the most oil and gas resources. The coal beds of the Mesaverde Group, underlying the Lewis Shale, are the objective for the exploratory wells proposed under the project.

There are no existing or plugged and abandoned wells in the Project Area. However, WOGCC records contain eight permits to drill wells in Section 14, T17N, R91W; six expired permits to drill and two current permits to drill wells in Section 22, T17N, R91W; and nine permits to drill wells (including one disposal well) in Section 23, T17N, R91W.

There are existing oil and gas wells in the Cow Creek Unit near the lateral sales pipeline route. In Section 6, T16N R91W, an oil well drilled to the Niobrara Formation was plugged and abandoned in 1966. There is also one shut-in gas well in Section 6. There are three plugged and abandoned oil wells in Section 1, T16N R92W, that were drilled to the Morapos or the Frontier Formations in the 1960s and 1970s. There is a plugged gas well (dated 1998) drilled to the Deep Creek Formation in Section 12, T16N R92W, near the termination point for the lateral sales pipeline. Two wells are currently producing in

Section 12, T16N 92W. One is producing oil and gas, and the other is producing gas only; both are near the terminus of the lateral sales pipeline route. In addition, five shut-in wells, one active injection well, and one abandoned well, are located in Section 12, T16N R92W.

Coal reserves in the Greater Green River Basin have been estimated at nearly 1,300 trillion tons (Scott et al. 1995). Coal occurs in the Mesaverde Group and the Fort Union Formation in the Washakie Basin. Coal occurs primarily in the Allen Ridge, Pine Ridge and Almond Formations within the upper part of the Mesaverde Group in the Doty Mountain area. The coal is sub-bituminous to high-volatile C bituminous in rank (Tyler et al. 1995). Two coal bed natural gas (CBNG) fields have been explored in the eastern Washakie Basin: the Dixon Field (T12N R90W), and the Cow Creek Field (T16N R92W), both of which target coal seams in the Mesaverde Group.

3.2.4 Geologic Hazards

Potential geologic hazards include landslides, subsidence, and known or suspected active faults. No known active faults with evidence of Quaternary movement or earthquake epicenters occur within the Project Area (Gary Holsan Environmental Planning [GHEP] 2003). Landslide potential is greatest in areas where steep slopes occur, particularly where rock layers dip parallel to the slope, or where erosional undercutting may occur. Slope gradients in the Project Area typically are gentle to moderate, although locations proposed for wells are predominantly along mildly sloping areas. Unstable soils in steep areas such as ridges or buttes may also be susceptible to slumping, sliding, and creeping.

An earthquake that measured 4.3 on the Richter scale occurred on April 4, 1999, 5.2 miles southeast of the Project Area, with its epicenter near Baldy Butte in T17N R92W (41.45°N, 107.74°W) (GHEP 2003). No other earthquake epicenters have been recorded in or immediately adjacent to the Project Area in the past 100 years.

No subsidence hazards or features with potential for subsidence are known to exist within the Project Area.

3.2.5 Paleontology

Paleontological resources include the remains or traces of any prehistoric organism that have been preserved in the earth's crust by natural processes (BLM Information Bulletin WY-93-371). Within sedimentary deposits in the Project Area, paleontological resources serve as a record of the history of animal and plant life in Wyoming during the Late Cretaceous Period. The Lewis Shale represents this period and is known to yield scientifically significant vertebrate fossils in several areas of Wyoming. However, no specific localities have been reported within the Project Area.

Fossils of scientific interest may occur within or in association with energy minerals such as coal, oil shale, lignite, bitumen, asphalt, and tar sands. They may also occur with industrial minerals such as phosphate, limestone, diatomaceous earth, and coquina. Fossils of scientific interest include those of interest to professional paleontologists and educa-

tors, or any vertebrate fossil. If other types of fossils are discovered in the Project Area, the BLM state director and field managers, in consultation with BLM staff paleontologists or other source of expertise, may consider them of scientific interest.

Fossils known from the Lewis Shale represent a large and varied marine invertebrate fauna, including many genera of bivalves, baculites, scaphites, and ammonites and isurid shark teeth (Breithaupt 1985; Gill et al. 1970). Significant fossils are known from the Lewis Shale from some areas of Wyoming. Still, the potential for discovery of scientifically significant fossils in the Project Area is considered moderate to low when compared with other Late Cretaceous age formations in Wyoming.

3.3 CLIMATE AND AIR QUALITY

3.3.1 Climate

The Project Area is located in a semiarid, upland climate regime of the northern Great Plains that is typified by dry, windy conditions with limited rainfall and long, cold winters. Baggs, Wyoming, located 27 miles south of the Project Area, is the nearest meteorological station. Meteorological measurements have been collected at Baggs at an elevation of 6,240 feet from September 1, 1979, to December 31, 2002 (WRCC 2003).

The average annual precipitation over the period of record at Baggs is 10.7 inches, ranging from 18.5 inches in 1983 to 4.63 inches in 1989. Precipitation is greatest during the summer, although minor peaks occur in May, July, and October. An average of 38.8 inches of snow falls annually. The annual high of 118.9 inches was recorded for the 1984-1985 season (WRCC 2003). The most snow falls in December and January, with mean snowfall of 9.1 inches in December and 8 inches in January. In the Project Area, annual average precipitation is estimated to be about 8 to 9 inches, based on local BLM information and Natural Resource Conservation Service (NRCS) range site descriptions.

Temperatures are generally cooler, frost-free periods are shorter, and both precipitation and snowfall are greater at higher elevations. The region is typically cool, with average daily temperatures ranging from a low of 5 °F to a high of 33 °F in mid-winter and between a low of 48 °F and a high of 86 °F in mid-summer. Extreme temperatures have ranged from -50 °F to 100 °F, and the frost-free period (at 32 °F) generally occurs from mid-May to mid-September.

Mean annual evaporation ranges from 38 inches (lake) to 55 inches (pan) and potential annual evapotranspiration is 18 inches (U.S. Department of Commerce 1979). Compared with the average annual precipitation of 10.7 inches (WRCC 2003), this mean annual evaporation yields an average annual deficit of 6 inches. These characteristics of the Project Area combine to produce a predominantly dry climate where evaporation exceeds precipitation.

The Project Area is subject to strong and gusty winds, which reflect the channeling and mountain valley flows caused by the complex terrain. During the winter, strong winds and snow often produce blizzard conditions and drifting snow. Comprehensive wind

measurements are collected at the airport in Rawlins, Wyoming, which is nearly 31.5 miles northeast of the Project Area at an elevation of 6,780 feet. However, hourly wind data measurements for December 1994 through November 1995 were collected near Baggs, Wyoming, during the Mount Zirkel Wilderness Area Visibility Study. Based on the data collected at Baggs, 27 miles south of the Project Area, winds originate from the south to southwest nearly 37 percent of the time, and the annual mean wind speed is nearly 10 mph.

3.3.2 Air Quality

The National Ambient Air Quality Standards (NAAQS) and the Wyoming Ambient Air Quality Standards (WAAQS) establish upper limits for concentrations of specific air pollutants. Incremental increases in the ambient concentration of criteria pollutants are regulated under the Prevention of Significant Deterioration (PSD) program. The program is designed to limit the incremental increase of specific air pollutants above a legally defined baseline level, depending on the classification of a location. The Project Area and adjacent areas are identified as PSD Class II, where incremental increases are not as restrictive when compared with the incremental increases allowed in PSD Class I areas.

Emissions are limited within the Project Area, with only a few industrial facilities and residential sources in the relatively small communities and isolated ranches. In addition, the good atmospheric dispersion conditions in the Project Area typically result in low concentrations of criteria air pollutants. Although criteria air pollutants have not been monitored in the Project Area, background values measured in the region are well below the National Ambient Air Quality Standards (NAAQS), Wyoming Ambient Air Quality Standards (WAAQS), and the Colorado Ambient Air Quality Standards (CAAQS). Standards have been established for six criteria air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter less than 10 microns in effective diameter (PM₁₀), sulfur dioxide (SO₂), and lead (Pb).

The WDEQ-AQD (1997) and Colorado Department of Public Health and Environment, Air Pollution Control Division (CDPHE APCD 1996) provided data on the background concentration of air pollutants, with the exception of lead. Inferred background concentrations of air pollutants, applicable WAAQS and NAAQS, and Class I and II increments (measured in micrograms per cubic meter, or µg/m³) are provided in Table 3-2. Values included in Table 3-2 reflect the most recently available air quality monitoring data collected near the Project Area. An estimate of background concentrations is needed to combine with modeled, project-related impacts to air quality and to compare the total predicted impacts with applicable air quality standards. It is important that the background concentration of each pollutant, model predictions, and air quality standards are all based on the same averaging times.

TABLE 3-2 AIR POLLUTANT BACKGROUND CONCENTRATIONS, STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS, AND PSD INCREMENTS ($\mu\text{G}/\text{M}^3$)

| Pollutant/Averaging Time | Measured Background Concentration | State and National Ambient Air Quality Standards | Incremental Increase Above Legal Baseline PSD Class I | Incremental Increase Above Legal Baseline PSD Class II |
|--|-----------------------------------|--|---|--|
| Carbon Monoxide (CO) 1-hour | 2,299 ^a | 40,000 | n/a | n/a |
| 8-hour | 1,148 ^a | 10,000 | n/a | n/a |
| Nitrogen Dioxide (NO ₂) Annual | 10 ^b | 100 | 2.5 | 25 |
| Ozone (O ₃) 1-hour | 117 ^c | 235 | n/a | n/a |
| Particulate Matter (PM ₁₀) | 20 ^c | 150 | 8 | 30 |
| 24-hour | 12 ^c | 50 | 4 | 17 |
| Annual | | | | |
| Sulfur Dioxide (SO ₂) 3-hour (National) | 29 ^d | 1,300 | 25 | 512 |
| 24-hour (National) | 18 ^d | 365 | 5 | 91 |
| 24-hour (Wyoming) | 18 ^d | 260 | n/a | n/a |
| Annual (National) | 5 ^d | 80 | 2 | 20 |
| Annual (Wyoming) | 5 ^d | 60 | n/a | n/a |

Notes:

- Data for measured background concentration of ozone are the top tenth percentile maximum 1-hour value during July; other short-term background concentrations are second-maximum values measured.
- N/A - not applicable
- Wyoming Ambient Standards from: Wyoming Air Quality Standards and Regulations, Chapter 2 – Ambient Standards
- National Ambient Standards from: Title 40 Code of Federal Regulations (CFR) Part 50
- PSD Increments from: 40 CFR Parts 51 and 52 Prevention of Significant Deterioration for Particulate Matter, EPA Final Rule. Federal Register Vol. 58, No. 105, Thursday, June 3, 1993.
- Background Air Quality Data Sources:
 - a Data collected at Rifle and Mack, Colorado, in conjunction with proposed oil shale development during early 1980s (CDPHE-APCD 1996).
 - b To supplement monitored NO₂ data, a separate NO₂ modeling analysis was performed, including many oxides of nitrogen (NO_x) emission sources (BLM 1996).
 - c Data collected at UCG Project, 9 miles west of Rawlins, Wyoming, June 1994 – November 1994 (WDEQ-AQD 1997).
 - d Data collected at Craig Power Plant site and at Colorado oil shale areas (CDPHE-APCD 1996).

Concern has been expressed in recent years regarding the potential impacts of oil and gas development, and other activities on air quality and Air Quality Related Values (AQRV) in the Class I and sensitive Class II airsheds in the region. The closest federally mandated Class I areas located potentially downwind (northeast or southeast) of the Project Area are the Mount Zirkel Wilderness, 46 miles to the southeast, and the Rawah Wilderness, 82 miles to the southeast, in northern Colorado. The USFS manages both of these areas. Table 3-3 shows Distant Class I and Class II wilderness areas or monuments located within 100 miles of the Project Area.

TABLE 3-3 CLASS I AND II WILDERNESS AREAS AND NATIONAL MONUMENT WITHIN 100 MILES OF THE PROJECT AREA

| Area | State | Federal Classification | Distance^a (miles) | Managed by |
|----------------------------|----------------------|-------------------------------|-------------------------------------|-------------------|
| Huston Park | Wyoming | II | 33 | USFS |
| Encampment River | Wyoming | II | 46 | USFS |
| Mount Zirkel | Colorado | I | 51 | USFS |
| Savage Run | Wyoming | II ^b | 61 | USFS |
| Platte River | Wyoming and Colorado | II | 64 | USFS |
| Dinosaur National Monument | Colorado and Utah | II ^c | 79 | NPS |
| Rawah | Colorado | I | 88 | USFS |

Notes:

^a Distances are south and east of the Project Area, except for Dinosaur National Monument, which is southwest of the Project Area.

^b The State of Wyoming manages the Savage Run Wilderness as a Class I air quality area.

^c The State of Colorado manages this monument as a Class I air quality area.

Continuous data for the visibility-related optical background were collected at the Class I Bridger Wilderness Area in Wyoming and the Class I Rocky Mountain National Park (just south of the Class I Rawah Wilderness Area) in Colorado, as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Visibility in the Central Rocky Mountains is very good (averaging more than 70 miles Standard Visual Range), with impacts from fine particles accounting for nearly half of the average degradation (Sisler 1996). In addition, impacts from background atmospheric deposition (acid rain) were monitored at the National Acid Deposition Program/National Trends Network sampling station near Pinedale, Wyoming. In addition, site-specific background data on lake chemistry (pH, acid neutralizing capacity, elemental concentrations, and other factors) have been collected by the U.S. Geological Survey (USGS) Water Quality Division in several high mountain lakes in the nearby wilderness area.

The frequency and strength of the winds greatly affect dispersion and transport of air pollutants. Because of the strong winds in the Project Area, the potential for atmospheric dispersion is relatively high. It is possible that nighttime cooling, which stabilizes air, could inhibit mixing and transport of air pollutants. Dispersion will be the greatest to the north and along the ridges and mountaintops.

The WDEQ-AQD is the primary regulatory agency responsible for evaluating potential impacts when detailed development plans are finalized. Plans for natural gas development are subject to applicable air quality laws, regulations, standards, control measures, and management practices. The State of Wyoming has responsibility, with EPA consultation, for reviewing and permitting proposed emission sources before the Companies

begin operations in the Project Area. The WDEQ-AQD pre-construction air quality permitting would be based on site-specific, detailed engineering values that would be included in the Companies' permit application.

3.4 SOILS

The description of the soils resource forms the basis by which to assess the intensity, duration and magnitude of soil impacts associated with the construction of access roads, well pads, and facilities and to develop effective mitigation measures to prevent, reduce or eliminate impacts to the soils resource. Productivity of soils can be affected by removal of vegetative cover, invasion by undesirable weed species, soil compaction and an increased potential for wind and water erosion. Wind and water erosion potential is, in part, dependent on grain size distribution. For example, clayey soils are sensitive to reduction in permeability through the reduction in the amount and distribution of pore spaces. Reduced permeability can increase runoff of precipitation thereby increasing concentrated overland flow. Reduction in the amount and distribution of porosity can also exacerbate potential for upward migration of soluble salts. In addition, clay in lower horizons of a soil retards permeability and may cause salt to build up in the soil, reducing productivity. In addition to these physical limitations of the soils, in many areas chemical limitations exist primarily in terms of sodium.

The soils in the Project Area have been formally mapped and described at different levels of detail. Munn and Arneson (1999) described the soils within the Project Area using a broad perspective of soils within a large area, at an Order IV or V level of detail. Texas Resource Consultants (1981) and Wells et al (1981) describe the dominant soils in the Project Area at an Order III level of detail. As the survey order number decreases, the level of survey detail or specificity increases. For example, the components of an Order IV map unit are typically phases above the series level, whereas the components of an Order III map unit are typically phases at or below the series level. The Order III soil surveys of the Project Area compliment the survey conducted by Munn and Arneson. The results of these surveys are described in this section.

Munn and Arneson (1999) describe the soils within the Project Area at an Order IV or V level of intensity. Order-IV soil surveys typically include a map scaled at 1:63,360 to 1:250,000, that contains soil map units of approximately 40 to 623 acres. Based on this survey, the Project Area is located within Soil Zone 9, which is characterized as intermontane basin, frigid, and aridic. There are two types of soils in the Project Area: the Ustic Haplargids (CR07) and the Ustic Torrifluvents and Typic Haplocambids (CR10). The Ustic Haplargids soil type is found in the majority of the Project Area; the Ustic Torrifluvents and Typic Haplocambids soil types are found on about 80 acres in T17N R91W, Section 22.

The Ustic Haplargids are fine loamy, mixed, and frigid, and occur on nearly level to gently sloping areas. This soil type is described as very deep and well drained and formed in slopewash alluvium (sediments deposited by running water) derived from shale and sandstone. This soil type is found on terraces, fans, fan remnants, hillslopes, and pediment toeslopes; the slopes generally range from 0 to 15 percent. Livestock grazing and wildlife

habitat are the primary uses of the Ustic Haplagrids soils. Native vegetation supported by these soils is generally big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, and needle-and-thread.

The Ustic Torrifuvents are coarse-loamy, mixed (calc), and frigid. The Typic Haplocambids are fine, montmorillonitic, and frigid.

More detailed soils information is also available for the Project Area. An Order III soil survey was prepared by Texas Resource Consultants (1981) and Wells et al (1981) for the BLM, in cooperation with the Natural Resources Conservation Service (then Soil Conservation Service). Order-III soil surveys typically include a map scaled at 1:20,000 to 1:63,360 that contains soil map units approximately of 4 to 40 acres in size that delineate soil associations and complexes. The soil associations and complexes that are mapped represent various soil series. To augment existing soils data, a field reconnaissance was conducted on September 19, 2003 as part of this analysis, to verify the distribution and properties of soils in the Project Area.

Characteristics of the soil map units delineated within the Project Area according to the Order III survey are presented in Table 3-4. Soils in the Project Area formed in residuum and alluvium derived from Cretaceous and Tertiary shales, siltstones and sandstones. An ustic moisture regime with a frigid temperature regime prevails. Soils typically are dry for more than 90 days, but less than 180 days within a year. The mean annual soil temperature is between 0°C to 8°C (32°F to 47°F).

Textures in surface soil are typically fine sandy loam to loam. The textures in the B-horizon (if present) are typically clay loam to loam. The textures in the C-horizon and regolith are typically clay loam to sandy loam. These soils are classified as well drained. In general, permeability is moderate. Runoff potentials are medium to rapid.

The water and wind erosion hazard classification for disturbed soils is generally moderate to severe. The soil erodibility factor (Revised Universal Soil Loss Equation - K-factor) for these soils varies from 0.28 to 0.49 and the tolerable soil loss is between 1 and 5 tons/acre/year. The soil erodibility factor is a measure of the susceptibility of a soil to erosion based on empirically derived relationships between soil texture, organic matter, structure and permeability. It ranges from 0.1 to 0.64, where higher values indicate a higher susceptibility to erosion. The wind erodibility grouping is 3 to 6. Wind erodibility groupings are explained in Table 3-4.

Soil salinity is generally low and ranges from 2-4 mmhos/cm. The soil horizon pH may range above 8.5 in all or parts of each map unit. Typically, this condition indicates sodic soils.

The average annual aboveground biomass productivity (based on range site classifications) of these soils ranges from 700 to 1500 lbs/acre (on a dry weight basis).

TABLE 3-4 DOTY MOUNTAIN SOIL CHARACTERISTICS

| Map Unit # | Map Unit Name | Series (% of map unit) | Taxonomic Classification | Landscape Position | Slope | Soil Parent Material | Horizon | Depth | Texture | Shrink/Swell | Depth to Bedrock | Erosion Factor | | Wind Erodability Group ¹ | Runoff | Drainage Class | Permeability | Erosion Hazard | | | |
|----------------|--|---|---|--|---------|--------------------------------|---------|----------|-----------------------------------|--------------|------------------|----------------|------------------|-------------------------------------|----------------|----------------|--------------------|-------------------|-------------------|----------|--|
| | | | | | | | | | | | | K | T (tons/acre/yr) | | | | | Water | Blowing | | |
| | | | | | | | | (inches) | | | (inches) | | | | | | | | | | |
| 202 | Rentsac - Shinbara Complex | Rentsac - 40% | Loamy-skeletal, mixed (calcareous), frigid, Lithic, Ustic Torriorthents | Gentle to steep upland ridges on residuum | 6%-30% | Hard sandstone | A | 0-3 | loam, fine sandy loam, sandy loam | NA | 18 | NA | NA | NA | Medium - Rapid | Well Drained | Moderately - Rapid | Moderate | NA | NA | |
| | | | | | | | C | 3-15 | loam, sandy loam | NA | | | | | | | | | | | |
| | | Shinbara - 40% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | 6%-30% | Shale and siltstone | A | 0-2 | loam | Low | 8 | 0.32 | 1 | 4L | Medium - Rapid | Well Drained | Moderate | Moderate - Severe | Moderate | Moderate | |
| | | | | | | | C | 2-9 | channery loam | Low | | 0.32 | | | | | | | | | |
| 233 | Forelle - Patent Complex | Forelle - 40% | Fine-loamy, mixed Borollic Haplargids | Gentle sloping alluvial fans in valleys | 3%-6% | Shale | A | 0-3 | loam | Low | >60 | 0.28 | 5 | 6 | Medium | Well Drained | Moderate | Slight - Moderate | Slight | | |
| | | | | | | | B | 3-22 | clay loam | Moderate | | 0.32 | | | | | | | | | |
| | | | | | | | C | 22-60 | clay loam | Moderate | | 0.32 | | | | | | | | | |
| | | Patent - 30% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | 3%-10% | Sedimentary Rock | A | 0-9 | loam | Moderate | >60 | 0.32 | 5-4 | 4-L | Medium | Well Drained | Moderate | Moderate | Moderate | | |
| | | | | | | | C | 9-60 | loam | Moderate | | 0.32 | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 235 | Blazon - Shinbara Complex | Blazon - 45% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | Ridgecrests, sideslopes, and footslopes on residuum. Slopes irregular with some highly dissected areas | 6%-20% | Shale | A | 0-10 | loam | Low | 10-20 | 0.32 | 1 | 4L | Rapid | Well Drained | Moderate | Severe | Moderate | | |
| | | | | | | | C | 2-9 | channery loam | Low | | 0.32 | | | | | | | | | |
| | | Shinbara - 30% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | 6%-40% | Shale | A | 0-2 | loam | Low | 2-10 | 0.32 | 1 | 4L | Rapid | Well Drained | Moderate | Severe | Moderate | | |
| | | | | | | | C | 2-9 | channery loam | Low | | 0.32 | | | | | | | | | |
| | | Rock Outcrop, Seaverson, Cushool and Diamondville - 25% | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 236 | Cushool-Worffman-Blackhall Complex | Cushool - 35% | Fine-loamy, mixed Borollic Haplargids | Gentle sloping to moderately steep uplands on residuum | 6%-15% | Sandstone or sandy shale | A | 0-2 | fine sandy loam | Low | 20-40 | 0.28 | 3 | 3 | Slow - Medium | Well Drained | Moderate | Slight - Moderate | Moderate - Severe | | |
| | | | | | | | B | 2-6 | loam | Low | | 0.32 | | | | | | | | | |
| | | | | | | | C | 6-30 | sandy clay loam | Low | | 0.28 | | | | | | | | | |
| | | Worffman - 20% | Loamy, mixed, shallow Borollic Haplargids | | 6%-20% | Sandstone | A | 0-2 | fine sandy loam | Low | 10-20 | 0.28 | 2 | 3 | Medium | Well Drained | Moderate | Moderate | Moderate - Severe | | |
| | | | | | | | B | 2-4 | loam | Moderate | | 0.32 | | | | | | | | | |
| | | | | | | | C | 4-15 | sandy clay loam | Moderate | | 0.32 | | | | | | | | | |
| | | Blackhall - 20% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | 10%-30% | Sandstone | C | 0-13 | sandy loam | Low | 10-20 | 0.24 | 1 | 3 | Medium | Well Drained | Moderate | Moderate | Moderate - Severe | | |
| | | | | | | | | | | | | | | | | | | | | | |
| 237 | Seaverson - Blazon Complex | Seaverson - 40% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | Undulating to rolling, dissected uplands on residuum | 3%-15% | Shale | A | 0-3 | clay loam | Moderate | 10-20 | 0.43 | 2 | 4L | Medium - Rapid | Well Drained | Moderately slow | Moderate - Severe | Moderate | | |
| | | | | | | | C | 3-16 | clay loam | Low | | 0.43 | | | | | | | | | |
| | | Blazon - 30% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | 3%-15% | Shale, siltstone, or loamstone | A | 0-15 | loam | Low | 10-20 | 0.32 | 1 | 4L | Medium - Rapid | Well Drained | Moderate | Moderate - Severe | Moderate | | |
| | | | | | | | | | | | | | | | | | | | | | |
| Shinbara - 10% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

TABLE 3-4 DOTY MOUNTAIN SOIL CHARACTERISTICS

| Map Unit # | Map Unit Name | Series (% of map unit) | Taxonomic Classification | Landscape Position | Slope | Soil Parent Material | Horizon | Depth | Texture | Shrink/Swell | Depth to Bedrock | Erosion Factor | | Wind Erodability Group ¹ | Runoff | Drainage Class | Permeability | Erosion Hazard | | |
|---------------|---|---|--|--|--------|----------------------|-----------|----------|-----------|--------------|------------------|----------------|--------|-------------------------------------|----------------|-------------------|--------------|-------------------|----------|--------|
| | | Abston, Ralod, Delphill, Diamondville, and Rock outcrop - 20% | | | | | | | | | | | | | | | | | | |
| 241 | Diamondville - Blazon - Forelle Complex | Diamondville - 40% | Fine-loamy, mixed Borolic Haplargids | Hilly uplands with convex ridgecrests, sideslopes, narrow valleys, and short alluvial fans | 3%-15% | Shale | A | 0-4 | loam | Low | 20-40 | 0.37 | 3 | 6 | Medium | Well Drained | Moderate | Moderate | Slight | |
| | | C | 4-22 | | | | clay loam | Moderate | 0.49 | | | | | | | | | | | |
| | | Blazon - 20% | Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents | | 3%-10% | Shale | A | 0-11 | loam | Low | 10-20 | 0.32 | 1 | 4L | Medium - Rapid | Well Drained | Moderate | Moderate - Severe | Moderate | |
| | | C | 4-60 | | | | clay loam | Moderate | >60 | 0.28 | 5 | 6 | Medium | Well Drained | Moderate | Slight - Moderate | Slight | | | |
| Forelle - 20% | Fine-loamy, mixed Borolic Haplargids | | | | | | | | | | | | | | | | | | | |
| | | Delphill, Seaverson, and Mowerson - 10% | | | | | | | | | | | | | | | | | | |
| 911 | Forelle - Diamondville Loams | Forelle - 60% | Fine-loamy, mixed Borolic Haplargids | Broad alluvial uplands | 3%-15% | Shale | A | 0-6 | loam | Low | >60 | 0.28 | 5 | 3 | Medium | Well Drained | Moderate | Moderate | Slight | |
| | | | | | | | B | 6-30 | clay loam | Moderate | | 0.32 | | | | | | | | |
| | | | | | | | C | 30-60 | clay loam | Moderate | | 0.32 | | | | | | | | |
| | | Diamondville - 20% | Fine-loamy, mixed Borolic Haplargids | | 3%-15% | Shale | A | 0-4 | loam | Low | 20-40 | 0.37 | 3 | 6 | Medium | Well Drained | Moderate | Moderate | Moderate | Slight |
| C | 4-25 | clay loam | Moderate | 0.49 | | | | | | | | | | | | | | | | |
| | | Pinelli, Yamac, and Evanston - 2% | | | | | | | | | | | | | | | | | | |
| 210 | | no data available | | | | | | | | | | | | | | | | | | |
| 251 | | no data available | | | | | | | | | | | | | | | | | | |

NA - data Not Available

Source - Soil Inventory of the Overland Area, Wyoming, Volume 1 - Soil and Land Use Technologies, Inc.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are:

- 1 Coarse sands, sands, fine sands, and very fine sands.
- 2 Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
- 3 Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.
- 4L Calcareous loams, silt loams, clay loams, and silty clay loams.
- 4 Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
- 5 Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
- 6 Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
- 7 Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
- 8 Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

3.5 WATER RESOURCES

3.5.1 Groundwater

Groundwater resources include deep and shallow confined and unconfined aquifers. Site-specific data on groundwater for the Project Area are limited, however. Existing information comes primarily from WOGCC oil and gas well records, Wyoming State Engineer's Office (WSEO) water-well records, and the USGS (Weigel 1987). Regional aquifer systems pertinent to the Project Area are discussed by Heath (1984), Freethey (1987), and Driver et al. (1984). Basin-wide evaluations of hydrogeology specific to the Project Area have been investigated by Collentine et al. (1981). The most relevant hydrogeologic study specific to the Project Area is by Welder and McGreevy (1966). The Project Area is located in the Colorado Plateau and Wyoming Basin groundwater regions described by Heath (1984); the Upper Colorado River Basin groundwater region described by Freethey (1987); and the Washakie Basin described by Collentine et al. (1981) and Welder and McGreevy (1966).

3.5.1.1 Location and Quantity

Groundwater in the Washakie Basin is generally found in artesian aquifers, although it is also present in unconfined alluvial valleys and in isolated, saturated outcrops (Welder and McGreevy 1966). Table 3-5 summarizes the water-bearing characteristics of the geologic formations (aquifers) in the Project Area and vicinity. Of the geologic units listed in Table 3-5, Welder and McGreevy (1966) suggest that the units that are capable of producing the largest quantity of water include the following: Quaternary alluvium; Tertiary deposits in the Browns Park, Wasatch, and Fort Union Formations; Cretaceous formations, including Mesaverde Group, Frontier and Cloverly Formations; the Sundance-Nugget Sandstone of Jurassic age; and the Tensleep Formation and Madison Limestone of Paleozoic age.

Quaternary aquifers in the Washakie Basin are made up of alluvial deposits along major floodplains and isolated windblown and lake sediments elsewhere. The major Quaternary aquifers in the vicinity of the Project Area occur in alluvial deposits along the Little Snake River and Muddy Creek and in windblown segments along the Sand Hills. Flow of groundwater within the sandy Quaternary aquifers is typically downward, toward permeable underlying formations (Collentine et al. 1981).

TABLE 3-5 WATER-BEARING CHARACTERISTICS OF GEOLOGIC FORMATIONS IN THE WASHAKIE BASIN

| Era | Period | Geologic Unit | Thickness | Hydrologic Properties | | | |
|--------------------|-------------------------------|--|--------------|--|-------------------------|--|--|
| | | | | Well Yield (gpm) | Transmissivity (gpd/ft) | Permeability (gpd/ft ^b) | |
| Cenozoic | Quaternary | | 0-70 | <30 | 168-560 | 21-62 | |
| | Tertiary | Browns Park Formation | 0-1,200 | 3-30 | 100-10,000 | NM ^d | |
| | | Wasatch Formation | 0-4,000+ | 30-50 | 150-10,000 | 0.04-18.2 | |
| | | Fort Union Formation | 0-2,700+ | 3-300 | <2,500 | <1 | |
| Mesozoic | Upper Cretaceous | Lance Formation | 0-4,500+ | <25 | <20 | 0.007-8.2 | |
| | | Fox Hill Sandstone | 0-400 | NM ^d | 10-20 | 0.9 | |
| | | Lewis Shale | 0-2,700+ | 2-25 ^b | 0.03-50 | 0.002-0.9 | |
| | | Almond Formation ^c | 0-600 | NM ^d | 2,000-8,000 | 100-800 | |
| | | Mesaverde Group (incl. Almond Formation) | 300-2,800 | <100 | <3,000 | NM ^d | |
| | | Baxter Shale (incl. Steele Shale and Niobrara Formation) | 2,000-5,000+ | Major regional aquitard between Mesaverde and Frontier aquifers. Hydrologic data unavailable. | | | |
| | | Frontier Formation | 190-1,900+ | 1-100+ | <100-6,500 | NM ^d | |
| | Lower Cretaceous | Mowry Shale | 150-525 | Regional aquitard. Hydrologic data unavailable. | | | |
| | | Thermopolis Shale (inclu. Muddy Sandstone) | 20-235 | Considered a leaking confining unit. Hydrologic data unavailable. | | | |
| | | Cloverly Formation | 45-240 | 25-120 | 340-1,700 | 1-177 | |
| | Upper Jurassic | Morrison Formation | 170-450+ | Confining unit between Cloverly and Sundance-Nugget aquifers. Hydrologic data unavailable. | | | |
| | | Sundance Formation | 130-450+ | 27-35 | 12-3,500 | NM ^d | |
| | Lower Jurassic-Upper Triassic | Nugget Sandstone | 0-650+ | 35-200 | <2,166 | NM ^d | |
| | Triassic | Chugwater Formation | 900-1,500+ | Confining unit between Sundance-Nugget and Paleozoic aquifers. Hydrologic data unavailable. | | | |
| Mesozoic-Paleozoic | Lower Triassic Permian | Phosphoria Formation (incl. Goose Egg Formation) | 170-460 | Probable poor water-bearing capabilities because of the low permeability. Hydrologic data unavailable. | | | |
| Paleozoic | Permian-Pennsylvanian | Tensleep Formation | 0-840+ | 24-400 | 1-374 | NM ^d | |
| Precambrian | Mississippian | Madison Limestone | 5-325+ | <400 | Variable | NM ^d | |
| | N/A | Igneous and metamorphic rocks | Unknown | 10-20 | <1,000 | Generally high in upper 200 ft of unit | |

Notes

^a Adapted from Table V-1 in Collentine et al. (1981). Formations that are not encountered in Project Area have been omitted.

^b From well completion records on file with WSEO.

^c From Atlantic Rim gas well test data.

^d NM = Not measured.

Tertiary aquifers in and near the Project Area occur in the Browns Park Formation along the Little Snake River floodplain and adjacent to the Sierra Madre Uplift, the Fort Union Formation near the Muddy Creek floodplain to the west, and isolated outcrops of the Washatch Formation near the center of the Project Area. Groundwater generally flows west-southwest from the higher elevations along the Sierra Madre Uplift toward the low-lying center of the Washakie Basin and the major streams (Collentine et al. 1981).

Cretaceous aquifers in the Project Area occur in three major geologic formations. From youngest to oldest, they are the Almond Formation of the Mesaverde Group, the Frontier Formation, and the Cloverly Formation. The Mesaverde Group is exposed along the eastern slopes of the Project Area, although a mantle of Tertiary deposits unconformably overlies large areas of Late Cretaceous strata. No outcrops of the Frontier or Cloverly Formations are present within the Project Area.

The Cretaceous aquifers are composed of interbedded sandstone, shale, and coal and have demonstrated considerable yields in existing wells (Collentine et al. 1981). Recharge to these water-bearing strata is principally from infiltration of precipitation and movement of groundwater from the overlying Tertiary sediments at their outcrops and subcrops along the elevated eastern margin of the Washakie Basin. The direction of regional groundwater flow is toward the west, in response to the structural dip and surface topography.

Separated from the Cretaceous aquifers by the impermeable Morrison Formation is the Sundance-Nugget Aquifer of Jurassic age. The Sundance-Nugget aquifer is composed of permeable sandstone with minor quantities of shale, siltstone, and limestone (Collentine et al. 1981). The flow characteristics of the Sundance-Nugget aquifer are not well defined.

The remaining two major aquifers occur in rocks of Paleozoic age. The Pennsylvanian Tensleep Formation consists of fine- to medium-grained sandstone between confining layers of the Chugwater Formation (Triassic) and the Amsden Formation (Pennsylvanian) (Collentine et al. 1981). The Madison aquifer is composed of limestone and dolomite overlain by fine-grained Amsden sediments and underlain by Cambrian rocks. Wells completed in both of these Paleozoic aquifers have demonstrated yields up to 400 gallons per minute (gpm). Groundwater flow is to the south-southeast in the Project Area.

Recharge to the aquifers is generally by precipitation and surface water seepage that percolate through permeable overlying materials (Welder and McGreevy 1966). Driver et al. (1984) suggest that the Browns Park Formation would be the best candidate for large-scale development of groundwater.

3.5.1.2 Quality

Seven permitted water wells have been completed within 1 mile of the Project Area. Six of these wells are located within the inferred circle of influence (within a 1/2-mile radius) of individual exploratory wells. Two of those wells yield water used for stock ponds; the remaining four are monitoring wells. Information on the existing wells is presented in Table 3-6. This information was obtained from the WSEO ([Appendix D](#)). The maximum

depth of all permitted wells is 419 feet. Deep injection wells are proposed for the Cherokee and Deep Creek Sandstones, which occur 3,800 to 4,600 feet below the surface. The water wells are much shallower than the proposed gas wells and proposed injection zones.

TABLE 3-6 PERMITTED WATER WELLS WITHIN 1 MILE OF THE DOTY MOUNTAIN PROJECT AREA

| Permit No. | Sec | Qtr/Qtr | Applicant | Facility Name | Use | Yield (gpm) | Well Depth | Static Depth |
|------------|-----|---------|---|---------------|------------------|-------------|------------|--------------|
| P33768W | 15 | SWNW | Union Pacific Minerals Inc. | ARW 1 | Monitoring Misc. | 0 | 280 | 144.88 |
| P54262W | 23 | NWNW | Union Pacific Minerals Inc. | AR 201 OW | Monitoring Misc. | 0 | 220 | 64 |
| P54264W | 23 | SESW | Union Pacific Minerals Inc. | AR 200 OW | Monitoring Misc. | 0 | 419 | 107 |
| P56613W | 23 | SWNW | P H Livestock Co. | Y Pasture #1 | Storage | 5 | 120 | 35 |
| P59801W | 23 | NENW | Wyoming Board of Land Commissioners — Pan Artic Exploration LTD | 9C-16-19-89 | Monitoring Misc. | Unk | Unk | Unk |
| P59802W | 23 | SWNW | Wyoming Board of Land Commissioners — Pan Artic Exploration LTD | 1-16-19-89 | Monitoring Misc. | Unk | Unk | Unk |
| P17356W | 28 | NENE | BLM | #4139 | Storage | 5 | 100 | Unk |

Groundwater quality is related to the depth of the aquifers, flow between aquifers, and rock type. Groundwater quality is variable in the Project Area. Total dissolved solids (TDS) are generally less than 2,000 milligrams per liter (mg/L), considered slightly saline to saline, in the Project Area, with local concentrations less than 500 mg/L (meeting EPA National Secondary Drinking Water Regulations).

As most existing groundwater wells and the proposed gas wells of the Project Area occur in aquifers in the Mesaverde Group, a detailed analysis of groundwater from this unit has been included in Table 3-7. Sodium and bicarbonate dominate as the major ionic species. Collentine et al. (1981) offers three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction, resulting in generation of bicarbonate; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde or adjacent aquifers.

TABLE 3-7 MAJOR ION COMPOSITION OF MESAVERDE GROUNDWATER

| Cation | Concentration (mg/L) | Anion | Concentration (mg/L) |
|------------------------|----------------------|--------------------------|----------------------|
| Sodium | 513 | Bicarbonate ^a | 1,284 |
| Calcium | 7 | Carbonate ^b | 9 |
| Magnesium | 3 | Chloride | 56 |
| Potassium ^a | 5 | Sulfate | 11 |

^a Bicarbonate was not measured; value shown was calculated from ion balance.

^b Concentrations of potassium and carbonate were not measured in samples from gas wells; values represent composite of USGS data for Mesaverde wells in the vicinity of the project (USGS 1980).

Table 3-8 presents a comparison of Mesaverde groundwater with WDEQ suitability standards. The composite results of samples from the three gas wells analyzed indicate that the water is generally suitable for livestock but is unsuitable for domestic supply or irrigation without treatment. Parameters measured at concentrations that exceed Wyoming drinking water standards include iron, manganese, and TDS. Calculated values for SAR (47.3) and residual sodium carbonate (41 milliequivalents per liter [meq/L]) exceed the agriculture suitability limits of 8.00 for SAR and 1.25 for residual sodium carbonate.

TABLE 3-8 GROUNDWATER QUALITY OF MESAVERDE WELLS IN PROJECT AREA

| Parameter | Concentration ^a | Unit | Groundwater Suitability Standards ^b | | |
|------------------|----------------------------|------|--|-------------|-----------|
| | | | Domestic | Agriculture | Livestock |
| Aluminum | 0.045 | mg/L | --- | 5 | 5 |
| Ammonia | 0.9 | mg/L | 0.5 | --- | --- |
| Arsenic | 0.0006 | mg/L | 0.05 | 0.1 | 0.2 |
| Barium | 0.36 | mg/L | 1 | --- | --- |
| Beryllium | <0.002 | mg/L | --- | 0.1 | --- |
| Boron | 0.25 | mg/L | 0.75 | 0.75 | 5 |
| Cadmium | <0.0002 | mg/L | 0.01 | 0.01 | 0.05 |
| Chloride | 56 | mg/L | 250 | 100 | 2000 |
| Chromium | 0.002 | mg/L | 0.05 | 0.1 | 0.05 |
| Cobalt | NM | mg/L | --- | 0.05 | 1 |
| Copper | 0.03 | mg/L | 1 | 0.2 | 0.5 |
| Cyanide | <5 | mg/L | 0.2 | --- | --- |
| Fluoride | 1.0 | mg/L | 1.4 - 2.4 | --- | --- |
| Hydrogen Sulfide | NM | mg/L | 0.05 | --- | --- |
| Iron | 3.06 | mg/L | 0.3 | 5 | --- |
| Lead | 0.004 | mg/L | 0.05 | 5 | 0.1 |
| Lithium | NM | mg/L | --- | 2.5 | --- |
| Manganese | 0.102 | mg/L | 0.05 | 0.2 | --- |
| Mercury | <0.0004 | mg/L | 0.002 | --- | 0.00005 |
| Nickel | 0.041 | mg/L | --- | 0.2 | --- |
| Nitrate | <0.03 | mg/L | 10 | --- | --- |
| Nitrite | <0.03 | mg/L | 1 | --- | 10 |

TABLE 3-8 GROUNDWATER QUALITY OF MESAVERDE WELLS IN PROJECT AREA

| Parameter | Concentration ^a | Unit | Groundwater Suitability Standards ^b | | |
|---------------------------|----------------------------|--------|--|-------------|-----------|
| | | | Domestic | Agriculture | Livestock |
| Oil & Grease ^c | <1 | mg/L | Virtually Free | 10 | 10 |
| Phenol | 65 | mg/L | 0.001 | --- | --- |
| Selenium | <0.005 | mg/L | 0.01 | 0.02 | 0.05 |
| Silver | <0.003 | mg/L | 0.05 | --- | --- |
| Sulfate | 11 | mg/L | 250 | 200 | 3000 |
| TDS | 1,322 | mg/L | 500 | 2000 | 5000 |
| Uranium | NM | mg/L | 5 | 5 | 5 |
| Vanadium | NM | mg/L | --- | 0.1 | 0.1 |
| Zinc | 0.3 | mg/L | 5 | 2 | 25 |
| pH | 8.2 | s.u. | 6.5 - 9.0 | 4.5 - 9.0 | 6.5 - 8.5 |
| SAR | 47.3 | <none> | --- | 8 | --- |
| RSC ^d | 41 | meq/L | --- | 1.25 | --- |
| Radium 226 + Radium 228 | 0.9 | pCi/L | 5 | 5 | 5 |
| Strontium 90 | NM | pCi/L | 8 | 8 | 8 |
| Gross alpha | NM | pCi/L | 15 | 15 | 15 |

a Concentrations of boron, ammonia, fluoride, and nitrate/nitrite from 11 Mesaverde groundwater wells (USGS 1980); remaining concentrations from three Mesaverde gas wells in Project Area.

b From WDEQ Water Quality Rules and Regulations, Chapter VIII.

c Reported as total petroleum hydrocarbons.

d Residual sodium carbonate calculated from measured concentrations of calcium and magnesium and calculated concentration of bicarbonate.

Notes:

meq/L = Milliequivalents per liter

mg/L = Milligrams per liter

NM = Not measured

pCi/L = Picocuries per liter

s.u. = Standard units

TDS = Total dissolved solids

The confining beds slow movement of water, and hence, movement of potential contaminants between aquifers. Although there is some downward movement of the water from the surface units, most of the groundwater movement, if any, is upward from the deeper aquifers to the shallower aquifers. Concerns have been raised for several gas field projects in southwest Wyoming over degradation of groundwater quality caused when confining layers are pierced and allow vertical and horizontal migration and mixing of water of variable qualities. Data that would suggest this degradation is a current problem in the Project Area are not available.

3.5.2 Surface Water

The Project Area is located in Muddy Hydrologic Unit Code (HUC) 14050004, upstream of the Little Snake (HUC 14050003) in the Upper Colorado River Basin. The nearest perennial stream is Muddy Creek, located 1.5 miles north of the Project Area. Muddy Creek originates in the Sierra Madre. It flows west and south of the Project Area to its confluence with the Little Snake River near Baggs. Four unnamed ephemeral drainages that are tributary to Dry Cow Creek traverse the Project Area. Dry Cow Creek is also an intermittent stream that flows southwesterly about 9 miles to its confluence with Cow Creek. Cow Creek is a perennial stream that is tributary to Muddy Creek.

3.5.2.1 Quantity

Annual flows for all channels within the Project Area generally occur in response to snowmelt during February through April, or from thunderstorms in the summer and fall. There are no stream gaging stations in the Project Area since all drainages are ephemeral. A USGS gaging station located on the Little Snake River near Dixon, recorded a maximum peak discharge of 13,000 cubic feet per second (cfs) on May 16, 1984, while minimum flows of near 0 cfs occur in late summer and early fall at the end of the irrigation season (Druse et al. 1994). At the BLM gaging station on Muddy Creek at Dad Road, an average flow of 984 cfs was measured from April to July in 1993, with maximum flow measured in May at 2,913 cfs and the minimum flow in June at 10.2 cfs.

3.5.2.2 Quality

There are seven existing USGS surface water gaging stations in the vicinity of the Project Area, including two on the Little Snake River, two on Muddy Creek, and one each on Cow Creek, Dry Cow Creek, and Wild Cow Creek. Wild Cow Creek is a perennial stream located south of Cow Creek that flows southwest to its confluence with Muddy Creek. Although no data are being collected currently, water quality samples were collected at these gaging stations from as early as 1957 to as recently as 1997. A maximum of 107 samples were collected on the Little Snake River (HUC 09257000) and a minimum of three samples were collected on Muddy Creek (HUC 09258900). Average sample water quality data from each of the stations are shown in Table 3-9.

TABLE 3-9 AVERAGE DATA FOR SURFACE WATER QUALITY IN THE PROJECT AREA

| USGS Surface Water Quality Station ^a | | | | | | | | |
|---|-----------|--------------------|--------------------|--------------------|-------------|------------------|-----------------|--------------------------------------|
| Parameter | Cow Creek | Dry Cow Creek | Little Snake River | Little Snake River | Muddy Creek | Muddy Creek | Wild Cow Creek | Muddy Creek at Dad Road ^g |
| Station Number | 09115080 | 09258200 | 09257000 | 09259050 | 09258900 | 09259000 | WLDCWC K:0 | MCDAD:O |
| Sample Period | 1978-1979 | 1975-1980 | 1957-1988 | 1980-1997 | 1976-1978 | 1957-1991 | 1986-1993 | April 1993- July 1993 |
| Number of Samples ^b | 20 | 9 | 107 | 100 | 3 | 41 | 42 | 4 |
| pH, standard units | 9.2 | 8.6 | 8.1 | 8.1 | 8.6 | 8.2 | 9.0 | 8.1 (Lab) |
| Specific Conductance, mmhos/cm | 2,925 | 2,162 | 259 | 366 | 1,350 | 966 | 2,663 | 782.2 (Lab) |
| Total Dissolved Solids (TDS) ^c | 1,801 | 1,438 ^d | 158 | 243 | 913 | 630 ^d | 1,955 | 549 |
| Total Suspended Solids (TSS) | 133 | 1,111 | 154 | 228 | 6,198 | 3,191 | NM ^e | 248 |
| Turbidity ^f | 284 NTU | 1,013 JTU | 13 JTU | 167 NTU | 1,260 NTU | NM | NM | NM |
| Hardness as CaCO ₃ | 174 | 37 | 111 | 151 | 315 | 270 | 334 | 336 |
| Dissolved Oxygen | 9 | 11 | 9 | 10 | 11 | 10 | NM | NM |
| Sodium | 560 | 98 | 11 | 26 | 200 | 286 | 550 | 47.5 |
| Calcium | 19 | 9 | 30 | 34 | 54 | 42 | 20 | 88.5 |
| Magnesium | 31 | 4 | 8 | 12 | 44 | 40 | 68 | 27.4 |
| Potassium | 11 | 4 | 2 | 2 | 7 | 9 | 7 | 3.74 |
| Bicarbonate | 870 | 170 | 159 | 190 | 373 | 308 | 1,000 | 237 |
| Carbonate | 186 | 4 | 0 | 1 | 0.5 | NM | 91 | 0.84 |
| Sulfate | 181 | 65 | 25 | 54 | 380 | 320 | 438 | 247 |
| Chloride | 132 | 21 | 3 | 2 | 65 | 32 | 60 | 7.86 |
| Fecal coliform, #/100 ml | 535 | NM | NM | 351 | NM | 8 | NM | NM |

Notes:

- ^a Data available on the Internet at <http://www.wrds.uwyo.edu>
- ^b Total number of grab samples analyzed; not every parameter was analyzed in every sample
- ^c All units are mg/L except as noted
- ^d TDS calculated from specific conductance because of lack of sample data
- ^e NM = not measured
- ^f Measured in Nephelometric Turbidity Units (NTU) or Jackson Turbidity Units (JTU)
- ^g BLM surface water gauging station

3.5.2.3 Waters of the U.S.

The majority of the surface water resources within the Project Area are considered waters of the U.S. This category includes territorial seas; interstate waters; navigable waterways (such as lakes, rivers, and streams); special aquatic sites and wetlands that are, have been, or could be used for travel, commerce, or industrial purposes; tributaries; and impoundments of these waters. All channels that carry surface flows and that show signs of active water movement are waters of the U.S. Similarly, all open bodies of water (except ponds and lakes created on upland sites and used exclusively for agricultural and industrial activities or aesthetic amenities) are waters of the U.S. (33 CFR 328.3(a)). These areas are regulated by the EPA and COE. Many of the drainage channels identified on the USGS topographic maps are vegetated swales that are not considered to be waters of the U.S. Any activity that involves excavation or discharge of dredge or fill material in a manner that affects waters of the U.S. is subject to regulation by the COE pursuant to Section 404 of the Clean Water Act (CWA). Activities that modify the morphology of stream channels are also subject to regulation by the WSEO.

3.6 VEGETATION, WETLANDS AND NOXIOUS WEEDS

3.6.1 Vegetation and Cover Types

A biological survey of the Project Area was conducted in 2000 and 2001 (HWA 2002). The Project Area is located in the sagebrush steppe plant community that is typical of the high intermountain desert of south-central Wyoming. The primary vegetation cover type of the Project Area is Wyoming big sagebrush, as identified as part of the Wyoming Gap Analysis Program (GAP) (HWA 2002). The Wyoming big sagebrush cover type typically consists of a mixture of greasewood, Wyoming big sagebrush, rabbitbrush and saltbush, with interspersed mixed grasses. In 1987, a prescribed burn was conducted on the southeast flank of Doty Mountain, affecting approximately 400 acres within the Project Area. Shrub cover in the Project Area averages between 5 and 10 percent. Common species in this plant community in addition to big sagebrush include: Douglas and rubber rabbitbrush, cotton horsebrush, black greasewood, snowberry, western and bluebunch wheatgrass, Indian ricegrass, needle and thread, mutton and little bluegrass, basin wildrye, bottlebrush, squirreltail, phlox, buckwheat, penstemon, onion, sego lily, miner's candle, Indian paintbrush, and violet.

To enhance the general vegetation information provided above, a field reconnaissance of the Project Area was conducted on September 17-18, 2003, as part of this analysis. Existing vegetation within the proposed disturbance areas was observed and recorded.

The vegetation community type in the proposed disturbance area is generally sagebrush/grassland. Typically two integrading varieties of sagebrush occur in the Project Area and tend to occupy distinctive habitats. Wyoming sagebrush typically is found in the more xeric uplands, while big sagebrush is found in the more mesic narrow valley bottoms. Wyoming sagebrush is distinguished from big sagebrush by its short growth form and regular canopy. In some location along broader alluvial-filled valleys and toe-slopes, the shrub canopy is absent and a grass canopy predominates. The dominant grass is Prairie junegrass, with species of wheatgrass and Indian ricegrass occurring less frequently.

Within the sagebrush/grassland community type, Rubber rabbitbrush, broom snakeweed, and Gray horsebrush are common and snowberry is rare. Black greasewood is generally uncommon but is often a dominant component of the shrub canopy along valley terraces and toe-slopes where shale and saline soils are prevalent. Common herbaceous forbs include species of buckwheat flower and lupine and, to a lesser degree, species of phlox. Antelope bitterbrush occurs rarely to infrequently in the Project Area.

3.6.2 Threatened and Endangered Species

According to the FWS (2000) and the Wyoming Natural Diversity Database (WYNDD), the only federally listed plant species that has the potential to occur near the Project Area is blowout penstemon (*Penstemon haydenii*). While there is potential for the species to exist, no plants have been found in the project area. Blowout penstemon is federally endangered (HWA 2002). No other threatened or endangered plant species are expected to occur near the Project Area.

Blowout Penstemon. Blowout penstemon is a member of the snapdragon family. The species is most commonly found in the bowls and along the rims of sandy blowouts (HWA 2002). In Wyoming, the species has been documented on very steep, unstable sand dunes (HWA 2002). Within these limited habitats, blowout penstemon typically occurs in large, multi-stemmed clumps. When in bloom, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts. In addition to the features of its leaves and flowers, blowout penstemon's lavender or vanilla-like fragrance is a characteristic that distinguishes it from other *Penstemon* species. Blowout penstemon typically blooms between late May and late June. This short flowering period is the best time of year to survey for the species.

A large area of sand dunes and blowouts exists in and around the Sandhills area about 1 to 3 miles southeast of the Project Area. This area may provide potential habitat for blowout penstemon, however, the species was not found during field surveys of this area conducted by the WYNDD in June of 2000 (HWA 2002). Very small and limited areas of sandy blowouts may occur near the Project Area, however, blowout penstemon was not found in the Sandhills area and is, therefore, unlikely to occur in the Project Area. The nearest documented population of blowout penstemon is located just south of the Ferris Mountains approximately 58.0 miles to the north of the Project Area (HWA 2002).

3.6.3 Species of Concern

Species of concern include candidates for federal listing under the Endangered Species Act (ESA), BLM special status species (BLM 2001), Wyoming Game and Fish Department (WGFD) special concern species, and species that are designated rare by The Nature Conservancy and the WYNDD. Species that have not been listed as endangered or threatened by the FWS, but have been identified for possible listing in the future, are classified as candidate species.

Seven plant species of concern may occur within or near the Project Area, of which Gibben's beardtongue has the highest priority for conservation (HWA 2002, HWA 2003). Four of the species are unlikely to occur in or near the Project Area because the habitat types required are not present. The remaining three special concern plant species have low to moderate potential to occur in or near the Project Area. [Appendix E](#) provides information on all seven species of concern, including sensitivity status, range, and distribution within Wyoming, probability of occurrence in the Project Area, and descriptions of the habitat where the plants are found.

3.6.4 Wetlands

No special aquatic sites or wetlands have been identified in or near the Project Area, including the lateral sales pipeline route; therefore, these resources were not analyzed further. The nearest potential riparian habitat is located along Dry Cow Creek, southwest of the Project Area.

3.6.5 Noxious Weeds and Invasive Species

The Project Area is vulnerable to infestations of noxious weeds species such as Canada thistle, musk thistle, Russian knapweed and whitetop and invasive species such as black henbane, halogeton and cheatgrass. Based on field reconnaissance conducted on September 17-18, 2003 as a part of this analysis, noxious weeds and invasive species are components of the vegetation community within the proposed disturbance areas of the Project Area and are discussed below.

Spotted or Russian knapweed was observed rarely to infrequently in the northeast quarter of Section 22 in T17N R91W. Both of these species are listed on the Wyoming Weed and Pest Control Designated List.

Cheatgrass, cactus and shephard's purse, or species of cress, are frequent to abundant in heavily grazed portions of the Project Area.

3.7 RANGE RESOURCES AND OTHER LAND USES

3.7.1 Range Resources

Agriculture (primarily grazing use by cattle, horses, or sheep) is a primary land use in the Project Area. The Project Area is entirely located within the Doty Mountain Allotment (#00415) managed by the BLM RFO in accordance with the Great Divide RMP. The Doty Mountain Allotment includes 84,008 acres (about one-third private) and supports 15,295 animal unit months (AUMs). It is used as a cow-calf operation with the base ranch located in Baggs. About two-thirds of the range is considered in good condition; the remainder is either in excellent, fair, or undetermined condition, with less than 1 percent of the range considered in poor condition. The average stocking rate for the Doty Mountain Allotment is 12 acres per AUM.

The season of use for the allotment is from April 1 to December 31. The Project Area lies within the summer pasture of the Doty Mountain Allotment, where cattle use is rotated within a nine-pasture system. The summer pasture is used from about mid-June through mid-September, which defers the growing season for most plant species. The water sources for livestock use in this pasture are numerous small reservoirs and two water wells. Some of the water sources for this pasture, 5 reservoirs and 1 well, are located within the Project Area. Water is occasionally limited within this summer pasture.

3.7.2 Other Land Uses

The Project Area contains an estimated 1,282 acres of federal surface ownership lands in Sections 14, 22, 28, and 32, T17N R91W; Section 6, T16N R91W; and Sections 1 and 12, T16N R92W. These public lands are open for public use, and are administered by the RFO in accordance with the Great Divide RMP. Within the Project Area, privately owned lands are located in Sections 15 and 23, T17N R91W, and Sections 27, 29, T17N R91W. The State of Wyoming owns Section 36 of T17N R92W, located just west of the Project Area.

Other uses within and adjacent to the Project Area include wildlife habitat; oil and gas exploration, development, and transmission; and dispersed outdoor recreation (primarily hunting in the fall). No facilities for developed recreation exist within the Project Area.

3.8 WILDLIFE AND FISHERIES

3.8.1 Wildlife

The Project Area includes 1,520 acres of sagebrush steppe wildlife habitat. Another 400 acres of sagebrush steppe habitat was burned in 1987 on the southeast flank of Doty Mountain within the Project Area. Shrub cover on these sites averages between 5 and 10 percent. Common species in this plant community in addition to big sagebrush include: Douglas' and rubber rabbitbrush, cotton horsebrush, black greasewood, snowberry, western and bluebunch wheatgrass, Indian ricegrass, needle and thread, mutton and little bluegrass, basin wildrye, bottlebrush squirreltail, phlox, buckwheat, penstemon, onion,

sego lily, miner's candle, Indian paintbrush, and violet. Many common species of birds, mammals, amphibians, and reptiles may be found within the Project Area. The proposed project is not expected to significantly alter the common species found in the Project Area; therefore, they were not specifically discussed in this analysis. The existing threatened, endangered, candidate and species of concern, as well as big game species, raptors, and greater sage grouse in the Project Area, are discussed in detail. The area of interest for wildlife concerns encompasses the Project Area and the proposed road access/pipeline route with a 2-mile buffer for greater sage grouse leks, and a 1-mile buffer for raptor nests. Wildlife surveys discussed and summarized here were conducted as part of the broader-scale surveys performed in 2000 and 2001.

Greater sage grouse habitat data, seasonal big game range designations, and raptor nest locations were obtained from the habitat data in WGFD's Wildlife Observation System (WOS). Additional information on raptors was obtained from BLM's raptor nest database (Jackson 2003). WGFD big game herd unit annual reports were used for herd unit population statistics. This existing wildlife information for the Project Area was supplemented through survey data collected in 2000 and 2001 (HWA 2003). Data were collected through a series of aerial and ground surveys to: (1) determine the occurrence, location, and size of white-tailed prairie dog colonies; (2) determine the location and activity status of raptor nests; (3) search for previously undocumented greater sage grouse leks and determine the activity status of all leks in the area; (4) locate winter concentration areas for greater sage grouse; and (5) record incidental observations of BLM sensitive species.

3.8.1.1 Big Game

Three big game species, pronghorn antelope, mule deer, and elk, occur within or may use the Project Area. The types of big game seasonal ranges designated by WGFD are winter, winter/yearlong, and crucial winter range. Winter ranges are used by substantial numbers of animals only during the winter (December through April). Winter/yearlong ranges are occupied throughout the year, but are also used by other species that migrate from other seasonal ranges.

Pronghorn Antelope. The Project Area is located within the 1,394-square-mile Baggs Herd Unit. The Project Area is designated as pronghorn winter/yearlong range (2,080 acres). Pronghorn likely migrate through the northern portion of the Project Area toward crucial winter/yearlong range located northwest of the area (HWA 2002). The 2001 post-hunt season population estimate for the Baggs Herd Unit was 6,800 animals, which is 9 percent higher than the population average of 6,240 animals estimated for 1996 through 2000. The population objective was increased by 25 percent in 1994, from 7,200 to 9,000. The population estimate of 6,240 for 1996 through 2000 was 24 percent below the WGFD management objective. According to HWA (2002), the Baggs pronghorn herd had experienced low fawn production, resulting in slow growth, but production has improved during recent years and the population appears to be rebounding. The Project Area is located within Hunt Area 53, where the hunter success rate for 2001 was 98.1 percent.

Mule Deer. The Project Area is located within the Baggs Herd Unit. The Baggs Herd Unit is large (3,440 square miles) and contains habitats ranging from subalpine to montane coniferous forests to desert scrub. The Project Area is designated as winter/yearlong mule deer range (2,080 acres). No major migration routes for mule deer across the Project Area were identified (HWA 2002). The post-hunt population estimate for the Baggs Herd Unit was 18,000 in 2001 (HWA 2002). This estimate is slightly below the WGFD management objective of 18,700. The Project Area is located within Hunt Area 82, where the hunter success rate for 2001 was 42.6 percent.

Elk. The Project Area is located within the Sierra Madre Herd Unit (2,425 square miles). Most elk in the herd unit use spring/summer/fall ranges in the Sierra Madre Mountains, although groups use habitats on Atlantic Rim and around McCarty Canyon. During winter, the elk migrate to winter range habitats at lower elevations on the western side of the Sierra Madre Mountains and into the Atlantic Rim and Sand Hills areas. Some animals may migrate as far west as the Powder Rim, located 40 miles west of Baggs (HWA 2002). No major elk migration routes across the Project Area were identified (HWA 2002). Habitats in the Project Area are designated as elk winter range (2,080 acres). The 2001 post-hunt season population estimate for the Sierra Madre Herd Unit of 5,500 animals is 31 percent above the WGFD management objective of 4,200. The Project Area is located within Hunt Area 21, where the hunter success rate for 2001 was 36.5 percent.

3.8.1.2 Upland Game Birds

Greater Sage Grouse. The Project Area is located within the extensive sagebrush and grassland habitats of south-central Wyoming, where greater sage grouse are common. Strutting grounds (leks), nesting, brood-rearing, and wintering habitats are all important components required by greater sage grouse. This habitat can occur as contiguous or in a patchy, disconnected pattern (HWA 2002). Preferred nesting habitat is usually located within 2 miles of leks (HWA 2002). The greater sage grouse is not formally listed as threatened or endangered, but it is a BLM sensitive species and it receives special consideration because its population is declining over much of its range.

The Project Area is located within the Sierra Madre upland game management unit area (Area 25). According to the Annual Report of Upland Game and Furbearer Harvest for 2001, 761 greater sage grouse were harvested in Area 25, providing 724 hunter recreation days (HWA 2002). In 2001, the Sierra Madre Upland Game Management Area accounted for approximately 6 percent of the statewide harvest of greater sage grouse (761 out of 12,742 birds taken).

The Project Area is covered by habitats dominated by sagebrush. Because greater sage grouse use sagebrush habitats all year, the area provides excellent year-round range. Aerial surveys were conducted during the winter in 2001 to identify and define greater sage grouse concentration areas. The Atlantic Rim area, including the Project Area, was surveyed on February 17 to 18, 2001. Snow cover during that winter was much deeper than normal. The deep snow cover forced greater sage grouse to seek out habitats with tall sagebrush. During spring and summer in 2001, each location where greater sage grouse were observed during the winter survey was visited during a ground survey, and habitat used by greater sage grouse was mapped. Habitat patches located from the air were re-

fined by walking the perimeter and recording UTM coordinates with a handheld GPS unit. Sagebrush in the winter use areas was usually located in long linear patches in drainage bottoms and was between 2 and 4 feet tall. These habitat areas are referred to as crucial or severe winter relief habitat (HWA 2003).

Aerial surveys were also conducted by HWA biologists during late March and early April in 2001 to check the status of known sage-grouse leks and document new leks. Although no active sage-grouse leks were documented within the Project Area during the 2001 aerial survey, three active leks occur within 2 miles of the Project Area ([Figure 3-1](#)). The overlapping 2-mile buffers around the two leks located southwest of the proposed project include about 540 acres within the Project Area. The proposed lateral pipeline and associated road intersect about 4.9 miles of potential sage-grouse nesting habitat within the 2-mile buffers of the two leks. One active sage-grouse lek was located less than 2 miles from the southeastern corner of the Project Area ([Figure 3-1](#)). The 2-mile buffer around this lek includes about 96 acres of the Project Area, in which the construction of one well is proposed.

3.8.1.3 Raptors

Species of raptors that may occur in the Project Area include golden eagle, bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, American kestrel, merlin, prairie falcon, peregrine falcon, short-eared owl, long-eared owl, great-horned owl, and burrowing owl. Helicopter surveys of raptor nests located in and around the Project Area were conducted during late May 2001 (HWA 2003). The helicopter survey protocol consisted of flying low-level transects at ½-mile intervals within a 1-mile buffer zone of each area. Areas of potential raptor nest habitat (such as cliffs and rock outcrops) were surveyed more intensively. Locations of nests were recorded with a GPS unit. No raptor nests (active or inactive) were located within the POD boundary. One inactive ferruginous hawk nest and one inactive golden eagle nest were located within 1 mile of the Project Area (HWA 2003).

Fifteen additional inactive ferruginous hawk nests and two inactive red-tailed hawk nests were located within one mile of the proposed access road and the proposed lateral pipeline (HWA 2003, Jackson 2003).

3.8.2 Special Status Species - Wildlife and Fish

3.8.2.1 Wildlife Species

Surveys for species that are federally listed as threatened, endangered, candidate, or species of concern were conducted in 2000 and 2001 as part of larger-scale surveys being performed in support of the Atlantic Rim Natural Gas Project EIS (HWA 2003). The area of interest for threatened, endangered, candidate and species of concern ([Appendix E](#)) includes the Project Area and a 1-mile buffer for raptor nests. In addition, the proposed route for the lateral pipeline and access road that would run approximately 7.1 miles southwest from the compressor station in T17N R91W, Section 23 to the existing

pipeline in T16N R92W, Section 12 is also considered. Locations for threatened and endangered species were obtained from the WOS.

Data were collected through a series of aerial and ground surveys to: (1) determine occurrence of threatened, endangered, proposed, or candidate species for listing in the Project Area; and (2) determine the occurrence, location, and size of mountain plover habitat and conduct a preliminary presence/absence survey for the species.

3.8.2.2 Threatened and Endangered Species – Wildlife and Fish

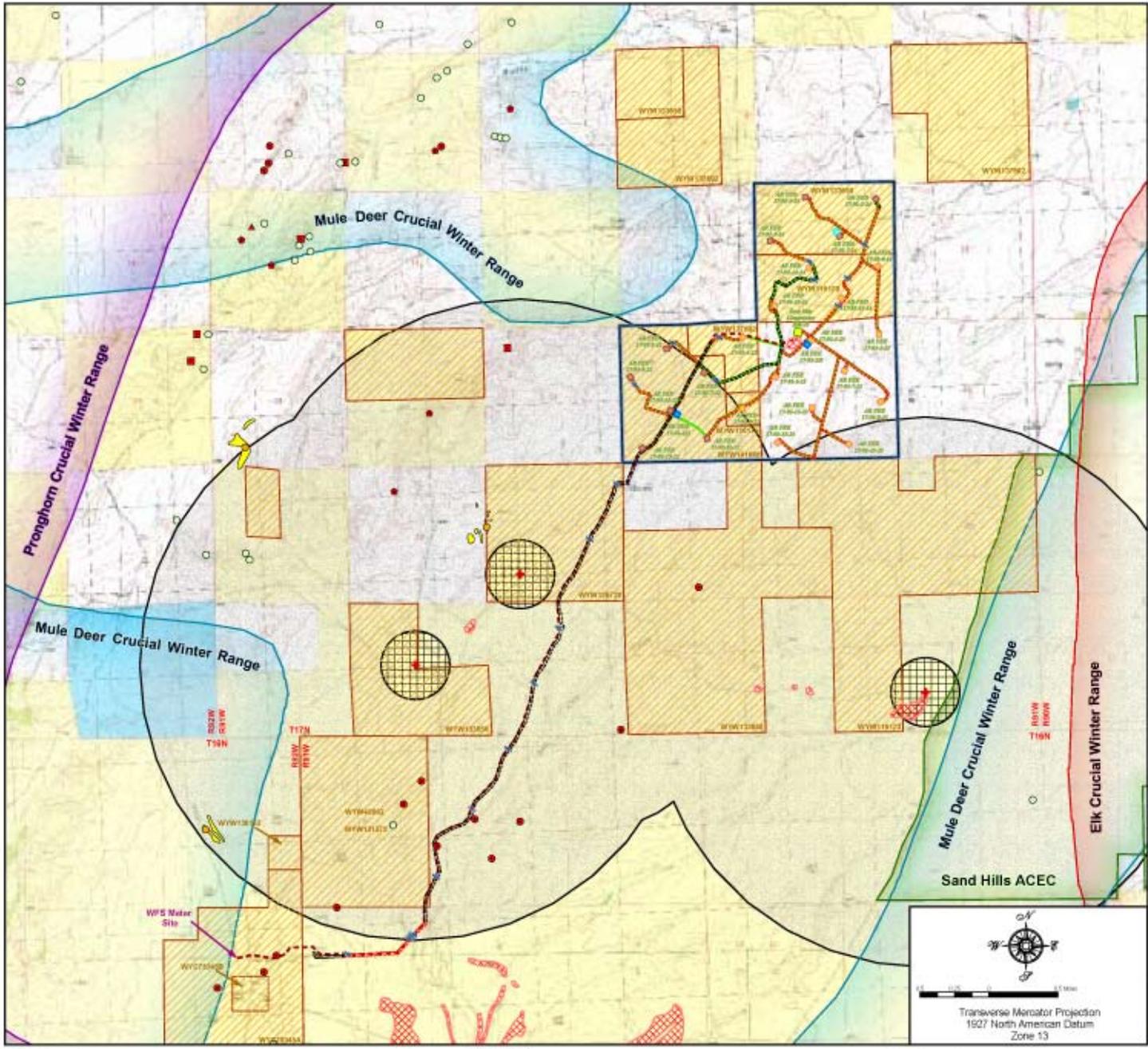
3.8.2.2.1. Wildlife Species

Black-footed Ferret and Associated White-tailed Prairie Dog Colonies. The original distribution of the black-footed ferret in North America closely corresponded to the distribution of prairie dogs (HWA 2002). In Wyoming, white-tailed prairie dog colonies provide habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food, and they use prairie dog burrows for shelter, parturition, and rearing their offspring (HWA 2002).

Aerial surveys of prairie dog colonies were conducted over the Project Area between March 26 and April 3, 2001 (HWA 2003). Linear transects (¼-mile spacing) were flown using a fixed-wing aircraft with GPS capabilities at an average altitude of 200 feet. Prairie dog colonies were observed from the air, and the approximate center of each town was recorded as a single GPS point. Prairie dog towns located from the air were mapped on the ground using a handheld GPS and an all-terrain vehicle (ATV) between June 6 and June 27, 2001. One small prairie dog colony, approximately 4 acres in size, was located within the Doty Mountain POD boundary.

Canada Lynx. Records of lynx in Wyoming indicate that most lynx or lynx sign between 1973 and 1986 were in lodgepole pine (18 percent) and spruce-fir (41 percent) communities. More than 50 percent of lynx records occurred in the northwestern region of the state (HWA 2002). The nearest records of lynx to the Project Area were from the Medicine Bow River in 1856 (HWA 2002). Since then, no lynx sightings or sign have been documented in Carbon County.

It is unlikely that lynx occur in or near the Project Area because (1) the Project Area does not include high-elevation lodgepole pine/spruce-fir habitat types preferred by this species; (2) the Project Area does not support a population of snowshoe hares (preferred prey); (3) there are no recorded lynx sightings near the Project Area (HWA 2002); and (4) the closest potential habitat is more than 10 miles away in the Sierra Madre Mountains.



Legend

- POB Boundary
- Proposed Anadarko Well Pad
- Proposed Double Eagle Well Pad
- Drilling Road
- Proposed Upgraded Road
- Proposed New Road
- Proposed Water, Gas and/or Electric Conduit
- Proposed Doty Mountain Lateral Pipeline
- Proposed Cabaret
- Proposed Compressor Station
- Proposed Deep Injection Well
- Federal Lease Boundaries
- Private Dog Colony
- Outer Sage Grouse Lek
- Lek Quarter Mile NDO
- Lek Ten Mile Buffer
- Outer Sage Grouse Severe Winter Relief Habitat

Raptor Nests
Hayden-Wing Assoc. 2001

- Ferruginous Hawk
- Golden Eagle
- Red-tailed Hawk
- Unknown Raptor
- Active Raptor Nest
- Historical Raptor Nest
- Wildlife Observation Site
- Burrowing Owl
- Greater Sage Grouse Winter Site

BLM Wildlife Data



Surface Ownership

- Bureau of Land Management
- State of Wyoming

ANADARKO PETROLEUM CORPORATION

FIGURE 3-1
DOTY MOUNTAIN POD
PROPOSED ACTION
WILDLIFE AND SENSITIVE SPECIES

ANADARKO AREA: CARBON COUNTY, WY

Date: 10/06/05

ADDITIONAL: 11/17/05, Job Site: W0400000

Prepared by: 1003

Bald Eagle. Primary wintering areas for the bald eagle are typically associated with concentrations of food sources along major rivers that remain unfrozen where fish and waterfowl are available, and near ungulate winter ranges that provide carrion (HWA 2003). Wintering bald eagles are also known to roost in forests with large, open conifers and snags that are protected from winds by ridges, often near concentrations of domestic sheep and big game (HWA 2003).

Incidental sightings of bald eagles have been recorded near the Project Area (HWA 2003). Most observations were documented between November and March, indicating that the area is used by bald eagles during the winter. No communal winter roosts are known to exist in or near the Project Area. Inspection of BLM and WGFD raptor nest records and results of aerial and ground raptor nest surveys revealed that no bald eagle nests occur within a 2-mile buffer of the Project Area. The closest known nest is located approximately 30 miles southwest of the Cow Creek POD, another exploratory project of the Atlantic Rim Interim Drilling Project (HWA 2003).

Bald eagles typically build stick nests in the tops of large coniferous or deciduous trees along streams, rivers, or lakes. These types of habitats are not present in the Project Area; therefore, bald eagles are not expected to nest there. Bald eagles may use the Project Area during the winter, when big game species are more concentrated on winter ranges. However, the Project Area does not support concentrated use by bald eagles, and bald eagle use is likely incidental.

3.8.2.2.2. Fish Species

Four federally endangered fish species may occur as residents of the Little Snake River system downstream of the Project Area. These species are the Colorado pikeminnow, bonytail, humpback chub, and razorback sucker (FWS 2003). The last sighting of any of these fish in the Little Snake River was of a single Colorado pikeminnow in 1990. The lack of perennial waters within the Project Area and for several miles downstream precludes potential for the occurrence of the four species of endangered fish within the Project Area (HWA 2003). Although highly unlikely, any of these fish species may occur in Muddy Creek outside of the Project Area or farther downstream in the Little Snake River or Yampa River on a seasonal basis for spawning and/or rearing. Currently, it is not known whether suitable spawning, age-0, or juvenile habitats for any of these species may still be present in the waters downstream from the Project Area. To date, critical habitat for these fish species has not been designated anywhere in Wyoming (HWA 2003).

3.8.3 Species of Concern - Wildlife and Fish

3.8.3.1 Wildlife Species

Species of concern include candidates for federal listing under the ESA, BLM special status species (BLM 2001), WGFD special concern species, and species that are designated rare by The Nature Conservancy and the WYNDD. Species that have not been listed as endangered or threatened by the FWS, but have been identified for possible listing in the future, are classified as candidate species.

3.8.3.1.1. BLM State Sensitive Species Found in the Rawlins Field Office Management Area

Six mammal species of concern, 16 bird species of concern, 3 amphibian species of concern, and 4 fish species of concern may occur in or near the Project Area (HWA 2002, HWA 2003). [Appendix E](#) provides information on all 28 wildlife and fish species of concern including sensitivity status, range, and distribution within Wyoming, probability of occurrence in the Project Area, and habitat descriptions.

3.8.3.1.2. Mammals

Six BLM Wyoming state sensitive mammal species are found in the RFO area (BLM 2002). These species include Wyoming pocket gopher, white-tailed prairie dog, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat. Only one of these species, the white-tailed prairie dog, is known to occur in the Project Area; one small colony (4.0 acres) exists in the northwest quarter of Section 23. The Wyoming pocket gopher and swift fox are likely to occur in the Project Area. The remaining species (fringed myotis, long-eared myotis, and Townsend's big-eared bat) have a slight potential to occur in the Project Area (HWA 2003).

3.8.3.1.3. Birds

Sixteen BLM Wyoming state sensitive bird species are found in the RFO area (BLM 2002). These species include mountain plover (discussed separately below), Baird's sparrow, sage sparrow, Brewer's sparrow, long-billed curlew, sage thrasher, western burrowing owl, yellow-billed cuckoo, loggerhead shrike, Columbian sharp-tailed grouse, greater sage grouse, white-faced ibis, trumpeter swan, peregrine falcon, ferruginous hawk, and northern goshawk. The western subspecies of yellow-billed cuckoo is considered a FWS candidate for listing as endangered. Species known to be present in the Project Area include: sage sparrow, sage thrasher, loggerhead shrike, greater sage grouse, and ferruginous hawk. Two of these species, western burrowing owl and Columbian sharp-tailed grouse may occur in the Project Area. Columbian sharp-tailed grouse have been documented in the Sand Hills area just east of the Project Area (Blomquist 2003), and western burrowing owls are known to utilize prairie dog colonies for nesting and rearing sites. Five species, including Baird's sparrow, long-billed curlew, yellow-billed cuckoo, white-faced ibis, and trumpeter swan, are unlikely to occur. Brewer's sparrow, peregrine falcon, and northern goshawk have a slight potential to occur in the Project Area (HWA 2003).

Mountain Plover. The mountain plover nests over much of Wyoming, but its preferred habitat is limited throughout its range (HWA 2003). This ground-nesting species is typically found in areas of short vegetation (less than 4 inches) on slopes of less than 5 percent. Any short grass, very short shrub, or cushion plant community could be considered plover nesting habitat (HWA 2003); however, mountain plovers prefer shortgrass prairie with open, level or slightly rolling areas dominated by blue grama and buffalograss (HWA 2003). Loss of wintering and breeding habitats and declines in the prey from pes-

ticide use are thought to be factors contributing to the decline of mountain plovers on the North American continent (HWA 2003).

The Atlantic Rim EIS study area was surveyed for mountain plover habitat in May 2001 (HWA 2003). Areas with habitat that meet the habitat requirements for mountain plovers discussed above were identified on the ground and mapped on 1:24,000 scale topographic maps. In order to not overlook any potential mountain plover habitat, habitat was conservatively classified including some areas with slopes greater than 5 percent and vegetation taller than 4 inches. These areas were termed potential mountain plover habitat.

3.8.3.1.4. Amphibians

Three BLM Wyoming state sensitive amphibian species are found in the RFO area (BLM 2002). These species include boreal toad, Great Basin spadefoot toad, and northern leopard frog. The Great Basin spadefoot toad has a slight potential to occur, and the boreal toad and northern leopard frog are unlikely to occur in the Project Area (HWA 2003).

3.8.3.2 Fish Species

Four BLM Wyoming state sensitive fish species may occur in Muddy Creek within the Project Area and immediately downstream of the Project Area in Muddy Creek and the Little Snake River. These fish include roundtail chub, bluehead sucker, flannelmouth sucker, and Colorado River cutthroat trout (HWA 2003).

3.9 RECREATION

Hunting, camping, and off-road vehicle (ORV) use are the most popular recreational activities in or near the Project Area, although no developed recreational sites, facilities, or special recreational management areas exist within or adjacent to the Project Area. The majority of recreation is associated with the fall hunting seasons, specifically during September and October for the greater sage grouse. Pronghorn hunting also occurs in September, and other hunting use occurs during the mule deer season in mid-to-late October. Rabbits and some predators are hunted during the fall and winter. Outside the hunting seasons, the area attracts small numbers of visitors who engage in rock collecting, camping and hiking, observing wildlife, outdoor photography, and picnicking. Although data on recreational visitation are not available, overall use levels are generally low (BLM 2000). Low visitation to the Project Area is a result of the small number of local residents, the long drives from major population centers, lack of publicized natural attractions, and road conditions that limit access by vehicles into many areas.

3.10 VISUAL RESOURCES

The Project Area is typical of the more rugged sections of Wyoming Red Desert region: lands in the Project Area are moderately undulating. Numerous small drainages dissect the landscape, providing topographic diversity. The visual resource management (VRM) class of the Project Area is Class III, which includes areas where changes in the basic elements (form, line, color, or texture) caused by management activities may be evident

in the characteristic landscape. The objective of this class is to provide for management activities that may modify the existing character of the landscape. However, changes should remain subordinate to the visual strength of the existing character.

Larger views that encompass several viewsheds are available from high points. The expansive panorama dominated by the horizon between sky and land is a significant aspect of all distant views. The predominant vegetation types, typical of cold desert steppe, are alkali and low sagebrush, mixed desert scrub, and grasses and forbs, with scattered patches of big sage/rabbit brush on flatter north- and east-facing slopes, along drainage ways, and in large depressions. Small, established stands of juniper also grow within the Project Area. The combination of plant communities creates a subtle mosaic of textures and colors. Predominant vegetation colors in early spring are green and gray green, changing to gray/green and buff/ochre as grasses and forbs cure in the summer and fall. Reddish brown and buff colors of the badland formations add contrast and dominate in areas of steep topography.

Evidence of cultural modification in and near the Project Area includes unimproved roads and some oil and gas production facilities. Motorists traveling WY 789 would not have visual access to the Project Area because of the viewing distance (3 to 6 miles) and intervening elevated topography. However, facilities and activities located on ridgelines or buttes would be visible over longer distances. The quality of the visual resource is an important part of the recreational experience for many users. Other non-recreational users of the area, including grazing permit holders and those working in the oil and gas industry, may also be affected by changes to the visual landscape.

3.11 CULTURAL RESOURCES

3.11.1 Culture History

The earliest known period of culture history in southwestern Wyoming is that of Paleoindian beginning about 12,000 years before present (B.P.), which has come to signify hunting and gathering adaptations of late Pleistocene and early Holocene age. The hunting and butchering of megafaunal animals such as mammoths and bison characterize this period. At these sites large, lanceolate projectile points are often found in association with the skeletal remains of the now extinct megafauna.

Following the Paleoindian period is the Archaic period. The Archaic period dates from about 8,500 to 2,000 years B.P. During this time, groups adopted a more varied hunting and gathering subsistence pattern. In southwestern Wyoming, recent investigations reveal a subsistence system with an emphasis on plant processing and small game. The Early Archaic period is also marked by a change in projectile point technology from lanceolate types to side-notched dart points. The Archaic period in the Washakie Basin is divided into Early and Late periods. The Early period is subdivided into the Great Divide and Opal phases. The Middle Archaic period is represented in other areas of the southwest Wyoming and is known as the McKean complex. The subsistence economy remained much as it had been during the Early Archaic period with both hunting and gathering activities in evidence. By 3,000 years before present, new cultural manifestations

replaced the McKean complex. The first of these is Pelican Lake, known for its corner-notched projectile points. In the Wyoming Basin, Elko series points are also relatively common during this time. In the Waskakie Basin, the chronology goes from the Early Archaic to a Late Archaic. The Late Archaic is subdivided into the Pine Spring and Deadman Wash phases. The subsistence economy remained much as it had been during the Early Archaic period.

The Late Prehistoric period 2,000 B.P. is subdivided into the Uinta and the Firehole phases in the Washakie Basin and is marked by the introduction of bow and arrow and pottery. Small side- and corner-notched projectile points including the Desert side-notched and Rose Springs types appear at this time. With the exception of the bow and arrow and ceramics, there was little change in the material culture or in life ways over the preceding Archaic periods. The Protohistoric period is marked by the introduction of the horse and European trade goods. The horse and gun allowed some tribes to concentrate intensely on bison hunting. The influx of European technology also changed patterns of trade and migration among groups. In some instances, the social and economic organization shifted from small family bands to larger, more permanent groups of several families. Southwestern Wyoming in the Historic period has predominately been used for cattle and sheep ranching. Fur trapping and trading was not an important occurrence in the project area due to lack of perennial streams. There are historic trails and transportation routes such as the Overland Trail, Cherokee Trail, Outlaw Trail, and Baggs to Wamsutter Road that are important corridors which occur near the Project Area. Settlement has been limited due to scarce water sources and rugged terrain.

The accepted cultural chronology of the Washakie Basin is based on a model for the Wyoming Basin by Metcalf (1987) and revised by Thompson and Pastor (1995). The prehistoric and historic chronology is documented in Tables 3-10 and 3-11.

3.11.2 Cultural Environment

The Washakie Basin is an area that has been heavily dissected by the tributary drainages of Dry Cow Creek and Muddy Creek. Landforms consist of ridges, finger ridges, knolls, and hills. Stabilized, intermittent sand dunes occur in hilly upland areas. Eolian sands from western sources add an additional component to localized soils. In southwest Wyoming, sand deposits (dunes, shadows, and sheets) are recognized as highly likely to contain cultural material.

TABLE 3-10 PREHISTORIC CHRONOLOGY OF THE WYOMING BASIN

| Period | Phase | Age (B.P.) |
|------------------|---------------|-------------------|
| | Paleoindian | 12,000 – 8,500 |
| Early Archaic | Great Divide | 8,500 – 6,500 |
| | Opal | 6,500 – 4,300 |
| Late Archaic | Pine Spring | 4,300 – 2,800 |
| | Deadman Wash | 2,800–2,000/1,800 |
| Late Prehistoric | Uinta | 2,000/1,800 – 650 |
| | Firehole | 650 – 300/250 |
| | Protohistoric | 300/250 – 150 |

Source: Metcalf (1987), as modified by Thompson and Pastor (1995)

TABLE 3-11 HISTORIC CHRONOLOGY OF THE WASHAKIE BASIN

| Phase | Age A.D. |
|-----------------|-----------------|
| Pre-Territorial | 1842 – 1868 |
| Territorial | 1868 – 1890 |
| Expansion | 1890 – 1920 |
| Depression | 1920 – 1939 |
| Modern | 1939 – Present |

Source: Massey 1989

Prehistoric use of the Washakie Basin reflects a hunter-gatherer lifestyle. Research into the subsistence and settlement patterns during the Archaic period indicates summer occupations in the mountains, winter occupations in the foothills, and spring and fall movements that made use of all available zones (Creasman and Thompson 1997). Subsistence patterns in the Archaic and the Late Prehistoric periods are similar in that they are based on seasonal movement throughout the basins and foothills in response to the availability of floral and faunal resources (Creasman and Thompson 1997). The topographic setting is conducive to prehistoric occupation. A high potential for prehistoric sites occurs near reliable water sources such as Dry Cow Creek and Muddy Creek. As distance increases from these water sources, site density drops.

Historical use of the Washakie Basin area was affected by the formidable topographic relief. Steep canyons, badlands, and escarpments made the area more difficult for settlement. The area was primarily used for cattle and sheep ranching. Limited ranching is identified by the presence of historic debris scatters and the historical record.

3.11.3 Summary of Cultural Resources

Previous fieldwork was identified during the Class I file searches requested from the Wyoming Cultural Records Office for the surveys (Hatcher 2001; 2003a; 2003b). A considerable amount of fieldwork has occurred near the Project Area, resulting in the documentation of cultural resources through survey, examination of ethnographic records, and research of historic records. No sites have been extensively tested or excavated in the Project Area. However, several sites have been excavated in the surrounding area, contributing data about the prehistory and history of the area.

3.11.3.1 Previous Surveys

Previous surveys have been conducted in the vicinity of the Project Area. This includes Class II and Class III surveys. Table 3-12 summarizes the previous work in or adjacent to the Project Area by township, range and section.

TABLE 3-12 PREVIOUS CULTURAL RESOURCE INVENTORIES IN THE VICINITY OF THE PROJECT AREA

| T/R/Sec | Survey Qty | Survey Type | Sites/Isolated Finds |
|----------------|-------------------|--------------------|-----------------------------|
| 16N/91W/6 | 2 | Class III | 5 sites |
| 16N/92W/1 | 3 | Class III | 2 sites |
| 16N/92W/12 | 21 | Class III | 4 sites |
| 17N/91W/14 | 1 | Class II/Class III | 1 site |
| 17N/91W/22 | 2 | Class II/Class III | 0 |
| 17N/91W/23 | 0 | No survey | 0 |
| 17N/91W/27 | 0 | No survey | 0 |
| 17N/91W/28 | 0 | No survey | 0 |
| 27N/91W/29 | 1 | Class III | 0 |
| 27N/91W/31 | 2 | Class III | 10 sites |
| 17N/91W/32 | 2 | Class II/Class III | 7 sites |
| Total | 34 | | 29 sites |

3.11.3.2 Previously Recorded Sites

Previous cultural resource inventories documented 29 sites and no isolated finds within or adjacent to the Project Area. Table 3-13 summarizes 9 sites that are located within the Project Area or within ¼ mile of the boundary. The table lists each site by type and eligibility for the NRHP. There are 7 prehistoric sites and 2 historic sites. The seven prehistoric sites include two eligible, two not eligible, and three with unknown eligibility for the NRHP. The two historic sites include one eligible and one not eligible for the NRHP. Two of the sites are within the Project Area but could not be relocated during the 2001 and 2003 investigations.

TABLE 3-13 PREVIOUS CULTURAL RESOURCE INVENTORIES

| Period | Site Type | Site Number | Eligibility |
|--------------------------|---------------------------|--------------------|--------------------|
| Prehistoric Sites | Lithic Scatter | 48CR389 | ENL |
| | | 48CR1322 | NE* |
| | | 48CR7823 | Unk* |
| | Lithic Scatter w/features | 48CR1078 | E* |
| | | 48CR1318 | E* |
| | | 48CR1321 | NE* |
| | | 48CR7821 | Unk* |
| | Historic Sites | Artifact Scatter | 48CR1320 |
| 48CR1334 | | | E |
| Shepherd Camp | | | |

ENL = Eligibility Not Listed; NE = Not Eligible; Unk = Unknown; E = Eligible; * indicates sites outside of the Project Area but within ¼ mile.

Site 48CR389 is a prehistoric lithic scatter. There is no eligibility listed for this site. The site is within the Doty Mountain POD boundary. The 2003 investigation could not relocate the site.

Site 48CR1334 is a shepherd's camp that is recommended as eligible by the field archaeologist but not reviewed by the SHPO. The site is within the boundaries of the Project Area. The site was not relocated during the 2001 survey.

3.11.3.3 Potential Site Types

Based on the results of the files searches, the expected cultural resources for this area include prehistoric and historic resources. The prehistoric and historic site types are:

- Prehistoric open camps that contain evidence of a broad range of activities, including subsistence-related activities. Cultural remains include features, lithic debris, chipped stone tools, and depending on the temporal period of use, evidence of milling and vegetable processing, including ground stone and pottery.
- Prehistoric lithic scatters consist of lithic debris such as debitage or chipped stone tools.
- Prehistoric or historic cairns that are low piles of local stone. Historic cairns are often constructed by shepherders.
- Historic artifact scatters that are collections of historic debris often left by shepherders and consist of artifacts such as glass, ceramic, and cans.

Other site types that could occur but that have not been recorded in the Project Area include:

- Prehistoric quarries that are areas where lithic raw material was obtained and initially processed.
- Human burials, rock art (both pictographs and petroglyphs), and rock alignment could occur and may be identified as sensitive or sacred to Native Americans. Few of these types of sites have been located in southwestern Wyoming.

3.11.3.4 Cultural Resource Inventories for the Project

The Project Area was intensively surveyed in 2001 and 2003 (Hatcher 2001; 2003a; 2003b). Those investigations resulted in the recording of four new sites. One site is historic and three are prehistoric. The three prehistoric sites are recommended eligible for inclusion in the NRHP.

Site 48CR7617 is a historic cairn. It is constructed of locally occurring sandstone slabs. Cairns, similar to this one, are common in the area and were often constructed by shepherders. This site is recommended as not eligible for inclusion in the NRHP.

Site 48CR7956 is a prehistoric open camp with lithic debitage and a hearth feature. Fire altered stone was also observed. The site has the potential for buried *in situ* cultural re-

mains and is recommended as eligible for inclusion in the NRHP based on the site's information potential.

Site 48CR7960 is a prehistoric open camp with a chipped stone tool, lithic debitage, and a possible hearth feature. The site has the potential for buried *in situ* cultural remains and is recommended as eligible for inclusion in the NRHP based on the site's information potential.

Site 48CR7961 is a prehistoric site, possibly an open camp. The site consists of lithic debitage and a possible hearth. The site has the potential for buried *in situ* cultural remains and is recommended as eligible for inclusion in the NRHP based on the site's information potential.

3.11.4 Conclusion

The recent cultural inventory of the Project Area identified 29 previously recorded sites, 3 newly recorded prehistoric sites, 1 historic site, and no isolated finds. There are 20 sites that are greater than ¼ mile from the Project Area. Of the remaining 12 sites that are in or within ¼ mile, 10 are prehistoric sites with 5 eligible, 2 not eligible, and 3 with unknown eligibility for the NRHP and 3 are historic sites with one eligible for the NRHP. Six of the sites are within the Project Area and six are outside the Project Area. Two of the previously recorded sites within the current boundary of the Project Area could not be relocated.

In southwest Wyoming, sand deposits (dunes, shadows, and sheets) are recognized as highly likely to contain cultural material. Certain topographic settings have greater archaeological sensitivity including eolian deposits (sand dunes, sand shadows, and sand sheets), and to a limited degree, colluvial deposits along lower slopes of ridges. The Project Area includes these deposits. Proximity to reliable water sources such as Dry Cow Creek and Muddy Creek is an important factor in predicting the occurrence of prehistoric resources and usually results in a high potential for prehistoric sites. If the proposed action were modified, an additional cultural resources inventory for the new area of proposed disturbance would be required.

3.12 SOCIOECONOMICS

The geographic area of analysis for potential socioeconomic effects is Carbon County, Wyoming, and the nearest established communities of Baggs, Dixon, and Rawlins. In addition, the availability of temporary housing is also described for the community of Craig in Moffat County, Colorado, and the community of Wamsutter in Sweetwater County, Wyoming, the closest and most likely sources of the available workforce. Socioeconomic conditions in Carbon County that were characterized in this document include economic and population conditions, temporary housing resources, law enforcement and emergency management services, certain local and state government revenues, and local attitudes and opinions.

3.12.1 Economic Conditions

The economy of Carbon County is based on natural resources. Basic economic sectors that bring revenues into the county include oil and gas production and processing, coal mining, electric power generation, agriculture (primarily ranching and logging), some manufacturing, and transportation (primarily the Union Pacific Railroad). Those portions of the retail and service sectors that serve travelers and tourism and recreation visitors are also basic.

Employment and earnings are two common measures of economic activity. The mining sector, which includes oil and gas employment, would be the primary sector affected by exploration or development of CBNG resources.

Employment, like the overall economy, has followed a boom and bust cycle. In 2000, employment in Carbon County totaled 12,392 full- and part-time jobs, which was about 25 percent higher than the 1990 level and about 9 percent lower than the 1980 level of 13,560 jobs (WDAI 2000a, 2003). Employment in the mining sector, which includes jobs in the oil and gas industry, decreased 76 percent from 1990 to 2000, from 934 to 223 jobs. The 2000 level was 94 percent lower than the 1980 level of 3,563 mining jobs (UW 1997). The losses in the mining sector and the volatility in total employment are attributed to the shutdown of the Rosebud and Seminoe # 2 mines (BLM 1999a) and more recently the RAG Shoshone mine near Hanna (Rawlins Daily Times 2000a). Other reductions in the mine workforce and the delay in opening an anticipated mine have further affected employment in the mining sector throughout Carbon County; however, increased natural gas drilling has resulted in growth in employment in the oil and gas industry in recent years (Schnal 2000).

In Carbon County, 10-year unemployment rates ranged from a low of 4 percent (2000) to a high of 6.1 percent (1993). In 2000, the total labor force in Carbon County was 8,357, which included 337 unemployed people, resulting in an unemployment rate of 4 percent (Wyoming Department of Employment 2003).

Earnings in Carbon County increased from \$202 million to \$211 million between 1990 and 1998, a 5 percent increase. However, when adjusted for inflation, earnings in Carbon County decreased by 21 percent from their 1990 level during the 8-year period.

3.12.1.1 Oil and Gas Production

Production of natural gas in Carbon County increased from 76 million cubic feet (MCF) in 1995 to about 97 MCF during 2000. In addition, production of oil in Carbon County in 2000 was within 1.6 percent of the 1995 level of 1.3 million barrels. During 1999, there were 742 producing oil and gas wells in Carbon County (WOGCC 1995-1999).

One indicator of future production, approved Applications for Permits to Drill, increased steadily in Carbon County in recent years, from 50 in 1995 to 162 in 2000 to 225 to date in 2003. Increased drilling may result in increased production in the county if drilling efforts are successful and commodity prices increase or stabilize at economic levels (WOGCC 1995-1999; WOGCC 2003).

3.12.1.2 Economic Activities

Other economic activities occurring in and near the Project Area include oil and gas exploration (Vosika Neuman 2000), cattle grazing (Warren 2000), and outdoor recreation such as hunting (pronghorn antelope, mule deer, elk, and upland birds), hiking, ORV use, camping, and sightseeing. The permit areas for many commercial hunting outfitters are partially within the Project Area (Clair 2000).

3.12.1.3 Population

The growth and decline in the population of Carbon County parallel the employment boom and bust cycle discussed previously in this section. For example, the 2000 population of Carbon County (15,639) was 29 percent lower than its 1980 level of 21,896 (WDAI 2001). Between 1990 and 2000, the City of Rawlins, the largest community in Carbon County, lost an estimated 842 persons to end the period at 8,538, although the city is growing because a new state prison opened. The Town of Baggs gained 76 residents or 28 percent of its 1990 population. Likewise, the Town of Dixon, several miles east of Baggs, gained 12 persons to end the period with an estimated population of 79.

3.12.2 Temporary Housing Resources

Natural gas development typically involves relatively short-duration tasks carried out primarily by contractors. The nature of these activities results in demand for temporary housing resources such as motel rooms and mobile home and recreational vehicle (RV) spaces in the Project Area and vicinity.

Most temporary housing resources are fully occupied by oil and gas industry workers during the summer in the area of Baggs and Dixon. More units become vacant during winter. A 26-space mobile home park in Baggs is equipped to accommodate RVs as well as mobile homes. There are several rental mobile homes within the park. There is a small four-space mobile home park in Savery, Wyoming, and a number of mobile home lots are scattered throughout the Little Snake River Valley (Grieve 2000).

There are two motels in Baggs with a total of 64 rooms, most of which can accommodate several guests. Both motels routinely house oil and gas industry workers as well as tourists, travelers, and hunters. As with mobile home parks, the motels are filled to capacity during the summer and fall, but some rooms are available during the winter. Most occupants who are employed in the oil and gas industry are relatively short term, residing in the community only during until work assignments are completed (Willis 2000; Hawkins 2000). Longer-term rental housing in the Baggs and Dixon area consists primarily of an apartment building and a newly constructed rental duplex.

Temporary housing resources are available in the Town of Wamsutter, including several mobile home parks and two motels (Carnes 2000). The town is the center of a 200-well per year British Petroleum (BP) drilling and field development program. Wamsutter officials recently stated that no housing was available in the town to accommodate workers

and their families associated with the current drilling and field development (Rock Springs Rocket Miner 2001).

More extensive temporary housing resources are available in Craig, Colorado, and Rawlins, Wyoming. The Craig Chamber of Commerce lists 12 motels with a total of 467 rooms and two campgrounds or RV parks with a total of 128 spaces (Craig Chamber of Commerce 2000). Rawlins has 20 motels and four RV parks (Hiatt 2000). There are also a substantial number of apartment buildings in these areas with some vacancies (Hewitt 2000; Rawlins Daily Times 2000b).

3.12.3 Local Government and State Government Revenues

The fiscal condition of local and state governments most likely to be affected by interim drilling includes ad valorem property tax revenues from the county, school, and special districts; state, county, and municipal sales and use tax revenues; state severance taxes; and federal and state mineral royalty distributions. Some county, municipal, and special district service expenditures may also be minimally affected.

3.12.3.1 Ad Valorem Property Tax

The assessed valuation in Carbon County for fiscal year (FY) 2001 totaled about \$554 million, which yielded total property tax revenues of \$34.9 million. Mineral production is assessed at 100 percent of value. The countrywide mill levy in 2001 was 12.76. FY 2001 assessed valuation from 2000 natural gas production totaled \$363 million, or about 66 percent of total assessed valuation. Assessed valuation from oil production totaled 31.1 million, or about 6 percent of total valuation (WTA 2001).

3.12.3.2 Sales and Use Tax

FY 2000 sales and use tax collections in Carbon County totaled about \$21 million. These collections include a 4 percent statewide sales and use tax, a 1 percent general purpose local-option sales and use tax, and a 1 percent specific-purpose local option sales and use tax, which expired in the summer of 2001 (WDAI 2000b).

3.12.3.3 Severance Taxes

In Wyoming, severance taxes are levied against certain minerals produced in the state, including a 6 percent severance tax on natural gas. In FY 2000, distributions from the severance tax totaled \$275 million (WDAI 2000c). Of the total, 44 percent was attributable to severance taxes on natural gas.

3.12.3.4 Federal Mineral Royalties

The federal government collects a 12.5 percent royalty on oil and natural gas extracted from federal lands. After certain costs are deducted, half of those royalties are returned to the state where production occurred. In Wyoming, the state's share is distributed to a variety of accounts, including the university, school foundation fund, highway fund, Legislative Royalty Impact Account, and cities, towns, and counties. During FY 2000, \$309

million in federal mineral royalty funds were distributed to entities in Wyoming (WDAI 2000d).

3.12.3.5 State Mineral Royalties

The State of Wyoming collects a 16.7 percent royalty on the fair market value of gas produced from state leases, less production and transportation costs. During FY 2000, state-leasing income was \$35 million (PRCBMIC 2001).

3.12.4 Attitudes and Opinions

A 1996 survey conducted in conjunction with preparation of the Carbon County Land Use Plan provides some insight into the attitudes and opinions of residents regarding land use, oil and gas development, natural resource conservation and use, and other topics. Slightly more than 300 residents completed the survey, yielding an estimated statistical reliability of about 95 percent (Pederson Planning Consultants 1998).

Water resource conservation and concern for government regulation of land use were the most frequently listed land use issues. This issue was followed closely by the availability of water to support future land uses; the economic viability of ranching, timber, and oil and gas industries; and the need to conserve wildlife habitat.

Approximately 55 percent of countywide survey respondents (based on a weighted average; some respondents indicated more than one response) indicated that conservation of land, water, and wildlife resources was more important than increased oil and gas production, while 36.9 percent indicated that increased oil and gas production was more important. However, 54 percent of the respondents from Baggs indicated that increased oil and gas production was more important than conservation of land, water, and wildlife resources, while 36 percent indicated that resource conservation was more important. The land use plan attributes this difference to the greater economic dependence in Baggs on future oil and gas employment.

Concerning management of federal lands, the largest number of respondents (69.5 percent) indicated that more federal lands within the county should be designated for conserving fish and wildlife habitat and surface water and groundwater resources. In addition, 60.8 percent of respondents indicated that more land should be designated for public recreation, 48.8 percent indicated that more land should be leased for oil and gas industry exploration and production, 48.7 percent indicated that more land should be leased for commercial mining, and 44.5 percent indicated that more land should be made available to local timber companies for commercial timber harvest.

3.12.5 Environmental Justice

Executive Order (EO) 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations," was published in the *Federal Register* (59 FR 7629) on February 11, 1994. EO 12898 requires federal agencies to identify and address disproportionately high and adverse effects on human health or the environment

of their programs, policies, and activities on minority and low-income populations (defined as living below the poverty level). The EO makes clear that its provisions apply fully to American Indian populations and Indian tribes, and specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Indian communities.

Communities within Carbon County and entities or individuals with interests in the area may have concerns about the presence of development within the Project Area. Communities potentially affected by the presence or absence of the proposed development have been identified in the previous sections. Environmental justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Environmental justice concerns focus on promoting the protection of human health and the environment, encouraging public participation, and disseminating relevant information to educate potentially affected communities.

Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right. With regard to environmental justice issues affecting Native American tribes or groups, the Project Area contains no tribal lands or Indian communities, and no treaty rights or Indian trust resources are known to exist for this area.

3.13 TRANSPORTATION

The regional transportation system that serves the Project Area includes an established network of interstate and state highways and county roads. Improved and unimproved BLM roads serve local traffic on federal land.

Federal and state highways providing access to the Project Area include U.S. Interstate Highway 80 (I-80) Wyoming State Highway (WY) 789, WY 71, and WY 70. The Wyoming Department of Transportation (WYDOT) measures annual average daily traffic (AADT) and collects accident statistics on federal and state highways. AADT and accident statistics for highways providing access to the ARPA are shown in Table 3-14.

WYDOT assigns levels of service to highways in the state system. Levels of service (A through F) are assigned based on qualitative measures (speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience) that characterize operational conditions within traffic streams and the perceptions of those conditions by motorists. "A" represents the best travel conditions, and "F" represents the worst. Levels of service for highways providing access to the Project Area are also shown in Table 3-14.

The primary roads used to reach the Project Area are Interstate-80 to WY 789 or WY 70 to WY 789, both of which lead to Carbon County 608 (Wild Cow Road), an existing graveled road. An existing BLM road provides access from Carbon County 608 to T16N R92W, Section 12. Access from the southwest to the drill locations would be provided by newly constructed road access along existing two-tracks that currently provide vehicle

access and newly constructed road access. BLM 3305 provides access to the southeastern edge of the Project Area, including the Sand Hills and the eastern flank of Doty Mountain, via unnamed roads and two-tracks.

TABLE 3-14 HIGHWAY ACCESS, ANNUAL AVERAGE DAILY TRAFFIC AND ACCIDENT STATISTICS

| Highway | 2000 AADT | Projected AADT in 2012 | Levels of Service/Annual Average Accidents 1996 –2000 |
|---|------------------|-------------------------------|--|
| I-80 from Rawlins west to Creston Junction | 10,900 | 15,000 | A/123.4 |
| I-80 from Rock Springs east to Creston Junction | 10,900 | 15,000 | A/246.6 |
| WY 789 from Creston Junction south to Baggs | 760 | 800 | B/18.8 |
| WY 70 from Savery west to Baggs | 530 | 550 | B/14.8 |
| WY 71 I-80 south | 160 | 160 | B/3.2 |

Source: GHEP 2003

3.14 HEALTH AND SAFETY

Existing health and safety concerns in and adjacent to the Project Area include occupational hazards associated with natural gas exploration and operations; risks associated with vehicular travel on improved and unimproved county and BLM roads; firearms accidents associated with hunting or casual use of firearms; and low-probability events such as landslides, flash floods, and rangeland fires.

3.14.1 Occupational Hazards

Two types of workers would be employed by the project: oil and gas workers who in 1998 had an annual accident rate of 4.0 per 100 workers, and special trade contractors who had a non-fatal accident rate of 8.9 per 100 workers (U.S. Department of Labor, Bureau of Labor Statistics 1998). These rates compare with an overall private industry average for all occupations of 6.2 per 100 workers.

There has been recent concern among drillers that worker safety standards and training used for conventional oil and gas may not be appropriate for the CBNG industry (Rock Springs Rocket Miner 2001). During 2000, five workers died and six others were seriously injured in CBNG-related accidents in Campbell County, Wyoming. The Wyoming Occupational Safety and Health Administration (OSHA), Worker’s Safety Division, is working with companies to consider changes in standards for worker safety and revised training requirements.

3.14.2 Pipeline Hazards

Accident rates for gas transmission pipelines are historically low. Nationwide, injuries associated with gas transmission pipelines averaged 12 per year from 1990 through 2001, fatalities averaged one per year, and incidents such as ruptures averaged 79 per year (U.S. Department of Transportation 2002).

3.14.3 Other Risks and Hazards

Hazards would exist from sanitation and materials used during oil and gas development. Federal regulations establish standards for safety procedures during drilling, including blowout prevention equipment to control abnormally high pressures, if encountered during drilling operations, and procedures to be employed for the control and removal of wastes, spill prevention, fire prevention, and suppression. The existing risks associated with wildfire in the Project Area have not been characterized or quantified for either natural or human-caused ignitions. The handling, storage, transportation, and disposal of hazardous materials, if any are used, also are regulated. A spill prevention, control, and countermeasures plan is required.

The types of materials used in the development of CBNG are materials that are often found in a garage at a residence, including ammonia, gasoline, diesel fuel, motor oil, greases and lubricants, solvents to clean equipment, antifreeze-type heat transfer fluids (glycols), paint, sand, fertilizers, and herbicides (weed killers). Additional materials that are typically used are solutions that are used to regulate acidity and alkalinity, such as those that could be used for spa maintenance, including sodium hydroxide, and acids. Surfactants (soap-like materials), inert gases that are not toxic, flammable, or explosive, and welding or cutting materials also are used.

3.15 NOISE

The Project Area is located in a sparsely populated rural setting with minimal sound disturbances. Vehicle traffic on WY 789; overflights by jet aircraft at high altitudes; localized vehicular traffic on roads; and nearby drilling cause sound disturbances within the Project Area. The principal source of sound within the Project Area is the wind. The U.S. Environmental Protection Agency (EPA) has established an average 24-hour noise level of 55 A-weighted decibel (dBA) as the maximum level that does not adversely affect public health and welfare. The State of Wyoming has not established regulations for quantitative noise levels. Definitive data have not been established concerning noise levels that may affect animals.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter analyzes the potential environmental consequences that would result from implementation of the Proposed Action or No Action alternatives. The Proposed Action involves development of federal land or minerals associated with the POD for 24 exploratory well locations, access roads, injection wells, compressor station, and associated facilities defined in one coordinated master plan. The No Action alternative would involve denial of the master plan for interim drilling and development in the Project Area. Without a master plan, future mineral development in the Project Area would occur ‘piecemeal’ or on a case-by-case basis, under the guidelines of the RMP and site-specific COAs, with no coordinated planning that could reduce the cumulative impacts of interim drilling and development. Measures that would avoid or reduce impacts under the project have been presented in Chapter 2. The following impact assessment considers these measures. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 are presented in this chapter, where applicable, under the Summary of Mitigation for each resource area.

As discussed in Chapters 1 and 2, the Project Area lies within the Atlantic Rim EIS study area ([Figure 1-1](#)). Drilling and field development associated with the project would conform with the guidance found in the Interim Drilling Policy ([Appendix A](#)). The purpose of the Interim Drilling Policy is to guide the gathering of information that will support the formulation of the Atlantic Rim EIS.

This analysis of environmental consequences addresses the direct and indirect impacts associated with exploration and interim development of the Doty Mountain area. It also addresses cumulative impacts that would result from past, present, and reasonably foreseeable future actions within a cumulative impact assessment area relevant to the resource analyzed. The description of the environmental consequences includes the following subsections, where applicable:

4.1.1. Direct and Indirect Effects

This subsection analyzes the level and duration of direct and indirect effects that would occur because of the Proposed Action or the No Action alternative. The impact evaluation assumes that the applicant-committed and BLM-required practices described in Chapter 2 would be implemented.

4.1.2. Cumulative Impacts

This section describes impacts that are likely to occur as a result of this project. These impacts are described in combination with other ongoing and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable future actions, or RFFAs).

This environmental analysis addresses cumulative impacts associated with exploration and interim development of 200 coal bed natural gas (CBNG) wells (including the project) and other activities, ongoing or proposed, within the Atlantic Rim EIS study area. The Atlantic Rim area is located generally in Townships 13 through 20 North and Ranges 89 through 92 West in Carbon County, Wyoming. Cumulative impacts associated with exploration and development of the Project Area are described later in this chapter.

4.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

4.2.1. Proposed Action

Use of cut and fill construction techniques to develop well locations and access roads and to install pipelines and facilities would alter existing topography. In total, an estimated 145 acres would be affected by surface-disturbing activities. Use of proper construction techniques, described in Chapter 2, would reduce the effects associated with topographic alteration.

In addition, as discussed in Chapter 3, no major landslides or other geologic hazards have been mapped within the Project Area. By following prescribed procedures, construction would not be likely to activate landslides, mudslides, debris flows, or slumps. Seismic activity is low in the Project Area, so the potential for an earthquake to damage project facilities is minimal.

Drilling the wells may result in discovery of CBNG resources. An economic discovery in the Project Area, in conjunction with other economic discoveries under the interim drilling projects, could lead to full-scale development, which is currently being analyzed in the Atlantic Rim EIS (in preparation). If no CBNG resources are discovered, however, additional exploratory wells may or may not be drilled, depending on the information obtained in drilling the proposed wells. In addition, the Atlantic Rim EIS may not be required or may be modified. No other major mineral resources would be affected by the project.

As discussed in Chapter 2, mitigation measures for the project presented in the sections on Water Resources or Soils would reduce potential effects to the surface geologic environment. Implementation of these measures and adherence to federal and state rules and regulations regarding drilling, testing, and completion procedures would prevent potential effects on the subsurface geologic environment.

It is not anticipated that development of the project would affect any sensitive resource area, such as a high-density paleontological site or stabilized sand dunes. Although the surface-disturbing activities associated with the project could disturb paleontological resources, the potential for recovery of important vertebrate fossils in the Project Area is considered low to moderate. Excavation associated with development of access roads, well pads, gas and water pipelines, and related gas production and water disposal facilities could directly expose, damage, or destroy scientifically significant fossil resources. For example, fossils may be damaged or destroyed by erosion that is accelerated by disturbance from construction. In addition, improved access and increased visibility as a re-

sult of construction and ongoing production may damage or destroy fossils through unauthorized collection or vandalism. However, no occurrences of paleontological resources are documented in the Project Area. The Lewis Shale of Cretaceous age, which underlies the area, has produced fossils of scientific significance elsewhere in Wyoming (and thus meets BLM Condition 2). However, mitigation measures discussed in Chapter 2 would protect potential paleontological resources that may be inadvertently uncovered during excavation.

4.2.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. The federal natural gas resources in the Project Area would not be depleted if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts. Furthermore, additional information on CBNG accumulation under federal lands in this area of the Washakie Basin would not be obtained, and the collective knowledge base would not increase.

4.3 AIR QUALITY

4.3.1. Proposed Action

The small number of exploratory wells and facilities included in the project would generate only a small amount of air pollutants. Some temporary effects on air quality would likely occur in the immediate vicinity of the project caused by particulate matter and exhausts from vehicles and equipment. These effects would be local and would be dispersed by prevailing winds. The effects on air quality would be minimized through dust abatement practices.

No noticeable deterioration in visibility would occur at Class I or sensitive Class II wilderness areas that are located within 100 miles of project activities (Mount Zirkel, Rawah, Savage Run, Platte River, Huston Park, or Encampment River). Similarly, no noticeable deterioration in visibility would occur at Dinosaur National Monument in Colorado. Dispersion by wind of the small quantity of air pollutants generated by the project would likely eliminate formation of regional haze or acid deposition.

If these wells were deemed economical to produce, the Companies would be required to file an application with WDEQ for an air quality permit for oil and gas production facilities under Section 21 of the Wyoming Air Quality Standards and Regulations.

No violations of applicable state or federal air quality regulations or standards are expected to occur as a result of direct or indirect emissions of air pollutants from well development (including both construction and operation) in the Project Area.

Air emissions would occur from construction and production of gas wells within the Project Area. Emissions from construction would include PM₁₀, SO₂, oxides of nitrogen (NO_x), CO, and volatile organic compounds (VOCs) from ground clearing, use of heavy equipment, drilling, and completion, as well as from construction of access roads. Emissions from construction are temporary and would occur in isolation, without significantly interacting with adjacent wells.

Production emissions of NO_x, CO, VOCs, and hazardous air pollutants (HAPs) (specifically formaldehyde) would result primarily from operation of compressor engines. Estimated impacts to air quality assumed that the average potential NO_x emission rate for the compressor engines would be approximately 2.0 grams per horsepower-hour (g/hp-hr) of operation. This rate reflects emission control levels that have already been required in similar applications, and is conservative when compared with the emissions projected in Chapter 2, (less than 1.5 g/hp-hr). WDEQ-AQD operating permit records also have shown existing facility emissions to be substantially less than 2.0 g/hp-hr. The emissions generated from operation of the compressors would contain negligible amounts of SO₂ and particulate matter because of the composition of methane from coal seams in the Mesaverde Group. Production emissions from the compressor engines would occur over the life of the project. Emissions from production wells would be negligible because the produced gas is nearly 100 percent methane and would require no ancillary production facilities at the well sites.

Pollutant emissions from construction and operation of natural gas fields near the Project Area have been analyzed in recent air quality studies completed by BLM under NEPA. Studies conducted for the Continental Divide/Wamsutter II and South Baggs Natural Gas Development Projects (BLM 1999a, 2000) indicated potential near field increases in concentrations of CO, NO₂, PM₁₀, and SO₂; however, the predicted maximum concentrations would be well below applicable WAAQS, CAAQS, and NAAQS. Similarly, predicted concentrations of HAPs (formaldehyde) would be below various 8-hour maximum Acceptable Ambient Concentration Levels, and the related incremental cancer risks to residents, would also be below applicable significance levels.

The emissions that would result from implementation of this project would be much the same as those projected for other oil and gas projects, such as Continental Divide, but on a smaller scale. The 24-well exploratory project described in this EA is within the limit of the 3,000-well air quality analysis prepared for the Continental Divide EIS, considering that only 2,130 wells were authorized for that project. The analysis for the Continental Divide EIS project included impacts to Class I areas from oil and gas development in southern Wyoming. Based on the relative size of this project, including the associated lateral sales pipeline when compared with the magnitude of these previous projects, no ambient air quality standards would be violated and no adverse air quality conditions would result from the proposed project.

4.3.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on air quality would be expected to occur beyond the current pollutant concentrations if the proposed wells are

not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.4 SOILS

4.4.1. Proposed Action

The proposed construction and operation of wells, facilities, and access roads could affect the productivity of soils in the Project Area by:

- Removing existing vegetation cover;
- Redistributing or removing all or part of the soil profile;
- Compacting soils;
- Potentially exposing soil to accelerated wind and water erosion;
- Potentially covering adjacent soils and drainages with sediments; and,
- Potentially exposing the soil to noxious weeds or invasive species.

These activities could reduce soil productivity within and immediately adjacent to the proposed area of disturbance. The affects of these activities on soil productivity have been evaluated based on their duration, magnitude and intensity and are described below. The measures that would be conducted to prevent, reduce or mitigate the effects of these activities on soil productivity are identified below. Any residual impacts (if any) to the soils productivity and their significance are identified.

Both long-term and short-term effects on soil productivity would occur under the Proposed Action. An estimated 145 acres of surface disturbance would occur as a result of drilling and testing and construction of facilities. If exploratory wells are productive an estimated 56 acres of land would remain disturbed for the production of natural gas. Therefore, approximately 99 acres of surface would be affected in the short-term only (i.e. no more than 2 to 4 years) and 46 acres would be affected in the long-term (i.e. for as long as 20 years).

Disturbance would occur within the following soil map units:

- Cushool-Worfman-Blackhall Complex
- Forelle - Patent Complex
- Rentsac - Shinbara Complex
- Blazon - Shinbara Complex
- Seaverson - Blazon Complex
- Diamondville - Blazon - Forelle Complex
- Forelle - Diamondville Loams

Vegetation and soil would be removed from 145 acres of land, and subsoil would be re-distributed to construct well and compressor pads, roads, flowlines, and facilities for the underground injection of produced water.

Removed and redistributed soils would be:

- Compacted in localized areas due to equipment traffic;
- Susceptible to accelerated wind and water erosion and deposition due to an increase in the amount of exposed and unprotected soil surfaces; and,
- Susceptible to noxious and invasive weed infestation due to the removal of desirable perennial vegetation.

As a result, the productivity of soils would decline due to:

- Reduced soil microbial activity and soil fertility;
- Interruption of nutrient and organic matter addition to soil from vegetation;
- Soil loss; and,
- Introduction of weed seeds.

The intensity of effects would vary according to the type and location of disturbance from development and production activities, and the period of disturbance prior to reclamation.

The Companies have committed to using the BMPs described in the Master Surface Use Plan (MSUP) ([Appendix B](#)) and Chapter 2 during construction, operation, and reclamation that, combined with existing regulatory requirements, would reduce the effects on soil productivity through the following measures:

- Removal and storage of soils prior to drilling and testing;
- Scarification of disturbed areas prior to soils redistribution;
- Management of noxious weeds and invasive species; and,
- Timely and effective erosion control and revegetation of disturbed areas.

Vegetation and the top 6 inches or more of soil material would be separately removed prior to the initiation of drilling and testing activities and facilities construction. The removed vegetation and soil would be stockpiled in specific locations around the perimeter of disturbed areas, seeded, and protected from wind and water erosion and other contaminants that may reduce their productivity.

Following construction, drilling, and testing activities, the disturbed areas not required for production of natural gas, or an estimated 99 acres, would be reclaimed as described in the MSUP and Chapter 2.

In early successional stages of reclamation invasive species may be beneficial to the recovery of disturbed areas due to protection from erosion and thermal extremes, and through additions of organic matter to the soils. However, native plant species may be excluded if growth of invasive species progresses to the point that the density of desirable plant species and plant diversity is reduced. Therefore, the procedures and measures that would be used to identify and eradicate undesirable plant species on soil stockpiles, disturbed areas, and areas that are undergoing reclamation are described in the MSUP and Chapter 2.

The anticipated reduction in soil productivity would require many years to fully recover due to low annual precipitation and soil fertility, and short growing season. However, the majority of the sagebrush/grassland community that would be disturbed by the proposed action is decadent with little herbaceous and grass cover and diversity. Therefore, the reclamation of disturbed areas would initially lead to greater diversity and production of herbaceous and grass species. In addition, the structural diversity of the sagebrush/grassland vegetation community would be increase due to the reclamation of disturbed areas. Eventually recolonization of the reclaimed area by surrounding native shrub species would reduce herbaceous and grass production, and species and structural diversity. Reclamation would reduce erosion within the disturbed areas and would more that compensate for the short-term loss in soil productivity due to natural gas development.

For the 46 acres that would be affected in the long-term, the impacts to soil productivity described above would be slightly more intense and prolonged. However, the intensity of the reduction in microbial activity and organic matter addition and its effect on inherent soil fertility will be substantially greater than for soils that would be disturbed in the short-term. To minimize this long-term effect on soil productivity, the BMPs described in the MSUP and Chapter 2 would be implemented.

Impacts to soil resources in the Project Area are anticipated to be minimal based on the following factors:

- Small area of disturbance;
- Small amount of disturbance to the soil map units when compared to the area covered by these same map units in Carbon County;
- Use of proper construction and reclamation techniques; and,
- Implementation of the measures described in the MSUP and Chapter 2.

4.4.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on soils would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.5 WATER RESOURCES

4.5.1. Proposed Action

Minimal effects on aquifers and groundwater quality would be anticipated as a result of the project with the use of proper construction techniques, drilling practices, and BMPs described in the MSUP ([Appendix B](#)) and Chapter 2. Groundwater would be removed from the coal seam aquifers within the Allen Ridge, Pine Ridge, and Almond Formations,

members of the Upper Cretaceous Mesaverde Group. Well testing is intended to lower the hydraulic head in the affected coal seam aquifer. (The reduction of hydraulic head in an aquifer also is referred to as drawdown.) Relative to the available drawdown within the aquifer, the effect on the coal aquifer during the interim drilling project is expected to be minimal.

These targeted coal seams are classified as confined to semi-confined aquifers because they are bounded by confining layers that consist of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the coal seams and any aquifer stratigraphically above or below the coal seams is limited. The hydrostatic head of the water measured in test wells completed in coal seams in the Project Area can be considerably higher than the aquifer or even the elevation of the ground level at a specific well location. Confined, or artesian, aquifer conditions of this type indicate an effective seal above and below the aquifer. However, lowering the hydraulic head in the coal seam aquifers by removing water may induce a slight leakage through the semi-pervious shale layers into the pumped aquifer. Because of the extremely low hydraulic conductivity of the confining layers and the limited number of gas wells proposed (24), enhanced leakage from an aquifer stratigraphically above or below the affected coal seams would be minimal.

The water level also may be lowered or drawn down in an area of influence within a 1/2-mile radius of individual exploratory wells completed in the Mesaverde aquifer. The potential yield from nearby water wells may be affected by removal of groundwater. Other wells completed in the coal seams could be affected by the project; however, no other wells permitted by the WSEO are known to occur within 1 mile of the Project Area. Potential effects on water wells would be minimized by a water well agreement and the other mitigation measures described in Chapter 2.

The exploratory wells would produce water that would be disposed of in two deep injection wells. The proposed injection targets are the Cherokee and Deep Creek Sandstones that occur about 3,800 to 4,600 feet below the surface. The injection wells would be stratigraphically below existing water wells. It is anticipated that the produced water that would be injected would be of equal or higher quality in regards to class of use as defined by WDEQ Ground Water Division regulations. In addition, injection of produced water is not expected to result in any deterioration in groundwater quality within the injection horizon. The only effect on the injection horizons would consist of an increase in the hydraulic head emanating from the injection well, which would dissipate with distance away from the wellbore. In terms of water quantity and quality, the effect of the Proposed Action on the injection horizon would be minimal.

The proposed deep injection wells would be drilled, cased, and cemented from total depth (50 feet below the base of the Cherokee or Deep Creek Sandstone) to the surface. These sandstones are isolated above and below by competent shale that is a barrier to flow. The Cherokee or Deep Creek Sandstone would be tested to evaluate its suitability for disposal before any water is injected. Maximum pressure requirements to prevent initiation and propagation of fractures through overlying strata to any zones of fresh water would be determined and would be regulated by the State of Wyoming and the BLM. The results of the open-hole log and injectivity test would be provided to the regulatory agencies. The

injectivity tests will be used to determine the fracture pressure limits that will be imposed to insure the overlying shale is not breached. In addition, before produced water is injected, water from the Cherokee or Deep Creek Sandstones (or both) would be analyzed and the results provided to the regulatory agencies. Produced water would come from coals in the Mesaverde Group.

Because water produced would be injected, no surface waters of the state would be affected by the management of produced water. All water disposal plans would be permitted with the state agency that regulates the facilities, including but not limited to the WOGCC or WDEQ.

Before the injection wells are completed, water produced from the exploratory wells may be transported to nearby drilling locations and used for drilling and completion activities in the operation of additional wells. Formation water may be temporarily contained in the reserve pit during drilling and well completion activities. During the testing period, produced water from the Mesaverde aquifer will be contained in closed tanks on location or trucked to an authorized disposal well, pending the completion of flowlines for produced water. Fracing fluids also will be contained in closed tanks on location. All closed tanks on location will be encompassed by protective berms. Once all wells have been drilled, water produced at the exploratory well sites would be gathered and transported to the injection wells for disposal, which would be permitted by all necessary agencies.

Produced water would be collected in a buried polyethylene flowline (pipeline) for transport to a water disposal facility. The water disposal facilities would be approved by the WOGCC or the WDEQ and the private surface owner, as required. To keep surface disturbance to a minimum, ditches would combine as many pipelines as possible (water, electricity, and gas). BMPs would be used to control erosion and divert overland flows away from the facility. Centrifugal pumps, reciprocating pumps, filter systems, and tanks at the disposal facility would be used to remove solids from the water stream and to pump the water at pressures sufficient to allow downhole disposal. If it is not possible to safely inject the volume of produced water planned into the proposed injection wells, some or all of the exploratory wells would be shut in temporarily while alternative plans are developed and approved. These alternative plans would include additional injection wells.

The fracture gradient of the shale aquitards that overlie and underlie the injection horizons will not be exceeded based on injectivity tests and applicable permit limits. Thus, all injected water would be contained in the injection horizon and would not migrate vertically. For this reason, the injected water is not expected to degrade water quality of the Mesaverde or any other aquifer.

The groundwater would be removed from a formation that is stratigraphically lower than and hydraulically isolated from shallow groundwater sources that are developed by water wells. The proposed injection zone is also stratigraphically lower than the shallow groundwater sources. Shallow groundwater sources (stratigraphically above the Mesaverde coal zones) are not likely to be affected by the project.

Information about the groundwater system in the Project Area could be obtained in three ways: first, by monitoring the quality of produced water; second, by monitoring the vol-

ume of water produced over time during testing; and third, by measuring the static water levels in nearby wells before the project begins and during the life of the project. This information also would be used to quantify impacts during the interim drilling phase of the project for use in the preparation of the Atlantic Rim EIS and evaluating future field development.

As almost all produced water is to be injected under the project, with only small amounts of produced water provided to livestock or wildlife in self-contained tanks that would not discharge to surface drainages, the quality or quantity of surface water would not be affected directly by its disposal. The Companies would implement BMPs to ensure that produced water is not spilled and that it would not come in contact with surface waters in the Project Area.

Surface disturbance associated with drilling and installing pipelines and utilities would increase the potential for erosion and the sediment and salt load in the already overburdened Muddy Creek drainage. These disturbances include removing vegetation and stockpiling topsoil, constructing roads, or digging shallow excavations for drill pads or facilities. The Companies would implement the mitigation measures described in the MSUP and Chapter 2 to control wind and water erosion at disturbed sites so that surface drainages are not affected by interim drilling. The Companies have committed to practices in the MSUP and Chapter 2 that, combined with existing regulatory requirements, would include design of surface-disturbing activities in a manner that diverts and controls runoff and provides for re-establishment of vegetation on disturbed areas. These measures, collectively, would represent BMPs for erosion control. Application of these BMPs would result in minimal impacts on water and soil resources.

Potential effects on surface water resources would include increased surface water runoff and off-site sedimentation caused by soil disturbance, impairment to surface water quality, and changes in stream channel morphology caused by construction of roads and pipeline crossings. Effects on surface water resources would depend on:

- The proximity of the disturbance to a drainage channel,
- The aspect and gradient of the slope,
- The degree and area of soil disturbance,
- Characteristics of the soil, duration of construction, and
- Timely implementation and success or failure of mitigation measures.

Increases in sedimentation that would occur as a result of the project would be minimal, because construction and operation would comply with measures described in the MSUP and Chapter 2. Construction would occur over a relatively short period. Impacts from construction would likely be greatest in the short term and would decrease in time as a result of stabilization, reclamation, and revegetation. Construction disturbance would not be uniformly distributed across the Project Area, but instead would be concentrated near drill locations and access roads.

Water for use in drilling the wells would be obtained from existing wells completed in the coal seams of the Mesaverde Group. Approximately 700 barrels of water (almost 30,000 gallons) would be needed to drill each well. The actual volume of water used in

drilling operations would depend on the depth of the well and any losses that might occur during drilling. In all, the proposed project would require nearly 100,000 gallons (or 0.3 acre-feet) of water per well for drilling, preparation of cement, well stimulation, and dust control.

4.5.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on water resources would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.6 VEGETATION, WETLANDS, AND NOXIOUS WEEDS

4.6.1. Proposed Action

Implementation of the project would result in the loss of natural vegetation in terms of cover and species composition in areas where well sites, facilities, and access roads would be constructed. An estimated 145 acres would temporarily be affected by surface disturbance associated with drilling and testing activities. Topsoil would be stockpiled, and reclaimed areas would be revegetated with site-specific seed mixes approved by BLM or the landowner, as appropriate, to avoid permanent loss of species diversity and vegetative cover. Should the exploratory wells be productive, the surface areas required for production facilities would not be reclaimed until production ends, which could be up to 20 years. An estimated 46 acres could be affected by production facilities over the long term. Reclamation efforts would initially lead to greater species and structure diversity within these communities. Herbaceous species composition and production would be increased once established, until big sagebrush or other shrubs reoccupy disturbed areas.

The Wyoming big sagebrush community type that would be disturbed under the project is commonly found across southwest Wyoming. The short-term or long-term loss in acreage described above would not alter the overall abundance and quality of these habitats.

In general, the duration of effects on vegetation in the Project Area would depend on the time required for natural succession to return disturbed areas to pre-disturbance conditions of diversity (both species and structural). Reestablishment of pre-disturbance conditions would be influenced by factors that are both climatic (growing season, temperature, and precipitation patterns) and edaphic (physical, chemical, and biological conditions in soil). Edaphic factors would include the amount and quality of topsoil salvaged, stockpiled, and spread over disturbed areas. Use of BMPs described in the MSUP ([Appendix B](#)) and Chapter 2 during construction, operation, and reclamation would minimize effects on vegetation resources.

Surface disturbance could affect vegetation directly and indirectly by removal of existing vegetation and by introducing weeds. Weedy species often thrive on disturbed sites such as road ROWs and out-compete more desirable plant species. Increased invasion by weeds may render a site less productive as a source of forage for wildlife and livestock. However, if the BMPs summarized in the MSUP and Chapter 2 are applied, invasion of weed species is not expected.

One noxious weed species (knapweed) was identified in the Project Area on September 18, 2003. Other noxious weed species may exist within the Project Area that were not apparent during the site reconnaissance. Noxious weeds would be monitored during drilling, production, and reclamation. Any noxious weeds found would be treated in accordance with BLM requirements.

No threatened or endangered plant species are expected to occur in the Project Area because of a lack of suitable habitat. Therefore, development of the project is not expected to directly affect federally listed plant species. Proposed BMPs and mitigation measures described in Chapter 2 would prevent impacts to federally listed species, if any are found.

The distribution of plant species of concern is likely limited in the Project Area because of a lack of suitable habitat for most of the species. Given the low likelihood that the sensitive plant species occur in the Project Area and the small amount of disturbance associated with the project, no effects on the plant species of concern would be expected.

No impacts on wetlands are anticipated, given that no wetlands have been identified in the Project Area. However, if produced water can be used by livestock during dry periods to stay the normal length of time in the summer pasture, riparian habitat along Muddy Creek north of the Project Area would benefit by delayed livestock use and less impact during the hot summer months (July-August).

4.6.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on existing vegetation would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.7 RANGE RESOURCES AND OTHER LAND USES

4.7.1. Proposed Action

Anticipated effects on range resources associated with the project are limited to a minimal loss of forage, an increased potential for collisions between livestock and vehicles, and an increased potential for the spread of noxious weeds and invasive species (previously discussed above under the section on Vegetation, Wetlands, and Noxious Weeds).

The project would not be likely to result in noticeable effects on range resources. In two to three years, reclaimed areas would have higher forage production that would compensate for the short-term loss of forage due to development.

Livestock grazing would continue during drilling and interim development. Forage in the Project Area would be reduced slightly during drilling and field development and would be restored as soon as practical. Areas used for roads, production equipment, and ancillary facilities would remain disturbed throughout the productive life of the field. The increased traffic in the Project Area during the drilling and field development phases could correspondingly enhance the potential for collisions between livestock and vehicles. Temporary, self-contained troughs that can be established for livestock use would benefit livestock season-of-use and distribution, particularly in the years with below normal levels of precipitation.

The project would result in an estimated 145 acres of short-term disturbance during drilling and field development; an estimated 46 acres of long-term disturbance would remain after the initial reclamation measures described in the MSUP ([Appendix B](#)) and Chapter 2 are completed. The short-term disturbance from portions of drill pads that are not needed for production facilities would be reclaimed as soon as practical after drilling ends, as would all areas disturbed for gas and produced water pipelines. All remaining disturbed areas would be reclaimed at the end of field operations, except any that BLM may identify as desirable for another use.

The average stocking rate for the Doty Mountain Allotment is 12 acres per AUM. The project would result in a short-term loss of forage associated with almost five AUMs in the Doty Mountain Allotment. This loss would correspond to a small long-term reduction in available forage within the Doty Mountain Allotment. These losses would amount to substantially less than 1 percent of the total grazing capacity in this area. Also, disturbances would be interspersed throughout the Project Area, and shouldn't affect grazing in the Doty Mountain Allotment.

There is potential for conflict between development of the project and range operations. The increased activity associated with drilling and field development could raise the potential for collisions between vehicles and livestock. Conversely, the activities under the project also could benefit range operations. Reclamation may increase forage production and availability, since shrubs would be removed in disturbance areas, and shrub species would be slow to recover.

4.7.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on range resources would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.8 WILDLIFE AND FISHERIES

4.8.1. Proposed Action

The effects on wildlife would be associated with construction and operation and would include displacement of some individuals of some wildlife species, loss of wildlife habitats, and an increase in the potential for collisions between wildlife and motor vehicles. Other potential effects include an increase in the potential for illegal kill, harassment, and disturbance of wildlife because of increased human presence and improved vehicle access. The magnitude of impacts to wildlife resources would depend on a number of factors, including the type and duration of disturbance, the species of wildlife present, the time of year, and successful implementation of avoidance and mitigation measures described in the MSUP ([Appendix B](#)) and Chapter 2.

The project would cause a loss of natural habitats in areas where well sites, facilities, and access roads would be constructed. An estimated 145 acres would be affected in the short term by surface-disturbing activities during drilling and testing.

Should the exploratory wells be productive, the surface areas required for roads or production facilities would not be reclaimed until production ends, which could be within 10 to 20 years. An estimated 46 acres could be affected by production facilities over the long term.

The capacity of the Project Area to support various wildlife populations should remain essentially unchanged from current conditions. Construction, operation, and maintenance of the proposed gas wells and associated facilities are expected to have minimal short-term effects on wildlife in the Project Area. Some wildlife species may be temporarily displaced during construction of pipeline routes, well sites, and access roads, but should return once construction is complete. Extensive, suitable habitats for many species exist on lands adjacent to the Project Area and would support any individuals that may be temporarily displaced. Long-term effects on wildlife are expected to be minimal, as most species would become accustomed to routine operation and maintenance. Only a small proportion of the available wildlife habitat in the Project Area would be affected. Temporary self-contained water troughs that would be established for livestock use also would benefit wildlife, providing sources of water in areas where it was previously not available.

During the production phase, pipelines and the unused portion of well sites would be reclaimed. After production operations end (the life of the project is estimated at 10 to 20 years), the well field and ancillary facilities would be reclaimed and abandoned. Well pads would be removed; the areas would be revegetated with seed mixes approved by the BLM, and some are specifically designed to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to pre-disturbance conditions. Grasses and forbs are expected to become established within the first several years after reclamation; however, much more time would be required to re-

establish shrub communities. Consequently, disturbance of shrub communities would result in a longer-term loss of the specific habitat.

In addition to the direct loss of habitat caused by construction of well pads and associated roads and pipelines, disturbances from human activity and traffic would lower use of habitat immediately adjacent to these areas. Species that are sensitive to indirect human disturbance (both noise and visual) would be most affected. Habitat effectiveness of these areas would be lowest during the construction phase, when human activities are more extensive and localized. Disturbance would be reduced during the production phase of operations, however, and many animals may become accustomed to equipment and facilities in the gas field and return to habitat adjacent to disturbance areas.

4.8.1.1. Wildlife

Direct disturbance likely would reduce the availability and effectiveness of wildlife habitat in the Project Area for a variety of common small mammals, birds, and their predators. The initial phases of surface disturbance and increased noise that are likely would result in some direct mortality to small mammals and would displace songbirds from construction sites. In addition, a slight increase in mortality from increased vehicle use of roads in the Project Area would be expected. Quantification of these losses is not possible; however, the loss is likely to be low over the short term. During the operations phase of the project, increased noise from compressor engines and other production activities would displace some animals and would affect the production potential of some species. Based on the relatively high production potential of these species and the relatively small amount of habitat disturbed, no long-term effects on populations of small mammals and songbirds would be expected.

4.8.1.1.1. Big Game

In general, effects on big game would include direct loss of habitat and forage and increased disturbance and noise from drilling, construction, operation, and maintenance operations. Disturbance of big game during the parturition period and on winter range can increase stress and may influence species distribution (Hayden-Wing 1980; Morgantini and Hudson 1980). There may also be a potential for an increase in poaching and harassment of big game, particularly during winter. According to management directives in the RMP (BLM 1990), crucial big game winter ranges would be closed to construction and development from November 15 through April 30. This seasonal closure of crucial winter ranges would reduce disturbance to wintering big game. This seasonal closure would also limit the potential for poaching and harassment of big game species wintering in the area. Recreational use of the area and production activities would not, however, be affected by the seasonal closure. Effects on big game are expected to be minimal and no long-term loss of habitat is expected once construction is complete, as big game species are expected to return to the Project Area.

A portion of the Project Area has been designated as winter/yearlong range for pronghorn antelope. Pronghorn likely migrate through the northern portion of the Project Area toward crucial winter/yearlong range located northwest of the POD boundary (HWA 2003). Activities associated with the construction phase of the project would likely temporarily

displace antelope; however, once construction is complete, antelope would likely return to pre-disturbance patterns of activity. HWA (2003) found that pronghorn became acclimated to increased traffic and machinery as long as both moved in a predictable manner.

A portion of the Project Area has been designated as winter/yearlong range for mule deer, but no major migration routes for mule deer cross the Doty Mountain area. Likewise, no major elk migration routes cross the Project Area, although habitat in the area is designated as elk winter range. Activities associated with the construction phase of the project would likely temporarily displace mule deer and elk; however, once construction is complete, these animals would likely return to pre-disturbance patterns of activity.

Overall, no noticeable effects on the antelope, mule deer or elk that inhabit the Project Area are expected, provided mitigation measures contained in this document, the RMP, and the Interim Drilling Policy ([Appendix A](#)) are implemented.

4.8.1.1.2. Upland Game Birds

Although no active greater sage grouse leks were documented within the POD boundary, three active leks occur within 2 miles of the POD boundary. The overlapping 2-mile buffers around the two leks that are located southwest of the POD boundary include 539.5 acres of the Project Area, where construction of 6 wells is proposed. The proposed pipeline and access road intersect 4.9 miles of potential sage-grouse nesting habitat within the 2-mile buffers of the two leks. Pipeline disturbance (approximately 32.1 acres) would be reclaimed; however, disturbance from the access road (approximately 14.1 acres) would remain for the life of the project. The proposed access road would not intersect severe winter relief habitat near the section line between Sections 28 and 29 in T17N R91W. One active sage-grouse lek is located less than 2 miles from the southeastern limit of the Project Area. The 2-mile buffer around this lek includes 96 acres within the POD boundary, where construction of one well is proposed.

Greater sage grouse are of special concern because populations throughout the west have been declining and this species is petitioned for listing under the Endangered Species Act. Under the Proposed Action, 136.9 acres of the Wyoming big sagebrush vegetation cover type located within the Project Area would be disturbed during construction over the short term and 36.5 acres would be disturbed in the long term. This amount of habitat disturbance is minimal considering the amount available in the Project Area, however, greater sage grouse can be affected by other activities associated with development, including increased human activity, increased traffic disturbance, and noise from pumping or compressor engines. Increased noise that occurs in sensitive resource areas could affect the ability of greater sage grouse to mate. Careful siting of noise sources, addressed in applicant-committed and BLM-required mitigation measures in Chapter 2, would result in minimal effects on greater sage grouse. Greater sage grouse exhibit site fidelity to leks, winter areas, summer areas, and nesting areas (HWA 2003). Therefore, steps should be taken to ensure that impacts to these areas, especially leks and nesting areas, are minimized.

Minimal effects on the population of greater sage grouse are expected, provided that all applicant-committed and BLM-required mitigation measures described in the MSUP ([Appendix B](#)) and Chapter 2 are implemented. Mitigation measures described in Chapter 2 and the Application for Permit to Drill (APD) conditions of approval would be followed to protect wildlife values in the Project Area. Production facilities at well sites often act as raptor perches, increasing predation on greater sage grouse and other wildlife. Use of low-profile structures should mitigate these potential effects of any wells that produce commercial quantities of natural gas.

The RMP contains mitigating measures that would protect nesting greater sage grouse from February 1 to July 31, including strutting grounds and nesting habitat. Exceptions may be granted, however, if the activity would occur in unsuitable nesting habitat. Controlled surface use (CSU) stipulations are applied within ¼-mile around active leks. The portion of the Project Area included within the 2-mile buffer of an active greater sage grouse lek is a sensitive resource area for the protection of nesting habitat. As a result, mitigation measures must be followed to protect this area, especially during periods when greater sage grouse mating could be affected by noise associated with the project. Direct disturbance to high quality greater sage grouse habitat could also be minimized by constructing well pads within the 400-acre area that was burned, instead of construction within denser sagebrush areas. If all avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are implemented, however, minimal impacts to habitats or populations of greater sage grouse would be expected.

4.8.1.1.3. Raptors

The principal potential effects of the project on avian species could be nest abandonment and reproductive failure caused by project-related disturbance and increased noise. Other potential effects involve increased public access and subsequent human disturbance that could result from new construction or production and from small, temporary reductions in prey populations for raptors. However, no active raptor nests were found within or near the Project Area during the 2001 and 2003 surveys (Jackson 2003). Seventeen inactive raptor nests were located within 1 mile of the pipeline and access road corridor. Construction activities may dissuade raptors from nesting at these sites in the future. Above-ground electrical transmission lines are not included in the project; therefore, there would be no potential effects.

No effects on breeding raptors are expected, provided avoidance and mitigation measures are followed. Mitigating measures contained in the RMP for oil and gas projects state that no activity or surface disturbance would be allowed near raptor nesting habitat from February 1 through July 31. The size of the restrictive radius and the timing on the restriction may be modified depending on the species of raptor and whether the nest is within the line of sight of construction. No effects on breeding raptors are expected, if avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are followed.

4.8.1.2. Threatened and Endangered Species - Wildlife and Fish

4.8.1.2.1. Wildlife Species

The following wildlife species are threatened, endangered, or proposed for listing under the ESA: black-footed ferret; bald eagle; and Canada lynx. These species may occur in or near the Project Area according to the FWS; therefore, potential impacts to these species that could occur under the Proposed Action are considered.

Black-footed Ferret. In Wyoming, white-tailed prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs to obtain food, and they rely on prairie dog burrows for shelter, parturition, and raising young (HWA 2002). One small prairie dog colony, encompassing approximately 4 acres in Section 23 of T17N, R91W, was located in the Project Area. Prairie dog towns must be larger than 200 acres and the burrow density must be greater than or equal to eight burrows per acre to be considered suitable habitat for black-footed ferrets (HWA 2002). No ferrets or their signs were found during surveys conducted in the Project Area during April and May 2001 (HWA 2003). As long as no construction occurs within the 4-acre prairie dog colony, implementation of the project is not expected to affect black-footed ferrets.

Bald Eagle: Although incidental sightings have occurred near the Project Area, no bald eagle nests were found within a 2-mile buffer of the Project Area during surveys in 2001 (HWA 2003). If bald eagles inhabited a portion of the Project Area, the proposed activities would not be expected to affect bald eagles, provided the avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy are implemented. Bald eagles feed on road-killed carrion in the Project Area, and workers should be educated about the danger of striking a bald eagle with a vehicle.

Canada Lynx. The Canada lynx is not expected to occur within the Project Area because of the lack of potentially suitable habitats. Thus, implementation of the project is not expected to affect Canada lynx.

4.8.1.2.2. Fish Species

The lack of large river habitat within the Project Area precludes the occurrence of adults of the four species of endangered fish: the Colorado pikeminnow, bonytail and humpback chubs, and razorback sucker. Furthermore, the project is not expected to reduce base flows in the area's major rivers, either through withdrawals of groundwater or surface water. Finally, critical habitat has not been established anywhere in Wyoming for any of these species (Upper Colorado River Endangered Fish Recovery Program 1999).

Depletions to the Colorado River that could result from reduced groundwater discharge (base flows) are not expected based on the project's distance from the Colorado River. In addition, depletions are not expected because of the subsurface orientation, or bedding attitude, of the aquifers contained in production formations that would be affected by the project. The depth and orientation of the Mesaverde aquifer would preclude groundwater contained in the coal zone that would be produced from discharging as base flow to the

Colorado River or its tributaries (Whitehead 1996). Therefore, removal of groundwater from the Mesaverde aquifer during the project would not be expected to affect base flows or water quality of the Colorado River or its tributaries.

Injection of produced water during the project would not be expected to affect base flows or water quality of the Colorado River or its tributaries, based on the project's distance from the Colorado River, a lack of major faults, and the subsurface orientation of the aquifers contained in injection formations. The depth and orientation of the formations in the injection zone would preclude groundwater that would be injected from discharging as base flow to the Colorado River or its tributaries (Whitehead 1996). Confining layers are expected to preclude interaction between the injection and production formations.

No surface water withdrawals from Colorado River system drainages are included in the project, and no surface discharge of produced water is planned. The project would not be expected to affect the quantity or quality of surface water in the Colorado River or its tributaries. Water would have to flow from Muddy Creek to the Little Snake River to the Yampa River and then to the Green River, finally reaching the Colorado River in southeastern Utah, for surface water in drainages in the Project Area to reach the Colorado River.

Colorado Pikeminnow

Although Muddy Creek and the Little Snake River may support this species of fish at certain times, this species is absent downstream of the Project Area. The project therefore would have no impact on this species.

Bonytail and Humpback Chub

These species are absent downstream of the Project Area; therefore, the project would have no impact on these species.

Razorback Sucker

Suitable habitat is not available in the Little Snake River drainage; therefore, the project would have no impact on this species.

The occurrence of these endangered fish species has not been confirmed in the Muddy Creek drainage or downstream in the Little Snake River, and is highly unlikely. If any of these species is identified within the downstream portion of Muddy Creek or immediately downstream in the Little Snake River, the BLM would consult with the FWS and develop a protection plan for the fish. Given these precautionary measures, no adverse impacts to any of these species would be expected to result from the project.

Within Muddy Creek, sediment levels may be elevated during construction of crossings for well access roads and road grades along and across the creek. Implementing reasonable precautions to limit off-site movement of sediment from these areas would prevent substantial increases in sediment loadings in the downstream section of Muddy Creek and downstream from its confluence with the Little Snake River. In addition, these precau-

tions would avoid violations of Wyoming Surface Water Quality Standards (WDEQ 2001). Because the limited water development and usage for this project are predicted to affect only subterranean aquifers related to the coal seams, surface flows would not be affected by wells developed for this project.

4.8.1.3. Species of Concern - Wildlife and Fish

4.8.1.3.1. Wildlife

Effects on BLM wildlife species of concern could occur as a result of loss of habitat or displacement caused by increased noise. Based on the relatively small size of the Project Area, the inherent mobility of the species of concern and the abundance of potentially suitable habitats nearby, no noticeable effects are expected under the project. Burrowing owls will not be affected as long as no construction occurs within the 4-acre prairie dog colony. However, the lack of effects assumes that the avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy are followed.

Mountain Plover. No portions of the Project Area were determined to provide potential habitat for mountain plovers (HWA 2003). Although no mountain plovers were found during surveys in 2001, the presence of prairie dog towns indicates that plovers may use these areas at some time. The potential exists for effects on mountain plovers if nesting habitat were removed or an active nest were disturbed. If mountain plovers were observed in the Project Area in the future, the avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy would be followed to prevent effects on mountain plovers. Implementation of the project is not expected to affect mountain plovers, provided any required avoidance and mitigation measures identified are implemented.

4.8.1.3.2. Fish

The project is not likely to adversely effect BLM sensitive fish species ([Appendix E](#)) that occur within or downstream of the Project Area if measures to prevent downstream sedimentation are implemented. These measures would prevent off-site movement of fluid spills (if any occur) or disturbed soils caused by construction under the project (WDEQ 2001). Implementation of reasonable precautions to limit off-site movement of sediment should prevent violations of Wyoming Surface Water Quality Standards (WDEQ 2001). Furthermore, water would be drawn from productive wells to avoid depleting surface flows in Muddy Creek and Little Snake River and subsequent adverse impacts to these species caused by removal of surface water or near-surface water for drilling use. Stream crossings of Muddy Creek and Dry Cow Creek would be constructed to allow passage for upstream spawning migrations of these sensitive native fish, including the roundtail chub, bluehead sucker, flannelmouth sucker, or Colorado River cutthroat trout. Given these precautionary measures, implementation of the project is not likely to adversely affect these sensitive fish species.

4.8.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on wildlife or fisheries or threatened, endangered, or sensitive species would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.9 RECREATION

4.9.1. Proposed Action

In light of the abundance of nearby, similar recreational opportunities for hunting, camping, and ORV use, no noticeable effects on the recreational experience are expected under the project. Impact to the recreational use of the Project Area would involve a temporary displacement of some hunters, particularly during construction and drilling. Some hunters perceive these activities as displacing game species and creating an environment that detracts from the hunting experience. Displacement would be highest during the general deer and elk season, when the most hunters are in the area. The proposed drilling schedule would limit displacement to one season. Furthermore, hunters could relocate to other areas near the project.

Undisturbed landscapes and solitude are important to some recreationists. Project-related disturbances that impair the characteristic landscape could also contribute to a decline in the recreational experience for these visitors. The recreational experience could be less satisfying than under the pre-disturbance conditions described in Chapter 3.

The effects would diminish substantially after drilling and construction are completed. Some long-term displacement of hunters and other recreationists likely would occur under the project. Human access and activities would increase under the project with the improved and new access roads. Overall, effects on the recreation resource would be minimal because of the short-term nature of drilling and construction and the concentrated locations of these activities.

4.9.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on recreation resources or use would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.10 VISUAL RESOURCES

4.10.1. Proposed Action

As noted in Chapter 3, Affected Environment, the Project Area is not pristine. ORV tracks are evident throughout the area and are used by ranchers, recreationists, and traffic related to mineral development. The Proposed Action would be consistent with the existing VRM Class III objectives in the Project Area.

Short-term impacts to visual resources associated with construction and drilling in the Project Area would include contrasts in line, form, color, and texture. These contrasts would be associated with drilling rigs, construction equipment, service trailers, and the general industrial character of drilling. Additional impacts may occur from fugitive dust produced by construction.

The Project Area would not be visible from WY 789 or the community of Baggs. Potential viewers of the contrasts described would be few and would include hunters and other recreationists, ranchers, and oil and gas field workers. In addition, project facilities would not be constructed on ridgelines.

The severity of impact with the BLM VRM rating system is related to the scenic quality, sensitivity level, and distance zone of the affected environment. In general, short-term impacts would be most severe where the level of contrast is high and is highly visible to the most viewers.

The short-term impacts would be considered acceptable impacts in a Class III area. The contrasts during construction would be seen by relatively few viewers and would be visible only for a short time.

Permanent production facilities, as described in Chapter 2, would remain after well drilling is completed. The presence of permanent production facilities would create continued impacts over the long term.

These facilities would create contrasts in line, form, color, texture, and overall pattern in the landscape that would remain for the duration of the project. Impacts from fugitive dust as part of ongoing operations would also persist, but could be reduced by dust abatement. However, as noted for short-term impacts, these contrasts would not be visible to many viewers. The level of contrast would not exceed Class III standards if the mitigating measures described in Chapter 2 are applied. Levels of contrast would, however, detract from the recreation experience of visitors to the Project Area.

Additional facilities, such as access roads, would be required to service production facilities. Roads would create additional contrasts in line, color, and texture. The level of contrast would not exceed Class III standards with appropriate mitigation measures. However, contrasts could diminish the experience of motorists and recreationists.

4.10.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on visual quality or visual resources would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.11 CULTURAL RESOURCES

4.11.1. Proposed Action

Direct and indirect adverse effects to historic properties can be through avoidance or mitigating measures (data recovery or recordation) and can be prevented on a case-by-case basis. There are six sites recorded within the Project Area. Two of these sites could not be relocated in the 2001 and 2003 cultural resource inventories. Three identified sites (48CR7956, 48CR7960, 48CR7961) are remains of prehistoric open camps and are recommended eligible for inclusion in the NRHP. One site (48CR7617) is a historic cairn and is recommended not eligible for inclusion in the NRHP. None of the known sites in the Project Area would be disturbed by the project.

Direct impacts would result primarily from construction-related activities. Activities that could affect cultural resources would include grading well pads and associated facilities and construction of roads and pipelines. Sites located outside the Project Area would not be directly affected by construction. Alteration of the environment that abuts eligible historic properties may be considered an adverse direct impact.

Indirect impacts would not immediately result in physical alteration of the property. Instead, indirect impacts to prehistoric sites would result primarily from unauthorized surface collection of artifacts, which could physically alter the sites. At historic properties, these impacts could include bottle or tool collecting or erosion from surface disturbance.

Block surveys have been completed in the Project Area, as required by the Interim Drilling Policy. Additional cultural inventory is required to encompass all of the area of potential effect for this project, however. Unless a supplemental report addressing uninventoried federal lands within the area of potential effect, including the proposed route for road access and the market pipeline, is submitted prior to the approval of the project, COAs would require completion of additional cultural inventory before surface disturbing activities could begin. Identification and avoidance or mitigation of eligible sites before disturbance would minimize impacts to these cultural resources. Previously unidentified buried sites could be impacted during construction activities. Implementation of measures described in Chapter 2 would reduce impacts and minimize the loss of cultural resource information.

Mitigation measures could include avoidance or monitoring of the historic properties. The proposed impact at the sites would be moved to prevent disturbance during construction or a qualified archaeologist would monitor construction of the proposed impact location. All recommendations are subject to approval and alteration by the BLM RFO archaeologist. In the event that buried cultural materials are discovered during construction, those activities would be halted until a qualified archaeologist visited the site and evaluated the find. If the Proposed Action is modified, an additional cultural resources inventory for the new area of proposed disturbance may be required.

4.11.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on cultural resources would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.12 SOCIOECONOMICS

4.12.1. Proposed Action

Socioeconomic impacts of the project would be largely positive. The project would enhance regional economic conditions and generate revenues from local, state, and federal government taxes and royalties. The relatively small, short-term drilling and field development workforce would not create noticeable effects on population or demand for temporary housing or local government services.

The project would involve capital investment in gas wells, injection wells for produced water, gathering systems, compression stations, and other field infrastructure. The project would require between 16 and 36 drilling and field development workers over a 30- to 45-day period and one operations worker for as much as a 20-year period (Table 2-2).

Development and operation of the project would require goods and services from a variety of local and regional contractors and vendors, from the oil and gas service industry and from other industries. Expenditures by the Companies for these goods and services, coupled with employee and contractor spending, would generate economic effects in Carbon County, southwest Wyoming, and the nation as a whole. The project may create up to three new indirect jobs (defined as jobs that become available in support industries as a result of project activities).

It is reasonable to assume that the direct and indirect economic benefits of the project would be positive.

4.12.1.1. Oil and Gas Activity in Carbon County

Successful completion of the project would increase production of natural gas in Carbon County, particularly during the first several years of the project. To date in 2003, 225 APDs have been issued for Carbon County. The 24 wells associated with the project would be about 11 percent of the current 2003 APD level for the county. However, the relatively short drilling time and low requirements for infrastructure and labor associated with the proposed wells would not result in a substantial increase in drilling activity or employment in the county.

Economic effects on grazing would include small losses of forage caused by temporary and long-term disturbance until revegetation of disturbed areas is successful. Temporary disturbance could result in a small reduction in grazing. If grazing does not increase accordingly in nearby areas, the associated economic activity in Carbon County could be lost. A recent University of Wyoming study estimated that each AUM of cattle grazing was worth \$65.07 in total economic impact in the region (UW 2000). Using this estimate, the proposed development could result in a loss of about \$300 annually in the Doty Mountain Allotment for the life of the project.

Some hunters and other recreationists may be temporarily displaced from the area associated with the project during drilling and field development. The effects of the project on the hunting and recreation economy in Carbon County are not expected to be noticeable given the short-term nature of drilling and field development. In addition, effects are likely to be limited based on the potential that hunters and recreationists may use other areas within Carbon County during this period.

4.12.1.2. Population Effects

Population effects of the project would not be noticeable. Some of the skills and services required for the project are available in the local labor pool, although the recent increase in oil and gas drilling in southwest Wyoming has absorbed much of the available workforce. Of the short-term demand for 16 to 36 drilling and field development workers, some would likely be contractors from other areas of Wyoming (such as Rock Springs, Gillette, and Casper) and from northern Colorado. The remainder would be hired from the local workforce. Given the short duration of the drilling phase (less than 2 months), most non-local workers who would relocate to Carbon County would be single.

Non-local workers would attempt to obtain temporary housing as close to the work site as possible, most likely in Baggs. Workers who are not able to secure temporary housing in Baggs might locate in Rawlins or Rock Springs, Wyoming, or to Craig, Colorado. Given the current level of drilling and field development in Wamsutter, it is unlikely that drilling and field development workers for the project would find temporary housing in that community.

Based on the relatively small workforce and short-term nature of the drilling and field development phase of the project, area businesses could accommodate the increase in economic activity with existing employees.

4.12.1.3. Temporary Demand for Housing

Existing resources could accommodate the relatively small demand for temporary housing during drilling and field development under the project. Demand may be accommodated in Baggs, Rawlins, Rock Springs, and Craig, depending on seasonal considerations and other activity in the oil and gas industry.

4.12.1.4. Law Enforcement and Emergency Response

The relatively small level of field development and operations would be accommodated by existing law enforcement and emergency management resources.

4.12.1.5. Fiscal Effects

If gas wells drilled for the project produce, the fiscal effects from the facilities developed and amount of natural gas that could be produced may be considerable. These effects would contribute to the financial well being of Carbon County, including its schools and roads, in addition to positive fiscal effects to the State of Wyoming and the U.S. Treasury.

Production of natural gas would generate revenues for the U.S., the State of Wyoming, and Carbon County; the distribution of these revenues would vary, but is generally shared. Sources of revenue consist of the following: federal and state oil and gas royalties; taxes that include severance, property, sales and use, ad valorem, and federal and state income taxes from the workers engaged in or supporting development of CBNG resources. These increased revenues would be realized for the life of the project.

The potential economic effect of CBNG development in the Project Area can be estimated based on assumptions regarding methane production rates, sales expectations, and the productive life of a well. Because no reliable data for the Atlantic Rim area would be available until exploratory drilling is complete, the assumptions presented here for this analysis may not be accurate.

If the productive life of each successful gas well in the project is 15 years and produces on average nearly 100 MCF per year of methane, which is sold (on average) for \$2.50 per MCF, the sales value of each well would be about \$3.5 million over the life of the project. If 16 federal gas wells within the project were productive, the federal royalties would be \$7 million. The severance tax collected by the State of Wyoming would exceed \$3 million. The ad valorem taxes collected by Carbon County also would exceed \$3 million. These values are approximate, are based on assumptions, and are intended to indicate the order of magnitude of possible fiscal effects.

4.12.1.6. Environmental Justice

The project would not directly affect the social, cultural, or economic well being and health of Native American, minority, or low-income populations. The Project Area is relatively distant from population centers, so no populations would be affected by physical or socioeconomic impacts from the project.

4.12.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No federal mineral royalties would be gathered and no additional socioeconomic effects would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.13 TRANSPORTATION

4.13.1. Proposed Action

4.13.1.1. Federal and State Highways

The project would increase the volume of traffic on highways that provide access to the Project Area and on county and operator-maintained roads within the Project Area. These increases would result from movement of project-related workers, equipment, and materials to and from the Project Area for drilling, field development, well service, field operations, and reclamation.

According to information provided by the proponent, drill rigs, water trucks, and other heavy equipment would be transported to and would remain within the Project Area until drilling is completed. Materials and supplies would be delivered weekly and stockpiled within the Project Area at a staging location. Drilling and completion crews and other personnel would commute to the Project Area daily, except for drilling engineers, who would reside in a mobile home at the drill site during the work week. Table 2-2 identifies the estimated average number of trips associated with various well field activities.

Based on these assumptions and estimates, the incremental increase in area traffic associated with the project would not result in a significant deterioration of level of service for I-80, WY 70, or WY 789 (Rounds 2000). Based on the relatively small increase and short duration of traffic caused by the project during the drilling and field development phase, it is unlikely that the project would result in a measurable increase in accident rates on federal and state highways. During the operations phase, the probability of an increase in accident rates that could be attributed to the project would be negligible.

4.13.1.2. County Roads

The project would increase traffic on the county roads that provide access to the Project Area (Carbon County 608). The relatively small, short-term increases in traffic are unlikely to result in significant deterioration of the roads or substantial increases in accidents. The primary effects of traffic related to the Proposed Action on county and BLM roads would be accelerated requirements for maintenance. The revenues related to the

Proposed Action generated to county government, which are described in the section on Socioeconomics, may offset the cost associated with accelerated maintenance on county roads.

Increased traffic may raise the potential for accidents that involve vehicles and stock animals, although the slower speeds required by the condition of county roads tend to minimize their frequency (Warren 2000). Coordination with livestock operators during sensitive periods (such as cattle movements and calving season) could further reduce the potential for accidents that involve vehicles and stock animals.

4.13.1.3. Internal Roads

The section in Chapter 2 on Access Road Construction describes the measure proposed by the Companies to develop the transportation network necessary to access wells and ancillary facilities within the Project Area. Based on these proposals, an estimated 7.9 miles of new roads would be constructed within the Project Area. The Companies would be responsible for constructing and maintaining new and improved roads within the Project Area; therefore, no fiscal impacts are anticipated for the BLM or Carbon County.

4.13.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on transportation would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.14 HEALTH AND SAFETY

4.14.1. Proposed Action

Health and safety impacts would include a relatively low risk to project workers from industrial accidents, firearms, and natural disasters. There would be a slight increase in risk of traffic accidents and range fires for the public during drilling and field development and a negligible increase during field operations.

4.14.1.1. Occupational Hazards

The statistical probability of injuries is low during the drilling and field development phase of the project, when a peak of 36 workers may be employed. The annual statistical probability of injuries is minimal during field development because only one worker would be employed.

The BLM, OSHA, USDOT, WOGCC, and WDEQ each regulate certain safety aspects of oil and gas development. Adherence to relevant safety regulations by the Companies and enforcement by the agencies would reduce the probability of accidents. Additionally, in light of the remote nature of the Project Area and the relatively low use of these lands by others (primarily grazing permittees and hunters), occupational hazards associated with the project would mainly be limited to employees and contractors rather than the public.

4.14.1.2. Pipeline Hazards

The risk of pipeline failure would increase with increasing length of the gathering system or market access pipeline. The relatively small amount of new pipeline associated with the project, coupled with the low probability of failure and the remote nature of the Project Area, would result in minimal risk to public health and safety. Pipeline markers posted on the rights of way for the pipelines reduce the likelihood that pipeline ruptures would be caused by excavation equipment, especially near road crossings or areas likely to be disturbed by road maintenance.

4.14.1.3. Other Risks and Hazards

Risks to public health and safety are not expected to increase under the project. Impacts to highway safety are discussed in the section on Transportation of this document. Impacts associated with sanitation or the materials used in CBNG development would be prevented or reduced by the mitigation measures described in Chapter 2.

The potential for firearms-related accidents would occur primarily during hunting season. If drilling and field development would occur during hunting season, the substantial activity in the Project Area would encourage hunters to seek more isolated areas, reducing the potential for accidents. The relatively few personnel onsite during production operations would create minimal risk of firearms-related accidents.

The risk of fire in the Project Area could increase under the project but would remain low. Fire is a potential impact associated with construction, industrial development, and the presence of fuels, storage tanks, natural gas pipelines, and gas production equipment. This small risk would be reduced further because facilities would be situated on pads and in locations that are graded and devoid of vegetation. In the event of a fire, property damage most likely would be limited to construction- or production-related equipment and rangeland resources. Fire suppression equipment, a no smoking policy, shutdown devices, and other safety measures typically incorporated into gas drilling and production also would minimize the risk of fire. Risk of wildfire would be heightened where construction places welding and other equipment near native vegetation. However, the risk to the public would be minimal because of limited public use and presence in the Project Area. There would be a small increase in risk to area fire suppression personnel associated with the project.

4.14.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional effects on public health or

safety would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.15 NOISE

4.15.1. Proposed Action

Noise associated with construction and natural gas production operations can create a disturbance that affects human safety (at extreme levels) or comfort and can modify animal behavior. Identifying the activities that may exceed the maximum standards is not a simple issue. Perception of sound varies with intensity and pitch of the source, air density, humidity, wind direction, screening or focusing by topography or vegetation, and distance from the observer. Noise levels that exceed the 55-dBA maximum standards can occur at construction and production operations. Noise levels around a compressor engine contained in an enclosed building would be below 55 dBA at an estimated 600 feet from the compressor site (BLM 1999b). Construction-related impacts would be short term, lasting as long as construction was under way at well sites, access roads, pipelines, and other ancillary facilities such as compressor sites. Noise would be created over a longer term at the individual well sites as a result of production facilities.

The density of the human population is low in the Project Area; therefore, construction and development operations under the project would be sufficiently distant from residences that none would likely be affected by construction or development operations. Overall, noise produced by construction and support equipment during periods of peak activity would be moderate because of the dispersed and short-term nature of these activities.

4.15.2. No Action

Under the No Action alternative, the coordinated plan of development described under the Proposed Action would not be approved. No additional noise effects would be expected to occur if the proposed wells are not drilled. Demand for natural gas locally and nationally, however, likely would result in new proposals for exploration and development of the Project Area. Future mineral development in the Project Area would occur under the guidelines of the RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

4.16 CUMULATIVE IMPACTS

4.16.1. Proposed Action

Cumulative impacts would result from the incremental impacts of the project when added to non-project impacts that result from past, present, and RFFAs. Reasonably foreseeable development is any development likely to occur within the Project Area or cumulative

impact assessment (CIA) area, within the next 5 years. CIA areas vary between resources and are generally based on relevant landscapes, resources, projects, or jurisdictional boundaries.

The only major resource development currently proposed near the Project Area is the exploration planned under the Interim Drilling Policy for the Atlantic Rim area ([Appendix A](#)). Thus, the effects of the Doty Mountain Project (described in this chapter) would not overlap cumulatively with the effects of current or reasonably foreseeable projects or activities other than the interim drilling program, grazing activities, and existing or planned prescribed burns within the Atlantic Rim EIS study area.

The Interim Drilling Policy allows a maximum of 200 gas wells within the Atlantic Rim area for research and exploration during the interim period while the Atlantic Rim EIS is prepared. Wells would be allowed only in the nine pods identified by the Companies. In addition, a maximum of only 24 gas wells would be allowed within any pod, even if multiple zones are to be evaluated. Total distance between pods at the north and south ends of the Atlantic Rim EIS study area is about 40 miles. The distances between the individual pods vary, from 1.5 miles to more than 6 miles. The Doty Mountain Project is part of the 200-well interim drilling program.

Existing CBNG development under the 200-well interim drilling program in the Atlantic Rim EIS study area includes wells and related facilities that have been developed in the Sun Dog, Cow Creek, Blue Sky, and Red Rim areas. There have been 39 gas wells drilled in these areas, along with related facilities that include injection wells, roads, corridors for gathering lines and utilities, compressor stations, pumping stations, and water handling facilities. The cumulative long-term disturbance associated with existing CBNG wells and related facilities in the Atlantic Rim EIS study area is projected to be 69 acres.

Reasonably foreseeable development in the Atlantic Rim EIS study area includes development of the Doty Mountain area and the remaining well pods within the 200-well interim drilling program. Considering the wells that already exist (39), the proposed wells in the Doty Mountain area (24), the reasonably foreseeable wells in the Red Rim area (14), and the 200-well limit imposed by BLM under the Interim Drilling Policy, the remaining RFFAs associated with the interim drilling program would include 123 CBNG wells that would be located in the remaining well pods within the Atlantic Rim EIS study area.

Surface-disturbing activities for the 200-well interim drilling program may affect an estimated 650 acres (short-and long-term disturbance), including an estimated 60 miles of new access roads. (New roads associated with the interim drilling program would likely be in the form of spurs from the existing network of roads.). In addition, an estimated 100 miles of water and gas flowlines could be required.

The long-term disturbance from CBNG wells and facilities associated with the 200-well interim drilling program during the life of the project, after short-term disturbance is reclaimed, would include existing wells and facilities (69 acres), proposed wells and facilities in the Doty Mountain area (29 acres), RFFAs in the Red Rim area (28 acres), and RFFAs in the remaining well pods (220 acres). The cumulative long-term disturbance

associated with the 200-well interim drilling program would likely affect an estimated 346 acres. These 346 acres would be reclaimed, after the wells have been found to not produce or when they cease to produce some time in the future.

Other past or existing actions on or near the Project Area that continue today and have major influences include the road network, oil and gas wells that are not part of the proposed project, ranching and livestock facilities (including fences, stock watering facilities, ranch houses, power lines, and pipelines), and prescribed burns.

To date, 59 non-project wells have been plugged and abandoned or are in various stages of reclamation; 37 non-project wells are in various stages of completion. An estimated 337 acres of cumulative, long-term disturbance from non-project wells and facilities is associated with development of oil and gas resources in the Atlantic Rim EIS study area.

The total cumulative long-term disturbance anticipated in the Atlantic Rim EIS study area from oil and gas development, including the 200-well interim drilling program, is almost 700 acres. This disturbance would be associated with 200 CBNG wells, 96 other oil and gas wells, and related facilities.

4.16.1.1. Geology, Minerals, and Paleontology

Existing, proposed, and reasonably foreseeable future actions would not affect landslide deposits and would be unlikely to trigger events such as landslides, mudslides, debris flows, or slumps. Therefore, no incremental increase in cumulative impacts associated with geologic hazards would occur. The cumulative impacts to the surface geologic environment would be minimized if the Interim Drilling Policy is followed and proper techniques for well pad and facility siting, construction, and reclamation are used. Proposed actions and RFFAs would require reclamation of disturbed lands and would minimize alterations to topography. Standard stipulations and site-specific construction and reclamation procedures would be required for development on federal lands. These measures would further minimize cumulative impacts on the surface geologic environment.

With the exception of CBNG, no major surface mineral resources would be affected by the RFFAs. Subsurface mineral resources are protected by the BLM and WDEQ policies on casing and well bore cementing.

Drilling exploratory wells would contribute to the cumulative knowledge of the occurrence or absence of recoverable CBNG resources within the Atlantic Rim EIS study area, which encompasses 310,335 acres within portions of T13 through T20N and R89 through R92W. If wells drilled under the interim drilling program are productive, these 200 wells would contribute to the cumulative production from the Atlantic Rim Project Area and Wyoming, while at the same time adding to the overall depletion of CBNG resources within the same area.

No cumulative adverse impacts on paleontological resources would occur as a result of the project beyond any discussed earlier in this chapter in combination with other existing, proposed, and reasonably foreseeable actions. Adoption of mitigation measures prescribed in that section could foster cumulative beneficial effects by promoting discovery

of new fossil resources or providing paleontologists with evidence that these resources are absent in the area.

4.16.1.2. Air Quality

Cumulative impacts from emissions that would result from past oil and gas projects and the proposed 200-well program would be much the same as were found on other oil and gas projects such as the Continental Divide. Emissions from oil and gas facilities approved before 1999 were included in the 3,000-well air quality analysis prepared for the Continental Divide EIS, although only 2,130 wells were approved. The emissions from the 200-well interim drilling program have been incorporated into the air quality model completed for the Continental Divide project.

The Cumulative Impact Analysis completed for the Desolation Flats Natural Gas Field Development Draft EIS (DEIS) also included the 200 exploratory gas wells under the interim drilling program for the Atlantic Rim area (BLM 2003b). Environmental effects of these 200 wells, which would include the proposed project in the Doty Mountain area, were considered for the cumulative emissions inventory.

The CALPUFF model was applied to estimate far-field air quality and AQRV impacts resulting from cumulative emissions from the Desolation Flats Project, state-permitted emission sources, producing natural gas wells, approved NEPA actions, and the 200 exploratory wells, including the proposed Doty Mountain project. Potential impacts on air quality were estimated at the following PSD Class and I and II sensitive receptor areas discussed above: Dinosaur National Monument (Class II), Savage Run Wilderness (Class I), Mount Zirkel Wilderness (Class I), and Rawah Wilderness (Class I).

Ambient concentrations of NO₂, SO₂, PM₁₀, and PM_{2.5} (particulate matter less than 2.5 microns in effective diameter) were estimated with the CALPUFF model to evaluate potential cumulative impacts. In addition, ambient concentrations were compared with applicable ambient air quality standards and PSD increments. The maximum cumulative impacts from all sources occurred at different sensitive areas, depending on the pollutant considered and the averaging time applied. The CALPUFF model showed that the maximum cumulative impacts from all sources analyzed in the Desolation Flats DEIS did not exceed the ambient air quality standards or the PDS Class I increments (BLM 2003b).

Also analyzed in the Desolation Flats DEIS were the cumulative impacts to visibility and acid deposition at the distant sensitive receptor areas (BLM 2003b). The effects of cumulative emissions on visibility were evaluated using the agency-recommended methods. Two thresholds of change in visibility are used in reporting: the number of days when the change in deciview (delta-deciview) is 0.5 or greater, and the number of days when the value is 1.0 or greater. Impacts on visibility of up to 25 days that exceed the 0.5-deciview threshold are predicted as a result of the cumulative emissions that were analyzed in the Desolation Flats DEIS.

Potential impacts of cumulative emission sources on acid deposition also were analyzed in the Desolation Flats DEIS. Using the method described by Fox (1989), the potential change in acid neutralizing capacity (ANC) was estimated at 12 sensitive lakes in the Bridger Wilderness, Fitzpatrick Wilderness, Popo Agie Wilderness, Mount Zirkel Wilderness, Medicine Bow Wilderness, and Rawah Wilderness. The potential impacts to ANC in the sensitive lakes analyzed were found to be less than the limits of acceptable change (BLM 2003b).

RFFAs, including the relatively small number of exploratory wells and facilities in the interim drilling program, would generate only a small amount of air pollutants. Some temporary effects on air quality would likely occur in the immediate vicinity of interim drilling, created by particulate matter and exhausts from vehicles and equipment. These effects would be local and would be dispersed by the prevailing winds from the west. The effects on air quality would be minimized through dust abatement practices. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, and vehicle emissions from recreation traffic, were not modeled, but would generate only a small amount of air pollutants.

No noticeable deterioration in visibility would occur at Class I or sensitive Class II wilderness areas located within 100 miles of interim drilling (Mount Zirkel, Rawah, Savage Run, Platte River, Huston Park, or Encampment River). Furthermore, no noticeable deterioration in visibility would occur at the Dinosaur National Monument in Colorado. Wind dispersion of the small quantity of air pollutants generated by RFFAs would likely eliminate formation of regional haze or acid deposition.

4.16.1.3. Soils

The CIA area for soils includes the 219,500-acre portion of the Muddy Creek Watershed that overlaps the Atlantic Rim EIS study area. Cumulative impacts include impacts to soil from ongoing exploration and development, recently constructed projects, and RFFAs. Cumulative long-term disturbance of about 700 acres would be 0.3 percent of the 219,500-acre Muddy Creek CIA area. This amount of cumulative impacts on the soil resources would be minimal if all mitigation and avoidance measures were implemented.

Minimal effects on soils would be anticipated under the interim drilling program with the use of proper construction techniques, drilling practices, and with the BMPs described earlier in this chapter in the section on Soils and Water Resources. Surface disturbance associated with drilling would increase the potential for erosion and sedimentation. This surface disturbance could include removing vegetation and stockpiling topsoil, road construction, or shallow excavations for drill pads or facilities. Implementation of BMPs during construction, operation, and reclamation to control erosion would minimize effects on soil resources. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, recreation use, and conventional oil and gas development, would have a minimal effect on soil resources, provided BMPs for the management of these activities are implemented. The establishment of self-contained troughs in scattered locations to provide for the beneficial use of small quantities produced water where water was previously not available, would reduce use of riparian areas by livestock and wildlife and conserve soil resources.

4.16.1.4. Water Resources

The CIA area for water resources includes the 219,500-acre portion of the Muddy Creek Watershed that overlaps the Atlantic Rim EIS study area. Existing and future disturbance consists of about 700 acres, or 0.3 percent, of the Muddy Creek CIA area. This cumulative disturbance would have minimal impact on the quantity or quality of surface water or groundwater.

The cumulative impacts that would be associated with interim drilling and that would be predicted to occur are based on the current knowledge of the geology, CBNG resources, and groundwater hydrology in the area. Both the rates of natural gas and water production from future wells and specific information on injection cannot be accurately predicted. These variables could affect the configuration of field production, gas processing, and gas and water conveyance facilities; however, none of these changes is expected to measurably affect the conclusions presented here. Federal regulations require additional analysis if substantial changes in resource conditions would alter the conclusions reached in this document.

Impacts to groundwater are not anticipated within the Atlantic Rim EIS study area. The springs in the area are classic “contact” springs, which result from permeable rocks that overlie rocks of much lower permeability. In the Atlantic Rim area, the permeable Browns Park Formation overlies the less permeable Almond Formation. Further evidence that there is no communication between the Almond Formation and the overlying permeable layers is the fact that the Almond Formation is currently overpressured or has a hydrostatic head that is substantially higher than current elevation of the overlying layers. A line of springs can result where this contact is exposed by erosion. No impact to these springs is foreseen from pumping the coal seams in the Almond Formation during the interim drilling program. The source of the springs is infiltrating precipitation, and this source would not be removed by pumping water from the underlying coal seams.

Water wells completed in water-bearing strata above or below the Almond Formation coal seams are not likely to be affected because of the thick confining layers. Water wells completed in the coal seams of the Almond Formation in close proximity (less than 1 mile) to interim drilling projects could be affected, but it is not likely that wells of this type exist. As described in Chapter 2, tests are under way to evaluate whether water from the coal seams in the Almond Formation contributes to the surface water system in the Colorado River Basin. It is highly unlikely that the Almond Formation is contributing to the Colorado River Basin considering that the overpressured condition of the Almond Formation indicates it is isolated and has no communication with upper horizons.

Cumulative impacts to the groundwater resources within the Mesaverde Group would be limited to a decline in hydrostatic head within the coal aquifers targeted that would result from development of gas wells associated with the interim drilling program. Existing impacts to groundwater resources within the Mesaverde Group that have resulted from prior development are so limited as to be nonexistent.

Minimal effects on groundwater aquifers or groundwater quality would be anticipated under the interim drilling program. These effects would be minimized with proper construction techniques, drilling practices, and BMPs similar to the applicant-committed and BLM-required mitigating measures. These measures are described in Chapter 2. Current and future oil and gas exploration and development in the Project Area must comply with federal and state environmental regulations. Specifically, wells would be completed in accordance with Onshore Order No. 2 and the recent BLM guidelines that reduce the potential for groundwater contamination.

Surface disturbance would increase the potential for erosion and sedimentation. This disturbance would be associated with related activities, such as removing vegetation and stockpiling topsoil, road construction, or shallow excavations for drill pads or facilities and existing burned areas within the CIA. Burns, prescribed and otherwise, would increase the potential for erosion and sedimentation for the first 2 years after they occur, because of their effects on erosion of areas without vegetative cover.

Cumulative impacts to surface water resources would be maximized shortly after construction begins and would decrease over time in response to reclamation efforts. These impacts would then stabilize during the production and operation period, when routine maintenance of wells and ancillary facilities takes place. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, recreation use, and conventional oil and gas development, would have a minimal effect on water resources, provided BMPs for the management of these activities are implemented. The establishment of self-contained troughs in scattered off-channel locations for the beneficial use of small quantities produced water, would reduce sedimentation caused by concentrated use of riparian areas along drainage channels by livestock and wildlife, and benefit water quality. Additionally, all roads, well locations, and facility infrastructure would be regularly inspected and maintained to minimize erosion, sedimentation, and impairment of surface water quality. BMPs to control erosion would ensure that surface water resources of the Colorado River Basin would not be affected by surface-disturbing activities.

4.16.1.5. Vegetation, Wetlands, and Noxious Weeds

The CIA area for vegetation, wetlands, and noxious weeds includes the 219,500-acre portion of the Muddy Creek Watershed that overlaps the Atlantic Rim EIS study area. Cumulative impacts include impacts to vegetation and wetlands from ongoing exploration and development, recently constructed projects, prescribed burns where the sagebrush cover type has been converted to grass and bare ground, and RFFAs. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, recreation uses such as hunting and ORV use, and conventional oil and gas development, would have a minimal effect on vegetation resources, provided BMPs for management of these activities are implemented.

An estimated 20,000 acres have been burned as a result of prescribed fires and 4,000 acres have been affected by wildfires over the past 15 years within a 500,000-acre area that includes the CIA. The objective in prescribed fires is not to burn all vegetation, but to leave mosaics of burned and unburned areas. These burned areas are in various stages of recovery.

Anticipated cumulative long-term disturbance that can be quantified (700 acres) would be 0.3 percent of the 219,500-acre Muddy Creek CIA area. This amount of vegetation loss would be minimal. In addition, no direct effects on wetlands or aquatic and riparian areas would be expected because existing and reasonably foreseeable activities would avoid these areas in accordance with provisions of the RMP. Provided mitigation measures are followed to control erosion, no indirect impacts to aquatic or riparian resources would be expected. Implementation of BMPs during construction, operation, and reclamation would minimize the effects on vegetation resources and the potential for invasive or weedy species to encroach during RFFAs. Cumulative impacts on both vegetation and wetland resources would be minimal, provided all mitigation and avoidance measures specified by the RFO are implemented. The effects on riparian areas caused by use of available forage by livestock and wildlife would be reduced by the establishment of self-contained troughs in scattered off-channel locations for the beneficial use of small quantities produced water away from riparian areas. The cumulative impact of existing and reasonably foreseeable future activities and prescribed burn areas in the CIA area would be a reduction in sagebrush cover and in sagebrush-dependent habitat types. An estimated 95 percent of the prescribed fires conducted by BLM occur in mountain big sagebrush and basin big sagebrush. Wyoming big sagebrush, the main forage for big game and main habitat for sage grouse, would not be affected. Most big sagebrush habitat is mature to decadent, so small disturbances with proper reclamation may provide beneficial turnover to younger plant communities with more variable species composition and structure. This diversity improves the health of the plant community and benefits wildlife, which use these habitats.

The distribution of plant species of concern is likely limited within the Atlantic Rim EIS study area by the lack of suitable habitat. The required application of existing FWS and BLM monitoring and mitigation measures would be expected to adequately protect threatened, endangered, and special status plant species. Thus, impacts to special status species would be expected to be minimal.

4.16.1.6. Range Resources and Other Land Uses

The CIA area for range resources and other land uses includes the 219,500-acre portion of the Muddy Creek Watershed that overlaps the Atlantic Rim EIS study area. Cumulative impacts include ongoing exploration and development of CBNG resources, recently constructed projects, and RFFAs. Cumulative long-term disturbance of 700 acres under the interim drilling program would be 0.3 percent of the 219,500-acre Muddy Creek CIA area. This amount of cumulative impacts on range resources and other land uses would be minimal if all BMPs are implemented. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, recreation uses such as hunting and ORV use, and conventional oil and gas

development, would have a minimal effect on range resources and other land uses, provided BMPs for management of these activities are implemented.

RFFAs located within the Doty Mountain Allotment include the proposed Doty Mountain Project analyzed in this document, the Blue Sky Project, and the Sun Dog Project. Based on the anticipated disturbance associated with these RFFAs, the cumulative disturbance would be 80 acres in the Doty Mountain Allotment. The estimated 80 acres of cumulative long-term disturbance equates to a small reduction in available forage within the Doty Mountain Allotment. The availability of small quantities of produced water at scattered locations in self-contained troughs that allow no discharge into surface drainages would benefit livestock grazing during the life of the interim drilling program.

4.16.1.7. Wildlife and Fisheries

4.16.1.7.1. Wildlife

RFFAs, including the interim drilling program, are expected to have minimal cumulative, short-term effects on wildlife. Some wildlife species may be temporarily displaced by construction at well sites, access roads, and pipeline routes, but should return once construction is complete. Extensive suitable habitats for many species exist on adjacent lands and would support individual animals that may be temporarily displaced during RFFAs. Cumulative long-term effects on wildlife also are expected to be minimal, as most species would become accustomed to routine operation and maintenance. Only a very small proportion of the amount of available wildlife habitats within the Atlantic Rim EIS study area would be affected. As a result, the capacity of the area to support various wildlife populations should remain essentially unchanged from current conditions. The presence of water in upland areas, where not previously available, would benefit wildlife by making more forage obtainable for the life of the project. These water developments could be removed at the end of the project, or could be maintained by ranchers once natural gas development has ended. No cumulative effects on wildlife, including threatened or endangered species or species of concern, are expected during the interim drilling program. This lack of effects is predicted provided avoidance and mitigation measures, lease stipulations, and provisions in the RMP are followed. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, recreation uses, and conventional oil and gas development, would have a minimal effect on wildlife and fisheries resources, provided BMPs are implemented.

The CIA area varies with species, as indicated in the analyses. Disturbance of wildlife habitat that results from RFFAs, including the interim drilling program, would reduce the availability and effectiveness of habitat for a variety of common mammals, birds, and their predators. Initial phases of surface disturbance would result in some direct mortality to small mammals, would displace songbirds, and would cause a slight increase in mortality from increased use of vehicles. However, populations of small mammals and songbirds would quickly rebound to pre-disturbance levels after reclamation is complete because of the relatively high production potential of these species and the relatively small amount of habitat disturbed (0.006 percent of the Atlantic Rim EIS study area). Therefore, no long-term impacts to these populations are expected.

RFFAs, including activities associated with the construction phase of each of the pods in the interim drilling program, would likely temporarily displace antelope, mule deer, and elk; however, once construction is completed, they would likely return to pre-disturbance activity patterns. Elk winter range occurs in the Project Area, but should not be affected by interim drilling. Crucial winter range for the pronghorn occurs only in the Blue Sky area. The proportion of crucial winter range for the pronghorn within the Baggs Herd Unit that would be affected over the short term would be 0.03 percent and would be 0.008 percent in the long term. Crucial winter range for mule deer occurs in well pods not yet proposed. The proportion of crucial winter range for mule deer within the Baggs Herd Unit that would be affected would be 0.05 percent over the short term and 0.01 percent over the long term. Furthermore, construction on crucial winter range would be limited to May 1 through November 14. Prescribed fires are not expected to affect big game, as the burns would not alter the dominant forage. Provided that mitigation measures described in Chapter 2 and the Interim Drilling Policy are implemented, cumulative impacts to big game populations within the herd units are expected to be minimal.

Greater sage grouse occupy the area where interim drilling is proposed year-round and make seasonal use of the habitats. No exact figures are available on the amount of greater sage grouse habitat available within the Atlantic Rim EIS study area, but the RMP identifies the area as included in the Baggs Habitat Management Plan. In this larger area, 160,500 acres of greater sage grouse habitat was identified. Prescribed fires are not expected to affect greater sage grouse, as the height and density of the sagebrush typically treated by burns are outside of the range that greater sage grouse use for nesting and brooding habitat.

The following habitat components area would be affected by RFFAs under the interim drilling program:

- a portion of the ¼-mile NSO radius of a lek
- about 11,005 acres (56.2 percent of the total surface area that would be affected by the 200-well interim drilling program) that overlaps the 2-mile radius of the historical leks in the area
- about 365 acres (3.3 percent) of potential nesting habitat for greater sage grouse would be affected cumulatively by short-term disturbances associated with production
- 112 acres (1.0 percent) would be affected in the long term

Considering the amount of potential nesting habitat available, the 112-acre loss would be minimal. Greater sage grouse within Sierra Madre Upland Game Management Unit (Area 25) would be only minimally affected by the cumulative 361-acre disturbance associated with RFFAs, including interim drilling. This minimal amount affected assumes that provisions and stipulations in the RMP, interim drilling guidelines, seasonal closures, reclamation, and mitigation measures specified by the RFO are followed.

Although no active raptor nests were located in the interim drilling pods during aerial surveys in 2001, the protection measures identified in Chapter 2 and the Interim Drilling Policy are expected to protect the raptor populations within the interim drilling area dur-

ing RFFAs. Therefore, only minimal cumulative impacts to raptors within the Muddy Creek Watershed are likely to occur.

Acreages and burrow densities that are adequate to support black-footed ferrets (200 or more acres with eight or more burrows per acre) are currently estimated to occur in only two of the pods included in the interim drilling program. Surveys for black-footed ferret have been conducted on both of these pods, and no ferrets or ferret sign were found. No impacts to this species are expected as the result of RFFAs, including the proposed 200-well interim drilling program. The lack of impacts is predicted because of the lack of evidence that black-footed ferrets occur and because surveys for the black-footed ferret will be conducted when required (per interim drilling guidelines).

4.16.1.7.2. Fisheries

Currently, four BLM sensitive fish species ([Appendix E](#)) are known to occur in Muddy Creek and downstream in the Little Snake River (Baxter and Stone 1995). Although it is unlikely, four endangered species of fish have the potential to occur immediately downstream in the Little Snake River. Cumulative impacts from existing, proposed, and reasonably foreseeable development may influence off-site endangered fisheries resources; therefore, potential impacts are evaluated within the boundaries of the Muddy Creek watershed. Additionally, direct impacts to the four BLM sensitive species through increased sediment or depletions of surface water in Muddy Creek may result from the interim drilling program.

Perennial surface waters are limited within the analysis area. Additionally, no contact between the surface springs and coal aquifers that would be affected by the interim drilling program is anticipated. Water used in drilling and construction associated with the interim drilling program would be obtained from wells drilled into aquifers that are geologically isolated from the Little Snake River. Furthermore, they are not generally associated with surface water expression in the Muddy Creek watershed. Therefore, no surface water depletions would occur that would affect BLM sensitive, threatened, or endangered fish species. If the existing, proposed, or reasonably foreseeable development depletes surface water in either Muddy Creek or the Little Snake River (both tributary to the Colorado River and falling under the Colorado River Compact), adverse impacts to the BLM sensitive species could occur. In that case, potential impacts to the four downstream endangered species would require consultation with FWS.

RFFAs are not expected to reduce the number of BLM sensitive, threatened, or endangered adult fish or exclude them from or degrade their spawning areas within the Muddy Creek watershed or in downstream waters of the Little Snake River. Additionally, permitted disturbances associated with well pod development and other actions within the Muddy Creek watershed would employ erosion control measures and construction techniques. These techniques would be suitable to limit off-site movement of soil and degradation of fisheries habitat downstream caused by sediment inputs.

The mitigation and avoidance measures set forth in this EA and standard protection and reclamation measures for wetlands and surface water to protect fisheries resources would be adequate to protect surface waters and the threatened, endangered, and BLM fish spe-

cies of concern. Thus, the cumulative impacts to fish species found within the affected watersheds are expected to be minimal.

The required application of existing FWS and BLM monitoring and mitigation measures to the proposed interim drilling program is expected to provide adequate protection for threatened, endangered, and special status species of fish.

4.16.1.8. Recreation

BLM has not obtained statistics on historical use of the interim drilling area by recreation groups that could be used to identify trends in cumulative impacts on recreation use and displacement that could result from past or current activities and RFFAs. Cumulatively, overall impacts to the recreation resource are expected to be minimal, with some temporary displacement of hunters and recreationists during the short-term construction and drilling periods. Some long-term displacement of hunters and nonconsumptive users may occur, and there may be reduced levels of satisfaction for any who might continue to use the area. The cumulative effects of other RFFAs in the Atlantic Rim EIS study area, such as prescribed burns that are planned, projected grazing of livestock, and conventional oil and gas development would have a minimal effect on recreation resources, provided BMPs for management of these activities are implemented.

4.16.1.9. Visual Resources

Existing visual qualities in the interim drilling area and adjacent lands have already been affected by ongoing natural gas development, including road building and pipeline construction. Existing, proposed, or reasonably foreseeable development would add to the level of impact to visual resources in the immediate area. The composite experience of people traveling through the area, particularly on back roads, is a modified landscape. Contrasts in line, form, color, and texture from development begin to dominate the viewer's experience. These conditions would increase the likelihood that viewers would be dissatisfied with the visual component of the recreation experience. However, the cumulative impact of the interim drilling program and other RFFAs, such as grazing, recreation use, prescribed burns, and conventional oil and gas development, on visual resources would still be consistent with the current VRM Class III designation, provided BMPs for these activities that are similar to the techniques described in Chapter 2 would be implemented.

4.16.1.10. Cultural Resources

Federal law and regulations protect cultural resources on public lands, including archaeological sites and historic properties. Cultural resources in the interim drilling area and adjacent lands already may have been affected by surface-disturbing activities, including ongoing natural gas development, road building, and pipeline construction. Existing, proposed, or reasonably foreseeable development could add to the level of impact on cultural resources in the immediate area unless inventories and protective or mitigation measures specified by BLM are followed. BLM has required cultural resource inventories before surface-disturbing activities can begin. These inventories have been used to

identify sites potentially eligible for inclusion on the NRHP and to identify sites BLM has required past exploration and development to avoid.

The potential for increased impacts on cultural artifacts would be minimized because Class III cultural resource inventories would be completed. Cultural resource inventories would have a beneficial, cumulative impact on the level of cultural information available about the interim drilling area.

It should be possible to eliminate direct and indirect adverse effects on historic properties under the interim drilling program through avoidance or mitigation measures (data recovery or recordation) on a case-by-case basis. The potential for incremental increases in cumulative impacts would be precluded by avoiding known cultural and historical sites during the layout of drill sites, access roads, and pipeline corridors. Some unintentional damage to subsurface resources could occur during grading or excavation. However, implementation of resource protection and mitigation measures similar to the techniques described in Chapter 2 would protect these resources when they are discovered.

4.16.1.11. Socioeconomics

Southwest Wyoming is currently experiencing an increase in the pace and level of natural gas development. Drilling and field development are occurring near the interim drilling area, including Continental Divide/Wamsutter II, South Baggs, Mulligan Draw, Creston/Blue Gap, Hay Reservoir and, potentially, Desolation Flats. Although this surge in development would result in increased employment, income, and tax revenues in the region, it would also raise the demand for housing and for local and state government facilities and services. Rawlins is also experiencing some growth associated with the opening of a new prison facility.

Communities such as Rawlins and Rock Springs are still below the peak population levels of the early 1980s and have infrastructure and housing in place to accommodate some growth in population. Smaller communities near the Project Area, such as Wamsutter or Baggs, are struggling to accommodate population growth associated with development of the currently approved natural gas fields identified above. Neither the relatively small, short-term drilling and field development workforce nor the minimal operations employment and activity associated with the existing, proposed, or reasonably foreseeable development would add appreciably to cumulative demand for housing and local government services in the area. Drilling and field development associated with these activities would be completed some time before the proposed Atlantic Rim Natural Gas Project begins.

The potential for degradation of the quality of recreation resources in the area would increase if the current accelerated pace of drilling and field development in southwest Wyoming continues. Levels of dissatisfaction among some residents and area visitors would correspondingly increase if Carbon County residents perceive that recreation resources have been degraded.

4.16.1.12. Transportation

Oil and gas development in western Carbon County and eastern Sweetwater County would result in increased traffic on affected segments of I-80, WY 70, and WY 789. The condition of these highways is adequate to accommodate existing levels of traffic with some increase (Rounds 2000).

Currently known cumulative impacts on Carbon County Roads 605 and 608 would be limited to grazing, recreation, and occasional traffic associated with oil and gas exploration. The increased traffic associated with drilling and field development under the interim drilling program would accelerate maintenance requirements; however, revenues generated, which are described under the section of this chapter on Socioeconomics, should offset associated costs.

4.16.1.13. Health and Safety

Cumulative impacts to health and safety would be limited to effects associated with the 200-well interim drilling proposal and existing grazing and recreation. Cumulative impacts to health and safety are anticipated to be similar to the effects described for the project. Occasional traffic and activity associated with oil and gas exploration would slightly increase the risks to workers and the public.

4.16.1.14. Noise

Cumulative noise impacts would be limited to the 200-well interim drilling proposal and existing grazing and recreation. Cumulative noise impacts are likely to be similar to the effects described for the project. Noise would result from ongoing construction, drilling, and production operations, including an estimated nine compressor stations, during the life of interim drilling. Traffic would increase on existing transportation system roads within the area where interim drilling is planned, thus adding to existing traffic noise. The additional traffic-related noise would be minimal given the current and anticipated low volume of traffic and the dispersed nature of traffic and natural gas operations within the interim drilling pods. The locations of the interim drilling pods are dispersed, so that the noise from compressor stations would not likely be noticeable throughout the interim drilling area ([Figure 1-1](#)). The distance between the pods also would minimize the overall impact of noise on visitors to the area; however, the cumulative additional noise from all RFFAs would combine to create an environment with an overall increase in sound disturbances. Applicant-committed and BLM-required mitigating measures for interim drilling activities, similar to the techniques described in Chapter 2 for the project, would result in minimal noise impacts.

4.16.2. No Action

Under the No Action alternative, without a coordinated plan of development for the Project Area, mineral development within the Project Area and other pods within the Atlantic Rim EIS study area likely would still occur. Demand for natural gas locally and nationally likely would result in new proposals for exploration and development. However, reasonably foreseeable mineral development would occur under the guidelines of the

RMP, by development of individual wells with no coordinated planning for the cumulative impacts.

The cumulative impacts could be similar to the effects of the 200-well interim drilling program described above under the Proposed Action, provided the consideration of drilling proposals individually, instead of in a coordinated plan, would not result in additional cumulative impacts. However, considering the difficulty of siting routes for road access and pipelines in the coordinated plan for Doty Mountain so that impacts to important wildlife habitat and cultural resources were prevented, impacts almost certainly would be greater without a coordinated plan.

Cumulative effects of RFFAs other than the 200-well interim drilling program would be similar to the Proposed Action. Grazing, hunting, ORV use, other recreational activities, prescribed burns, and conventional oil and gas development still would occur. These RFFAs would affect soil and water resources, vegetation, and socioeconomics of the Atlantic Rim EIS study area even if RFFAs associated with the interim drilling program did not occur, or did not occur under a coordinated plan. If no coordinated plan were developed, the potential benefits to grazing, soil and water resources, vegetation in riparian areas, and wildlife, that would be associated with a coordinated plan to reduce concentrated use of riparian areas by providing small quantities of produced water where it was previously not available, might be reduced or eliminated.

5.0 CONSULTATION AND COORDINATION

5.1 CONSULTATION AND COORDINATION

An environmental analysis is prepared when a federal government agency considers approving an action within its jurisdiction that may impact the human environment. An environmental analysis aids federal decision makers by presenting information on the physical, biological, and social environment of a proposed project and its alternatives. The first step in conducting an environmental analysis that meets the requirements of NEPA is to determine the scope of the project, the range of action alternatives, and the impacts to be included in the document.

The Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508) require an early scoping process to determine the issues related to the Proposed Action and alternatives that the analysis should address. The purpose of the scoping process is to identify important issues, concerns, and potential impacts that require analysis. The results of the scoping process are used to focus the analysis on the issues and concerns identified for the proposed project, so that alternatives or mitigation considered can be responsive to the issues and concerns. Alternatives that are not technically or economically feasible or responsive to the issues and concerns are not considered further in the analysis.

The environmental assessment documenting the NEPA analysis conducted for the Doty Mountain Project was prepared by a third-party contractor working under the direction of and in cooperation with the lead agency for the project, BLM Rawlins Field Office in Rawlins, Wyoming.

5.2 PUBLIC PARTICIPATION

A scoping notice was prepared and submitted to the public by the BLM on June 14, 2001, requesting comments on the proposed Atlantic Rim Natural Gas Project. Scoping documents were sent out to the public listed on the BLM mailing list, as well as organizations, groups, and individuals that requested a copy of the scoping document.

As a part of the scoping process, the interim drilling programs proposed by the Companies were included in the scoping notice. The scoping period ended on July 25, 2001. During preparation of the EA, the BLM and the consultant interdisciplinary team have communicated with, and received or solicited input from various federal, state, county, and local agencies, elected representatives, environmental and citizens groups, industries, and individuals potentially concerned with issues regarding the proposed exploratory drilling activities. The contacts made are summarized in the following sections.

The following organizations and individuals either provided comment or were provided the opportunity to comment during the scoping period.

FEDERAL OFFICES

U.S. Bureau of Land Management, Wyoming State Office
U.S. Congresswoman Barbara Cubin
U.S. Senator Mike Enzi
U.S. Senator Craig Thomas
U.S. Army Corps of Engineers
U.S. Bureau of Reclamation
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service

STATE AGENCIES

Governor Jim Geringer
State Representatives
State Senators
State Engineer's Office
Wyoming Department of Environmental Quality
Wyoming Department of Transportation
Wyoming Game and Fish Department
Wyoming Oil and Gas Conservation Commission
Wyoming State Planning Coordinator

COUNTY GOVERNMENT

Carbon County Commissioners
Carbon County Planning Commission

MUNICIPALITIES

Mayor-Baggs
Mayor-Rawlins
Mayor-Wamsutter

NATIVE AMERICAN TRIBES

Northern Arapahoe Tribal Council
Shoshone Tribal Council
Ute Mountain Tribe
Ute Tribal Council
Shoshone-Arapahoe Joint Tribal Council
Uinta-Ouray Tribal Council

GRAZING PERMITTEES

Weber Ranch
Montgomery Livestock Company
Salisbury Livestock Company

Stratton Sheep Company
Three Forks Ranch Corporation
Sam Morgan
Mike Sheehan
Robert Orchard
H.B. Lee
Matt Weber
Espy Livestock
Jack Creek Land and Cattle Company
PH Livestock Company

LEASE AND ROW HOLDERS

Benson–Montin–Greer
KCS Mountain Resources, Inc.
Merit Energy Company
North Finn, LLC
P&M Petroleum Management
Stone & Wolf, LLC

LANDOWNERS

The scoping notice was sent to 111 landowners potentially affected by the proposal.

LOCAL MEDIA

Casper Star-Tribune
Rawlins Daily Times
Rock Springs Rocket Miner
Wyoming State Journal
Wyoming State Tribune/Eagle
Gillette News-Record
Northwest Colorado Daily News
KRAI - Craig, Colorado
KRAL - Rawlins
KRKK - Rock Springs
KSIT - Rock Springs
KTWO - Casper
KTWO TV - Casper
KUWR - University of Wyoming

OTHER AGENCIES, INDUSTRY REPRESENTATIVES, INDIVIDUALS, AND ORGANIZATIONS

Audubon Society
National Wildlife Federation
Wilderness Society
Carbon County Stockgrowers

The Nature Conservancy
 Wyoming Association of Professional Archaeologists
 Field Museum of Natural History, Department of Geology
 Independent Petroleum Association of Mountain States
 Montana Oil Journal
 Murie Audubon Society
 Petroleum Association of Wyoming
 Sierra Club
 Wyoming Farm Bureau Federation
 Wyoming Outdoor Council
 Wyoming Public Lands Council
 Wyoming Stockgrowers Association
 Wyoming Wildlife Federation
 Wyoming Woolgrowers Association
 Vern Brodsho
 Ivan Herold
 Little Snake River Conservation District

5.3 LIST OF PREPARERS

The following tables identify the core BLM IDT (**Table 5-1**) and the consultant IDT (**Table 5-2**) who were principally involved in preparing this EA.

TABLE 5-1 BLM INTERDISCIPLINARY REVIEWERS

| Name | Responsibility |
|-----------------|---------------------------------------|
| BLM Team | |
| Larry Jackson | BLM IDT Lead |
| Dave Simons | Atlantic Rim EIS Coordinator |
| Pat Walker | Cultural Resources |
| Krystal Clair | Visual Resources/Recreation |
| Bob Lange | Water Resources |
| Lloyd Chism | Petroleum Engineering, Geology |
| Andy Warren | Vegetation/Range Issues |
| Gay Seay | Pipeline Construction |
| Susan Foley | Soils/Reclamation |
| Frank Blomquist | Wildlife/T & E Issues |
| Mike Bower | Fisheries Biologist; Riparian/Wetland |
| Janelle Wrigley | Realty Specialist |

TABLE 5-2 CONSULTANT INTERDISCIPLINARY TEAM EA PREPARERS

| Name | Affiliation | Area of Expertise and Responsibility |
|---|---|--|
| Principal Interdisciplinary Team | | |
| Kathy Wilkerson | Greystone Environmental Consultants, Inc. | Interdisciplinary Team Leader, Project Manager, Mineral and Energy Resource Specialist |
| Sue Barker | Greystone Environmental Consultants, Inc. | Hydrologist |
| Henry Sauer | Greystone Environmental Consultants, Inc. | Soils and Range Science |
| Bliss Lilley | Greystone Environmental Consultants, Inc. | Physical Resources |
| Lisa Welch | Greystone Environmental Consultants, Inc. | Environmental Scientist |
| Cherie Walth | Greystone Environmental Consultants, Inc. | Archaeologist |
| Pat Golden | Greystone Environmental Consultants, Inc. | Wildlife and Fisheries Biologist |
| Mike Holle | Greystone Environmental Consultants, Inc. | GIS Specialist |
| Dave Cameron | Greystone Environmental Consultants, Inc. | NEPA Specialist, Wildlife Biologist |
| Technical Support Team | | |
| Larry Hayden-Wing | Hayden-Wing Associates | Wildlife/Fisheries/Special Status Species |
| Travis Olson | Hayden-Wing Associates | Wildlife Biologist |
| Jeffrey Winstead | Hayden-Wing Associates | Wildlife Biologist & Cartographer |
| Scott Mullner | Hayden-Wing Associates | Fisheries Biologist |
| Butch Fries | Greystone Environmental Consultants, Inc. | Editor |
| Julie Hatcher | Pronghorn Archaeology | Cultural Resources |
| Gary Holsan | Gary Holsan & Associates | Atlantic Rim Coalbed Methane Project - ongoing environmental analysis for EIS |

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7.0 ACRONYMS

| | |
|---------|---|
| ACEC | Area of Critical Environmental Concern |
| ADT | Average Daily Traffic |
| AADT | Annual Average Daily Traffic |
| ANC | Acid Neutralizing Capacity |
| APCD | Air Pollution Control Division (Colorado Department of Public Health and Environment) |
| APD | Application for Permit to Drill |
| AQD | Air Quality Division (Wyoming Department of Environmental Quality) |
| AQRV | Air Quality Related Value |
| ASTM | American Society for Testing and Materials |
| ATV | All-terrain Vehicle |
| AUM | Animal Unit Months |
| bbf | Barrel (42 U.S. gallons) |
| BLM | U.S. Bureau of Land Management |
| BMPs | Best Management Practices |
| B.P. | Before Present |
| CAAQS | Colorado Ambient Air Quality Standards |
| CBM | Coal Bed Methane |
| CCR | Carbon County Road |
| CDPHE | Colorado Department of Public Health and Environment |
| CFR | Code of Federal Regulations |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| cfs | Cubic feet per second (equivalent to 448.83 gallons per minute) |
| CIA | Cumulative Impact Assessment |
| CO | Carbon monoxide |
| COA | Conditions of Approval |
| COE | U.S. Army Corps of Engineers |
| CWA | Clean Water Act |
| CWR | Crucial Winter Range |
| dBA | A-weighted scale, decibels |
| DEIS | Draft Environmental Impact Statement |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| F | Degrees in Fahrenheit |
| FEIS | Final Environmental Impact Statement |
| FR | Federal Register |
| FWS | U.S. Fish and Wildlife Service |
| FY | Fiscal Year |
| IDT | Interdisciplinary Team |
| g/hp-hr | Grams per horsepower-hour |

| | |
|---------------------|---|
| GAP | Wyoming Gap Analysis Program |
| gpd/ft | Gallons per day per foot |
| gpd/ft ² | Gallons per day per square foot |
| gpm | Gallons per minute |
| GPS | Global Positioning System |
| GWD | Ground Water Division, Wyoming Department of Environmental Quality |
| HAP | Hazardous Air Pollutants |
| HDPE | High Density Polyethylene |
| HUC | Hydrologic Unit Code |
| IMPROVE | Interagency Monitoring of Protected Visual Environments |
| JTU | Jackson Turbidity Unit |
| MDF | Million Cubic Feet |
| MDP | Master Drilling Plan |
| meq/L | Milliequivalents per liter |
| mg/L | Milligrams per liter |
| mmhos/cm | Soluble salts (salinity) in a soil expressed in millihmos per centimeter. |
| MSDS | Material Safety Data Sheet |
| MSHA | Mine Safety and Health Administration |
| MSUP | Master Surface Use Program |
| NAAQS | National Ambient Air Quality Standard |
| NCR | Nonselective Catalytic Reduction |
| NEPA | National Environmental Policy Act |
| NO ₂ | Nitrogen dioxide |
| NO _x | Nitrogen oxides |
| NPDES | National Pollutant Discharge Elimination System |
| NRCS | Natural Resource Conservation Service |
| NRHP | National Register of Historic Places |
| NSO | No Surface Occupancy |
| NTU | Nephelometric Turbidity Unit |
| O ₃ | Ozone |
| ORV | Off-road Vehicle |
| OSHA | Occupational Safety and Health Administration (federal and state) |
| Pb | Lead |
| pCi/l | Picocurie per liter, used to measure Radium 226. |
| PM ₁₀ | Particulate matter less than 10 microns in effective diameter |
| PM _{2.5} | Particulate matter less than 2.5 microns in effective diameter |
| Pod | Grouping of CBM wells into a well pod, for example, Pod 7 |
| POD | Plan of Development |
| PPP | Pollution Prevention Plan |
| PRCBMIC | Powder River CBM Information Council |
| PSD | Prevention of Significant Deterioration |
| psi | Pounds per square inch |
| RCRA | Resource Conservation and Recovery Act |
| RFFA | Reasonably Foreseeable Future Action |
| RFO | Rawlins Field Office, Bureau of Land Management |
| RMP | Resource Management Plan |
| ROD | Record of Decision |
| ROW | Right-of-Way |

| | |
|------------------|---|
| RV | Recreational Vehicle |
| R_W | Range number West |
| SAR | Sodium Adsorption Ratio |
| SARA | Superfund Amendments and Reauthorization Act |
| SCR | Selective Catalytic Reduction |
| SH | State Highway |
| SHPO | State Historic Preservation Office |
| SO ₂ | Sulfur dioxide |
| SPCC | Spill Prevention Control and Countermeasures |
| s.u. | Standard Units |
| TDS | Total Dissolved Solids |
| TEG | Triethylene Glycol |
| T_N | Township number North |
| TPQ | Threshold Planning Quantity |
| TRI | Toxic Release Inventory |
| TSS | Total Suspended Solids |
| g/m ³ | Micrograms per cubic meter (1 g=0.001 mg or 1 part per billion) |
| USDI | U.S. Department of the Interior |
| USDOT | U.S. Department of Transportation |
| USFS | U.S. Forest Service |
| USGS | U.S. Geological Survey |
| UW | University of Wyoming, Laramie |
| VOC | Volatile Organic Compounds |
| VRM | Visual Resources Management |
| WAAQS | Wyoming Ambient Air Quality Standard |
| WDAI | Wyoming Department of Administration and Information |
| WDEQ | Wyoming Department of Environmental Quality |
| WGFD | Wyoming Game and Fish Department |
| WMP | Water Management Plan |
| WOGCC | Wyoming Oil and Gas Conservation Commission |
| WOS | Wildlife Observation System |
| WRCC | Western Regional Climate Center |
| WSEO | Wyoming State Engineer's Office |
| WTA | Wyoming Taxpayers Association |
| WY | Wyoming State Highway |
| WYDOT | Wyoming Department of Transportation |
| WYNDD | Wyoming Natural Diversity Database |

APPENDIX A

Interim Drilling Policy - Development Authorized Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project

During the preparation of the Atlantic Rim Coalbed Methane EIS, the Bureau of Land Management's (BLM) authority to allow drilling on the federal mineral estate is limited. The Council on Environmental Quality (CEQ) Regulations and 40 CFR 1506.1, *limitations on actions during NEPA process* to comply with the National Environmental Policy Act (NEPA) provide the following regarding limitation on concurrent authorizations:

Section 1506.1

(a) Until an agency issues a record of decision as provided in para. 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:

- (1) Have an adverse environmental impact; or*
- (2) Limit the choice of reasonable alternatives.*

(b) If any agency is considering an application from a non-federal entity, and is aware that the applicant is about to take an action within the agency's jurisdiction that would meet either of the criteria in paragraph (a) of this section, then the agency shall promptly notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved.

(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:

- (1) Is justified independently of the program;*
- (2) Is itself accompanied by an adequate environmental impact statement; and*
- (3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.*

(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance....

The above regulations and the following criteria and conditions will be used by the BLM to determine new exploratory activities allowed on Federal surface and/or minerals during preparation of the EIS. They also establish conditions under which these activities will be approved. The intent of these criteria and conditions are to keep all activity within the scope of existing analysis and at a reasonable level, to allow limited drilling activity for acquisition of additional data necessary for completion of the EIS, and to prevent unnecessary hardship to leaseholders. These criteria may be modified by the BLM authorized officer (AO) if any of the allowed activities are viewed as having a potentially significant effect on the environment or prejudice the ultimate decision on the drilling program for the EIS as outlined in the CEQ regulations quoted above.

APPENDIX A: INTERIM DRILLING POLICY

Activities Allowed on Federal Lands and Minerals During EIS Preparation

1. A maximum of 200 coalbed methane wells will be allowed within the project area, for research and exploratory purposes, during the interim period in which the EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple zones to be evaluated (see map).
2. Activities within individual pods will be authorized by BLM. For any pod location which overlaps the boundary of a sensitive resource area for sage grouse, mountain plover, raptors, big game migration corridors, and sensitive plants, appropriate stipulations and mitigation will be applied to protect any sensitive resources present (see Term Definitions below). Some sensitive resources such as high density paleontological or cultural resources sites, are not mapped and will also be handled on a pod basis.
3. Existing coalbed methane wells (two wells re-completed as coalbed methane producers in the Cow Creek Unit by Double Eagle and one new well completed by Petroleum Development Corporation, to the east of this unit) will count toward the above well limits. As Federal 1691 #10-8 has been plugged and abandoned, it will not count toward the above well limit. In addition, the six coalbed methane wells originally permitted by North Finn LLC and drilled in Section 5, T17N, R90W, and the well located in Section 36, T15 N, R91W, will not count toward the allowed well number, as long as they are not included as part of any proposed pod. In addition, required injection wells and monitoring wells will not count toward the well limit.
4. Any modifications proposed to the approved pods (i.e. changing pod locations, drilling wells outside of the current pod locations, or increasing the total number of wells allowed during interim drilling), will only be approved if geologic, hydrologic, or reservoir characteristics support a change. These changes will be allowed after review by, and concurrence of, the Reservoir Management Group and authorization by the BLM, Rawlins Field Office. Additional federal drainage protection wells may be required.
5. During preparation of the EIS, coalbed methane wells and associated roads and pipelines on any private surface/private mineral where the operator has, or has obtained legal access (i.e., county roads, approved BLM ROW grant or private access road) prior to approval of the interim drilling plan, may be developed as deemed appropriate by the operator/lessee. However, these wells will count toward the total number of wells allowed to be drilled under this interim drilling policy.

Criteria and Conditions that Apply to Interim Drilling Operations

1. A detailed Plan of Development/Surface Use Plan (POD/SUP) and Master Drilling Plan for each individual pod, using guidance provided by the BLM Rawlins Field Office, will be submitted and approved prior to surface disturbing activities.
2. The operator(s) agree to supply the geologic, coal, and water data information discussed in Appendix C of this document.
3. Prior to initiating interim drilling, an environmental assessment (EA), including a detailed Water Management Plan will be prepared and approved for each individual pod. Because

APPENDIX A: INTERIM DRILLING POLICY

- of the current BLM workload, and in order to expedite the completion of the EAs, it is recommended that these documents be prepared by a third-party contractor.
4. All pod EA's will be submitted to the BLM in pdf format and each document will be placed on the BLM Wyoming web page. A 30-day public review of each document will occur from the date the document is placed on the site. BLM will be responsible for writing the Decision Record for each EA.
 5. A 1/4 mile buffer is required between surface disturbing activities and the Overland Trail.
 6. Block surveys for cultural resources will be required for each pod.
 7. No interim drilling will be allowed in the Sand Hills Area of Critical Environmental Concern as described in the Great Divide Resource Management Plan Record of Decision (RMP-1990).
 8. The Great Divide RMP states the BLM will include intensive land-use practices to mitigate salt and sediment loading caused by surface disturbing activities within the Muddy Creek watershed. The Muddy Creek Coordinated Resource Management (CRM) group was established as an advisory group to address this issue. Because this area overlaps with the Muddy Creek CRM effort, and since road use contributes the most in increasing the amount of sediment in the Muddy Creek drainage, the POD/SUP will be reviewed by the Muddy Creek CRM Road Committee and recommendations of the group will be considered by BLM. Changes to the POD/SUP will be made prior to initiating work on the pod EA.
 9. Surface discharge as a method of disposal for produced coalbed methane waters will be considered for each individual pod during interim drilling activities within the Great Divide Basin. This is subject to the approval of the Water Management Plan and upon obtaining all required federal, state and local permits.
 10. Prior to completion of the EIS, water produced from coalbed methane wells located in the Colorado River Basin will be disposed of by re-injection. The only exception to this would be waters produced from the Double Eagle's coalbed methane existing and proposed wells located in the Cow Creek POD. Double Eagle has applied to the Wyoming Department of Environmental Quality (WDEQ) for a National Pollutant Discharge Elimination System (NPDES) permit for their two existing wells and four wells permitted recently by BLM. Should Double Eagle receive their state permit, they will be allowed to surface discharge from these six wells. Prior to any additional drilling of CBM wells by Double Eagle in the Cow Creek Pod, an environmental assessment, including a Water Management Plan, will be prepared and submitted to BLM which will examine the environmental impacts from these wells. Double Eagle will be allowed to dispose of produced CBM waters to the surface only after completion of the environmental analysis and a determination is made that the additional surface discharge will cause no significant impact to the environment.
 11. No drilling activities will be allowed in prairie dog towns during interim operations. However, drilling will be allowed in each individual pod containing prairie dog towns upon the completion of black-footed ferrets survey using methods approved by the United States Fish and Wildlife Service. These surveys will clear the pod for a one year period. The operators also have the option of completing surveys in the whole EIS area which would clear the area for the life of the project.

APPENDIX A: INTERIM DRILLING POLICY

In the event a black-footed ferret or its sign is found, the BLM Authorized Officer shall stop all action on the application in hand, and/or action on any application that may directly, indirectly, or cumulatively affect the colony/complex, and initiate Section 7 review with the USFWS. No project related activities will be allowed to proceed until the USFWS issues their biological opinion. The USFWS biological opinion will specify when and under what conditions and/or prudent measures the action could proceed or whether the action will be allowed to proceed at all.

12. No drilling or disturbance will be allowed in those areas determined to be critical winter habitat for sage grouse.
13. No drilling or disturbance will be allowed in areas where any two or more big game (elk, deer, or antelope) crucial winter ranges overlap.
14. The operators will be required to submit a drilling schedule as part of the Master Drilling Plan. This schedule will be reviewed, and approved by BLM, to ensure that activities are limited within proven big game migration corridors at critical use times during the year.
15. Pipelines, power lines, waterlines, fiber optic lines will be buried and, where possible, will follow the road rights-of-way.
16. Fish passage structures will be installed for roads which cross drainages with fisheries concerns as identified by BLM.

Term/Definitions

SENSITIVE RESOURCE AREAS are defined as those areas containing stabilized sand dunes, sensitive plant areas, raptor nesting concentration areas, prairie dog towns, two-mile buffer around sage grouse leks, mountain plover aggregation areas or potential habitat, big game migration corridors and crucial big game winter ranges, and areas with high density cultural or paleontological resource sites. Field inspections by the BLM will be conducted to verify presence of these resource values and potential impacts prior to considering authorization of any proposed development activity on Federal surface and/or minerals.

WILL BE AUTHORIZED means BLM will authorize the action if, following the environmental review of the APD or ROW application, sensitive resource areas are protected with appropriate stipulations or mitigation and the criteria established under CEQ regulation 40 CFR 1506.1 have been met. An environmental assessment (EA) will be completed for each individual pod prior to authorizing the proposal. Consultation and Coordination with the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service will occur when applicable for proposed activity within sensitive resource areas. The pod EA will identify the most environmentally acceptable access route, well site, and pipeline location. Mitigation measures developed from nearby project EISs and EAs for protection of resource values may be considered in the assessment. Any action proposed must be in conformance with the Great Divide Resource Management Plan (RMP) and mineral lease terms and conditions.

A coalbed methane pod may consist of two or more production wells, injection wells, access roads, product pipelines, water pipelines, power lines and other ancillary facilities designed specifically to assess the development potential of the play.

Appendix B

MASTER SURFACE USE PROGRAM (MSUP) DOTY MOUNTAIN PLAN OF DEVELOPMENT (POD) RIGHT-OF-WAY (ROW) APPLICATION FOR FACILITIES

OPERATORS:

**Warren E & P, Inc.
Double Eagle Petroleum Company
Anadarko E & P Company**

LANDS INVOLVED:

Sections 14, 22, & 23 in T17N R91W, 6th PM, Carbon County, Wyoming

BLM LEASES:

WYW116179, WYW133658, WYW137692, WYW141686

Surface Use Program and Plan of Development for the subject wells listed below:

Gas Wells in Section 14

AR Federal 17-91-1-14 (WYW133658)
AR Federal 17-91-3-14 (WYW133658)
AR Federal 17-91-5-14 (WYW133658)
AR Federal 17-91-7-14 (WYW133658)
AR Federal 17-91-9-14 (WYW116179)
AR Federal 17-91-11-14 (WYW116179)
AR Federal 17-91-13-14 (WYW116179)
AR Federal 17-91-15-14 (WYW116179)

Gas Wells in Section 22

AR Federal 17-91-1-22 (WYW137692)
AR Federal 17-91-3-22 (WYW141686)
AR Federal 17-91-5-22 (WYW141686)
AR Federal 17-91-7-22 (WYW141686)
AR Federal 17-91-9-22 (WYW116179)
AR Federal 17-91-11-22 (WYW141686)
AR Federal 17-91-13-22 (WYW141686)
AR Federal 17-91-15-22 (WYW141686)

Deep Injection Well in Section 22

AR Federal 17-91-22I (WYW141686)

Plan of Development for the facilities listed below:

Proposed ROW (BLM surface ownership lands): Road Access to Fee Gas Wells in T17N R91W, Section 23 (AR Fee 17-91-1-23, AR Fee 17-91-3-23, AR Fee 17-91-5-23, AR Fee 17-91-7-23, AR Fee 17-91-9-23, AR Fee 17-91-11-23, AR Fee 17-91-13-23, and AR Fee 17-91-15-23):

T16N R91W Sections 5, 6, 7
T16N R92W Section 12
T17N R91W Sections 22, 27, 28, and 33

Proposed ROW (BLM surface ownership lands): Road Access to Fee Injection Well in T17N R91W:

AR Fee 17-91-23I in Section 23

T16N R91W Sections 5, 6, 7
T16N R92W Section 12
T17N R91W Sections 22, 27, 28, and 33

Proposed ROW (BLM surface ownership lands): Road Access to Compressor Station DM-23 in T17N R91W:

T16N R91W Sections 5, 6, 7
T16N R92W Section 12
T17N R91W Sections 22, 27, 28, and 33

Proposed ROW (BLM surface ownership lands): Gathering System for Water and Gas in T17N R91W, Sections 14 and 22

Proposed ROW (BLM surface ownership lands): Buried Electrical Utility Lines in T17N R91W, Sections 14 and 22

Proposed ROW (BLM surface ownership lands): Delivery Pipeline for Gas

T16N R91W Sections 5, 6, 7
T16N R92W Sections 12
T17N R91W Sections 22, 27, 28, and 33

PROJECT DESCRIPTION

The MSUP for the Doty Mountain POD is submitted by Warren E & P, Inc. (Warren), Double Eagle Petroleum Company (Double Eagle), and Anadarko E & P Company (AEPC), collectively referred to as “the Companies.” The proposed project would be located 25 miles southwest of Rawlins, Wyoming, near the intersection of Wyoming State Highway (WY) 789 and Carbon County Road 608 (Wild Cow Road). The project is one of nine areas or well pods that make up the Atlantic Rim Interim Drilling Project. Of the 24 proposed well locations, 16 wells would be located on surface ownership lands administered by the Bureau of Land Management (BLM) Rawlins Field Office (RFO) and would develop federal minerals. The remaining proposed wells (eight) would develop fee minerals on fee surface. One proposed deep injection well would be located on lands administered by RFO. The compressor station and one proposed deep injection well would be located on fee lands.

The MSUP contains surface operating procedures for the Companies’ federal Applications for Permits to Drill (APDs), as required under Onshore Order No. 1. The enclosed [Project Map](#) shows all proposed interim drilling activities associated with the Doty Mountain POD. Name, number, location, and lease information for the proposed wells and information on the proposed facilities are listed in **Table B-1 – Doty Mountain Project**. Additional information on each federal well is contained in the **BLM APD Form 3160-3 and Well Survey Plat**.

Wells are currently planned on federal leases WYW116179, WYW133658, WYW137692, and WYW141686 in T17N R91W, Sections 14 and 22. Lease stipulations that affect these sections are described below.

Lease WYW116179 contains a timing limitation stipulation in Section 22 to protect nesting habitat for raptors and greater sage grouse, from February 1 through July 31 (raptors), and from March 1 through June 30 (greater sage grouse and sharp tailed grouse). Lease WYW133658 contains a timing limitation stipulation in Section 14 to protect nesting habitat for raptors and greater sage grouse, from February 1 through July 31 (raptors), and from March 1 through June 30 (greater sage grouse and sharp tailed grouse). Lease WYW137692 contains a multiple mineral development stipulation and a timing limitation stipulation in Section 22 to protect nesting habitat for raptors and greater sage grouse, from February 1 through July 31 (raptors), and from March 1 through June 30 (greater sage grouse and sharp tailed grouse). Lease WYW141686 contains a timing limitation stipulation in Section 22 to protect nesting habitat for greater sage grouse, from March 1 through June 30.

The Companies are applying for a ROW to use existing roads and newly constructed roads as access to the Doty Mountain project area. An existing road runs northeast for about 2.5 miles from its intersection with County Road 608 in Section 23, T16N R92W, to a point in Section 7, T16N R91W, where new access road would be constructed. The proposed segment of new access road would follow an existing two-track that parallels Dry Cow Creek through Sections 5 and 6 in T16N R91W and Sections 27, 28, and 33 in T17N R91W.

TABLE B-1 DOTY MOUNTAIN PROJECT

| Proposed Gas Wells | | | |
|---|-------------------------------|--------------------|--|
| Lease Number | Well Name | Well Number | Location |
| WYW116179 (Anadarko) | AR Federal | 17-91-9-14 | T17N R91W Sec. 14 NESE |
| | AR Federal | 17-91-11-14 | T17N R91W Sec. 14 NESW |
| | AR Federal | 17-91-13-14 | T17N R91W Sec. 14 SWSW |
| | AR Federal | 17-91-15-14 | T17N R91W Sec. 14 SWSE |
| | AR Federal | 17-91-9-22 | T17N R91W Sec. 22 NESE |
| WYW137692 (Anadarko) | AR Federal | 17-91-1-22 | T17N R91W Sec. 22 NENE |
| WYW141686 (Double Eagle) | AR Federal | 17-91-3-22 | T17N R91W Sec. 22 NENW |
| | AR Federal | 17-91-5-22 | T17N R91W Sec. 22 SWNW |
| | AR Federal | 17-91-7-22 | T17N R91W Sec. 22 SWNE |
| | AR Federal | 17-91-11-22 | T17N R91W Sec. 22 NESW |
| | AR Federal | 17-91-13-22 | T17N R91W Sec. 22 SWSW |
| | AR Federal | 17-91-15-22 | T17N R91W Sec. 22 SWSE |
| WYW133658 (Double Eagle) | AR Federal | 17-91-1-14 | T17N R91W Sec. 14 NENE |
| | AR Federal | 17-91-3-14 | T17N R91W Sec. 14 NENW |
| | AR Federal | 17-91-5-14 | T17N R91W Sec. 14 SWNW |
| | AR Federal | 17-91-7-14 | T17N R91W Sec. 14 SWNE |
| Fee Lease | AR Fee | 17-91-1-23 | T17N R91W Sec. 23 NENE |
| | AR Fee | 17-91-3-23 | T17N R91W Sec. 23 NENW |
| | AR Fee | 17-91-5-23 | T17N R91W Sec. 23 SWNW |
| | AR Fee | 17-91-7-23 | T17N R91W Sec. 23 SWNE |
| | AR Fee | 17-91-9-23 | T17N R91W Sec. 23 NESE |
| | AR Fee | 17-91-11-23 | T17N R91W Sec. 23 NESW |
| | AR Fee | 17-91-13-23 | T17N R91W Sec. 23 SWSW |
| | AR Fee | 17-91-15-23 | T17N R91W Sec. 23 SWSE |
| Proposed Deep Injection Wells | | | |
| Lease Number | Well Name | Well Number | Location |
| WYW141686 (Double Eagle) | AR Federal | 17-91-22I | T17N R91W Sec. 22 NESW |
| Fee Lease (Anadarko) | AR Fee | 17-91-23I | T17N R91W Sec. 23 NENW |
| Proposed Facilities (specified locations only) | | | |
| Lease/ROW | Facility | Number | Location |
| Fee Lease | Compressor Station | DM-23 | T17N R91W Sec. 23 NENW |
| ROWs | Gathering Lines and Utilities | N/A | T17N R91W Secs. 14, 15, 22, 23 and 27 |
| ROW | Delivery Pipeline | N/A | T16N R91W Secs. 5, 6, 7 T16N R92W Sec. 12 T17N R91W Secs. 22, 27, 28, and 33 |

This MSUP is intended to serve as the ROW application for the gas lines, water lines, access roads to well locations, access road to the compressor station, and electric lines in the POD. Roads will require a 30-foot right-of-way. Gas-gathering lines will require a 30-foot right-of-way, water-gathering lines a 20-foot right-of-way, and electric lines a 10-foot right-of-way. The delivery pipeline will require a 50-foot right-of-way. All ROWs located in the same corridor will overlap each other to the maximum extent possible, while maintaining sound construction and installation practices. Where ROW corridors are located along a road, working space for installation of facilities will be along the road. All flowlines and roads have been collocated where possible. The enclosed **Project Map** shows the location of all access routes, gatherings lines, and the delivery pipeline.

The primary targeted reservoir in the Doty Mountain POD is coal seams within recognized productive formations of the Mesaverde Group. All unproductive wells will be plugged and abandoned as soon as practical after the conclusion of production testing. Productive wells may be shut-in temporarily for gas pipeline connections and/or Sundry Notices under review by the BLM for production activities and facilities.

The Doty Mountain POD contains approximately 1,920 acres. **Table B-2** summarizes the estimated disturbances that would result from implementing the project. The following schematics, which show typical facilities, operating standards, and methodologies, are attached to this MSUP: Drill Site Layout; Well Site; Water Disposal Facility; Water Transfer Facility; and Compressor Station. Additional schematics for this POD are attached to the Master Drilling Plan (MDP): B.O.P.; Bottom Flange; Configuration Options; Completed Well; and Injection Well.

TABLE B-2 ESTIMATES OF DISTURBED AREAS – DOTY MOUNTAIN PROJECT AREA

| Facility | Evaluation Phase | | | | Operations |
|--|------------------|--------------|-------------------|-----------------|-----------------------|
| | Length (feet) | Width (feet) | Area, ea. (acres) | Temporary Acres | Life of Project Acres |
| New Roads | 41,500 | 20 | N/A | 19.1 | 19.1 |
| Existing Well Access Road ^a | 1,300 | 20 | N/A | N/A | N/A |
| Road Construction Along Existing Two-tracks | 35,500 | 20 | N/A | 16.3 | 16.3 |
| New Gathering Lines | 54,900 | 30 | N/A | 37.8 | 0 |
| New Market Access Line | 37,700 | 50 | N/A | 43.3 | 0 |
| New Drill Pads (24) | N/A | N/A | 1.0 | 24.0 | 6.0 |
| New Deep Injection Wells ^c (2) | N/A | N/A | 1.0 | 2.0 | 2.0 |
| Existing Drill Pad (0) | N/A | N/A | N/A | N/A | N/A |
| Compressor Station | N/A | N/A | 2.2 | 2.2 | 2.2 |
| Water Transfer Facility (0) | N/A | N/A | 0.4 | 0 | 0 |
| Total Disturbance | | | | 144.7 | 45.6 |
| Total New Disturbance (excluding existing disturbance) | | | | 128.4 | 29.3 |

a. Existing access road in T16N R91W Section 7.

b. Improvement of existing two-tracks from Section 7 in T16N R 91W to Section 14 in T17N R91W

c. Deep injection wells would be collocated with other facilities (Figure 2-1).

Natural gas is naturally adsorbed to the surfaces of the coal matrix and typically is not free to migrate in the subsurface until pressure is relieved. Generally speaking, hydrostatic head provides the pressure that keeps the majority of the gas adsorbed to the coal. Gas is liberated from the coal matrix by the withdrawal of water, which in turn reduces the hydrostatic head present in the coal formation. Once a “critical” subsurface coal formation pressure is reached as water is pumped from the coal formation, gas is free to migrate. Gas will then flow or can be pumped to the surface through the wellbore.

The Companies plan to spud the wells during fall 2003. The wells will be drilled through the coal seam formations. The methane gas will be produced from the coal seams through perforations in the casing. Drilling and testing activities are expected to occur over several months. Wet gas from the productive wells will be routed to the compressor station by buried pipeline. Produced water will be gathered from the well sites and routed (by buried pipeline) to an approved injection well for disposal.

The wells may be tested for a period of months. Well testing involves pumping and testing water from each well and determining its capacity to produce natural gas. It is anticipated that well testing will be completed within 6 to 12 months. If unproductive, the drill holes will be plugged and abandoned in accordance with Wyoming Oil and Gas Conservation Commission (WOGCC) rules and regulations and BLM guidance as soon as practicable after the conclusion of well testing. If productive, natural gas will be collected and transported via buried pipelines to the compressor station.

An allocation meter will be used to measure raw produced gas volumes for each well in the POD. A sales meter will be located downstream of the final compressor and dehydration unit, at the compressor station, and will be used to measure dry salable-quality gas. A request for variance from Onshore Order No. 5, if needed, along with a description of the measurement equipment, will be submitted in a Sundry Notice if the wells are deemed producible.

During well testing associated with this project, natural gas, to the extent it is produced, will be vented or flared on-location in accordance with the applicable BLM Onshore Orders, Notices To Lessees, and WOGCC regulations, and authorized by the WOGCC and the BLM in Sundry Notices. During testing, produced water from the proposed wells will be transported off-location to an approved injection well for disposal.

Oil and gas activities in Wyoming are managed by the WOGCC. All of the Companies’ operations, and those of its contractors, will be conducted in accordance with all BLM and WOGCC rules and regulations.

Drill site locations will be on approved 80-acre spacing. The WOGCC has established an 80-acre well spacing pattern for wells completed in the Mesaverde Group in the Doty Mountain area, including the project area. Spacing for this area was established under Cause No. 1, Order No. 1, Docket Nos. 157-2001 and 113-2002.

1. EXISTING ROADS AND TRAVELWAYS

The project area is accessible from Baggs, Wyoming, by traveling approximately 20 miles north on WY 789 to the intersection with Carbon County Road 608, or south on WY 789 from Interstate 80 (I-80) to Carbon County Road 608. Turn east onto County Road 608 and travel approximately 3 miles northeast. In Section 23, T16N R92W, County Road 608 turns to the southeast and an existing road continues to the northeast. Turn northeast and travel approximately 6 miles to the project area.

The existing road runs northeast for about 2.5 miles from its intersection with County Road 608 in Section 23, T16N R92W, to a point in Section 7, T16N R91W, where new access road would be constructed. The proposed segment of new access road would follow an existing two-track that parallels Dry Cow Creek through Sections 5 and 6 in T16N R91W and Sections 27, 28, and 33 in T17N R91W. As stated previously, the Companies are applying for a ROW to construct road access along existing two-tracks that currently provide vehicle access and construct new road access to the project area. The remainder of the access road is on private surface and will be maintained by access agreement with fee surface owners.

Local roads are shown on the enclosed map of the project area. Existing roads and gates will be used when practical. If necessary, existing roads will be improved. All existing roads shall will be brought up to minimum standards for a Resource Road as found in BLM Manual 9113.

The existing roads will be maintained in the same or better condition as existed prior to the start of operations. Maintenance of the roads used to access the well locations will continue until final abandonment and reclamation of the well locations occur. A regular maintenance program will include, but is not limited to, blading, ditching, culvert installation and cleanout, and gravel surfacing where excessive rutting or erosion may occur. Limiting or temporarily suspending vehicle access during adverse conditions will reduce excessive rutting or other resource damage that may be caused by vehicle traffic on access roads that are wet, soft, or partially frozen. If vehicles create ruts in excess of 4 inches deep, the soil will be deemed too wet to adequately support vehicles, and routine activities shall be temporarily suspended.

Culverts will be placed in the existing BLM roads as the need arises or as directed by BLM's Authorized Officer. Gates and cattle guards will be installed where appropriate (refer to Project Map).

The Companies will share maintenance costs in dollars, equipment, materials, or labor proportionate to the Companies' use with other authorized users. Upon request, the BLM's Authorized Officer shall be provided with copies of any maintenance agreement entered into.

During periods of high potential for wildfire, extreme caution will be used in accessing the drill locations. To ensure that no ignitions occur, measures such as mowing the access rights-of-way or limiting vehicles may be undertaken as necessary. The Companies are sensitive to fire issues and risks in the western United States.

2. PROPOSED ACCESS ROUTES

Well Access

New access routes will be sited to avoid sensitive resource areas, such as leks, and areas susceptible to increased resource damage from the proposed project, such as areas of steep terrain or poor vegetative cover. Every effort will be made to minimize the amount of cut-and-fill construction needed to maintain safe, environmentally sound, year-round access to the well sites. The special conditions of approval specified for this POD by the BLM will be implemented.

Access to the individual well sites will be provided by crowned and ditched roads that are surfaced with an appropriate grade of gravel. To the extent possible, the access roads will follow existing terrain and two-tracks that would represent a sound alignment for a constructed road.

Where possible, roads will be constructed along existing two-tracks, as specified by BLM, to provide access to well sites. Newly constructed access routes will be crowned, ditched, and graveled, as specified by BLM. All equipment and vehicles will be confined to identified travel corridors and other areas specified in this MSUP. Gates and cattle guards will be installed where appropriate. The access roads will be surfaced with an appropriate grade of aggregate or gravel to a depth of 4 inches before the drilling equipment or rig is moved onto the pad.

Unless otherwise exempted, free and unrestricted public access will be maintained on the access road. All construction work will be accomplished as specified by the landowner and the BLM. Access roads will be maintained in a safe and usable condition. A regular maintenance program will include, but is not limited to, blading, ditching, installing or cleaning culverts, and surfacing. Maintenance work will be accomplished as specified by the BLM.

The access roads will be constructed to minimum standards for a BLM Resource Road, as outlined in BLM Manual 9113. The minimum travelway width of the road will be 14 feet with turnouts. No structure will be allowed to narrow the road top. The inside slope will be 4:1. The bottom of the ditch will be a smooth V with no vertical cut in the bottom. The outside slope will be 2:1 or shallower. Turnouts will be spaced at a maximum distance of 1,000 feet and will be intervisible.

Wing ditches will be constructed as deemed necessary to divert water from the road ditches. Wing ditches will be constructed at a slope of ½ percent to 1 percent.

Topsoil and vegetation will be windrowed to the side of the newly constructed access roads. After the roads are crowned and ditched with a 0.03 to 0.05 foot crown, the topsoil will be pulled back onto the cut slopes of the road right-of-way so no berm is left at the top of the cut slope.

Drainage crossings on the access routes will be low water crossings or crossings using “fish friendly” culverts. Crossings of tributaries to Dry Cow Creek will be accomplished according to BLM specifications. Low water crossings would be used in shallow channel crossings and at crossings of the main channel. Crossings of the main channel would consist of excavating an area approximately 4 feet deep, or deeper if specified by BLM, under the travelway and filling it with rock and gravel to the level of the drainage bottom. Channel banks on either side of these crossings would be cut down to reduce grade where necessary. Culverts would be installed on smaller, steeper channel crossings. Rip-rap will be added at the outlet of each culvert to minimize erosion. Topsoil would be conserved before channel crossing construction occurs. Additional culverts would be placed as the need arises or as directed by the BLM’s Authorized Officer. Also, the total area to be disturbed would be flagged on the ground for review during the onsite and before construction begins.

Where low water crossings are required, a 30-inch deep rock fill over geotextile through the drainage will be required. The rock fill will consist of 75 percent 3-inch to 10-inch diameter rough rock and 25 percent Wyoming Grading “W” Material to fill the voids. The geotextile will be overlapping at all joints and will extend beyond the rock fill. The top of the rock fill in the drainage bottom will match the elevation of the natural drainage to allow for smooth flow with no unnatural scouring or water backup. Four inches of course gravel over the rock will be used for the surface.

Culverts will be covered with a minimum of 12 inches of fill or one-half the diameter of the pipe, whichever is greater. The inlet and outlet will be set flush with existing ground and lined up in the center of the draw. Before the area is backfilled, the bottom of the pipe will be bedded on stable ground that does not contain expansive or clay soils, protruding rocks that would damage the pipe, or unevenly sized material that would not form a good seat for the pipe. The site will be backfilled with unfrozen material and rocks no larger than 2 inches in diameter. Care will be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill will be brought up evenly in 6-inch layers on both sides of the conduit and thoroughly compacted. A permanent marker will be installed at both ends of the culvert to help keep traffic from running over the ends. Culverts will be installed in a manner that minimizes erosion or head-cutting and may include rip rapping or other measures as required. Additional culverts will be placed in the access road as the need arises or as directed by BLM’s Authorized Officer.

If additional structures are warranted to maintain the access routes in acceptable condition during use, the affected road segments will be identified for BLM approval. In the event that specific BLM field survey requirements are not provided or do not exist, the field survey requirements described in BLM Manual 9113 will be followed.

The access roads will be winterized by providing a well-drained travelway to minimize erosion and other damage to the roadway or the surrounding public land. Construction activity or routine maintenance will not be conducted using frozen or saturated soil material or during periods when watershed damage is likely to occur.

No construction or routine maintenance activities will be performed during periods when the soil is too wet to adequately support construction equipment. If such equipment creates ruts in excess of 4 inches deep, the soil will be deemed too wet to adequately support construction equipment, and construction and maintenance will be temporarily suspended.

The written approval of the Authorized Officer will be obtained before snow removal is undertaken outside the new and existing roadways. If approval is given, equipment used for snow removal operations outside the road ditches will be equipped with shoes to keep the blade off the ground surface. Special precautions will be taken where the surface of the ground is uneven to ensure that equipment blades do not destroy the vegetation.

Design drawings and templates will be submitted only if specifically required by the BLM. A “plans-in-hand” review will be conducted with the drilling contractor prior to construction to review the access routes to the well sites. Directional markers will be set where needed and will be removed as soon as they are no longer needed.

If drilling is productive, all access roads to the well site would remain in place for well servicing (such as maintenance and improvements). Portions of the drill location outside the well pad that are no longer needed would be reclaimed. Any portions of the ROW for the access road that are no longer needed also would be reclaimed. The outside ditch cuts also would be seeded and reclaimed.

Compressor Station Access

The road to the compressor station in Section 23 will be constructed as an all-weather road with a travel width of approximately 14 feet, using requirements set out by the BLM, if no other requirements are provided by the landowner. All equipment and vehicles will be confined to the travel corridor and other areas specified in the POD. All disturbance related to this access road will be confined within the travel corridor.

3. LOCATION OF EXISTING WELLS

Seven permitted water wells are located within 1 mile of the project area (**Table B-3 Permitted Water Wells Within 1 Mile of the Doty Mountain Project Area**). Five of those wells are located within the inferred circle of influence (within a half-mile radius) of AEPC’s proposed gas wells. One of those wells yields water and is used to supply a stock pond, the remaining four are monitoring wells. All permitted wells are much shallower than the proposed wells and proposed injection zones, and are not expected to be impacted. This information, including the well site and other pertinent data, was obtained from the Wyoming State Engineer’s Office (WSEO).

Each Company will offer a water well agreement to the landowner for all wells within the circle of influence for that Company’s producible wells.

The enclosed **Project Map** shows locations of disposal, drilling, producing, injection, and abandoned oil and gas wells within 1 mile of the Doty Mountain POD wells. The well locations were obtained by a search of the WOGCC website.

TABLE B-3 PERMITTED WATER WELLS WITHIN 1 MILE OF THE DOTY MOUNTAIN PROJECT AREA

| Permit No. | Twn | Rng | Sec | Qtr/Qtr | Applicant | Facility Name | Use | YldAct | Well Depth | Stat Depth |
|-------------------|------------|------------|------------|----------------|---|----------------------|------------|---------------|-------------------|-------------------|
| P33768W | 17N | 91W | 15 | SWNW | Union Pacific Minerals Inc. | ARW 1 | MON, MIS | 0 | 280 | 144.88 |
| P54262W | 17N | 91W | 23 | NWNW | Union Pacific Minerals Inc. | AR 201 OW | MON, MIS | 0 | 220 | 64 |
| P54264W | 17N | 91W | 23 | SESW | Union Pacific Minerals Inc. | AR 200 OW | MON, MIS | 0 | 419 | 107 |
| P56613W | 17N | 91W | 23 | SWNW | P H Livestock Co. | Y Pasture #1 | STO | 5 | 120 | 35 |
| P59801W | 17N | 91W | 23 | NENW | WY Board of Land Commissioners Pan Artic Exploration LTD | 9C-16-19-89 | MON, MIS | Unk | Unk | Unk |
| P59802W | 17N | 91W | 23 | SWNW | WY Board of Land Commissioners Pan Artic Exploration LTD | 1-16-19-89 | MON, MIS | Unk | Unk | Unk |
| P17356W | 17N | 91W | 28 | NENE | USDI BLM | #4139 | STO | 5 | 100 | Unk |

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES, IF WELLS ARE PRODUCTIVE

On Well Pad

Wellhead facilities would be installed if the wells are productive. Natural gas and produced water would be collected and transported from the wellhead via buried pipelines. Gas and water would be measured as specified elsewhere in this MSUP.

The long-term surface disturbance at the location of each productive well would encompass approximately 0.25 acre, including cut and fill slopes. Typically, only the production facilities at the well site would be fenced or otherwise removed from existing uses. A loop road or a small, graveled pad area would provide a safe turnaround area for vehicles. The perimeter of the pad area would be fenced if adjacent cut and fill slopes represent a safety hazard for vehicles.

The wellhead facilities would be contained within an area covering approximately 15 feet by 15 feet. The surface equipment at each well will consist of the wellhead, a pump panel, and an insulated wellhead cover. Additionally, a vertical separator at some well sites would separate gas from the water stream. Each productive well is expected to require installation of an electric submersible pump below ground level, which will be used to produce water necessary to lower pressure within the coal seams. A schematic of a [Typical Well Site](#) is enclosed with the MSUP.

The Companies will paint structures at wells and central facilities with flat colors that blend with the adjacent undisturbed terrain. The paint used will be a color which simulates "Carlsbad Canyon" tan, color 2.5Y 6/2 of the "Standard Environmental Colors," unless otherwise specified by the BLM. This measure does not apply to structures that require safety coloration in accordance with the requirements of the Occupational Safety and Health administration (OSHA).

Electricity would be used to power pumps during well development and to initiate and maintain production. Engines fired by natural gas or propane would be used to run generators temporarily at individual wells until electric distribution lines are analyzed in the Atlantic Rim EIS and then constructed. If a well is productive, it will be shut-in until production facilities are constructed.

After construction of the production facilities, a temporary generator would be centrally located and used until permanent electrical services are installed. The Companies may choose to use centrally located generation equipment at the compressor station and an underground distribution system to supply power to well sites.

Where practical, utility lines on the well pad would be installed in the same trench as the gas-gathering and water-gathering lines to minimize surface disturbance. All utility lines would be buried in accordance with the Interim Drilling Policy.

Off Well Pad

Pipelines (Gathering Lines and Delivery Pipeline)/Compressor Station/ Water Handling and Disposal Facilities/Injection Wells/Tanks

The operator will submit a Sundry Notice for approval prior to construction of any new surface-disturbing activities on-lease that are not specifically addressed in the MSUP or individual APDs.

Pipelines

The ROWs for the gathering systems will typically follow access roads, except in a limited number of cases where topography dictates otherwise or as required by BLM. ROWs located in the same corridor will overlap each other to the maximum extent possible, while maintaining sound construction and installation practices. Where ROW corridors are located along a road, working space for installation of facilities will be along the road.

Trenches will be excavated to install the flowlines and electrical lines. Trenching will occur as close to the road prism as feasible. Gas-gathering and produced water-gathering pipelines (as well as utility lines) will be laid together in the same trench when practical. Trenches excavated for well gathering lines and electrical lines (which would require ROWs of 30 feet in width for gas lines, 20 feet in width for water lines, and 10 feet in width for electrical lines) are expected to temporarily disturb 30-foot wide corridors, which would be reclaimed as soon as practical after trenching and backfilling are completed. An additional area, estimated to be 10 feet wide, would not be disturbed during construction. However, it would be used to transport machinery, personnel, and equipment along the corridor to install flowlines and electrical lines wherever the gathering system would not follow an access road. This corridor is used to allow working room for the machinery, personnel, and equipment during the installation process. Corridors for the system of gathering lines in the Project Area would be 10.4 miles long. About 6.7 miles of corridors for gathering lines would be located on BLM surface ownership lands.

Construction and installation of gathering lines for gas and water would occur at the same time as access roads are constructed or immediately after drilling has been completed. Construction and installation of the gas delivery pipeline would occur after the producibility of the wells has been confirmed. All produced water used to test the integrity of the gas delivery pipeline (500 barrels [bbls] or 21,000 gallons) would be injected in deep injection wells. Pipeline corridors would be reclaimed as soon as practical after construction of the pipeline is complete. Three types of pipelines would be constructed as part of the proposed project:

1. A gas-gathering pipeline system (low pressure) would be constructed from the wellheads to the compressor station. This system would use high-density polyethylene (HDPE) pipe, starting with 4-inch diameter pipe at the wellhead and graduating up to 12-inch diameter pipe at the inlet to the compressor.

2. A produced water-gathering pipeline system (low pressure) would be constructed from the wellheads to the centralized facilities for deep injection. This network of water lines would use 4-inch through 12-inch diameter pipe made of HDPE.
3. Should encouraging quantities of natural gas be discovered, a gas delivery pipeline (high pressure) would be constructed. This pipeline would be constructed of 8-inch diameter steel pipe.

The alignment of the delivery line from the compressor station to the existing transmission pipeline is shown on the **Project Map**. The Companies are applying for a ROW for the delivery pipeline that would be buried 6 feet deep on a 50-foot wide ROW. This pipeline would be anchored at the compressor station and would proceed southwest to the existing pipeline in Section 12 of T16N R92W. This gas delivery pipeline would be 7.2 miles long, of which about 6.6 miles would be located on BLM surface ownership lands.

Construction and installation of this delivery pipeline would temporarily disturb a 50-foot wide corridor, which will be reclaimed as soon as practical after construction is completed. An area, estimated to be 25 feet wide, would not be disturbed during construction, but would be used to transport machinery, personnel, and equipment along the corridor to install the pipeline wherever the delivery pipeline would not follow an access road. This corridor would allow working room for machinery, personnel, and equipment during the installation process.

The delivery pipeline will be constructed using open cut construction methods for upland areas, and dry ditch construction methods for water body crossings. The disturbed area will be kept to a minimum. Surface soil material will be stockpiled to the side and segregated. Surface soil material will not be mixed or covered with subsurface material. Trenches will be compacted during backfilling. Pipeline routes will be graded to conform to the adjacent terrain. Cuts and fills will be made only where necessary. After construction, cut and fill slopes will be waterbarred or regraded to conform to the adjacent terrain, as specified by BLM. The constructed pipeline will not block, dam, or change the natural course of any drainage. Water body crossings will be completed as quickly as possible, with ditching, pipeline installation, and backfilling completed in less than 48 hours if possible. All minimum requirements contained in the pipeline safety regulations of the U.S. Department of Transportation will be met or exceeded.

The Companies would complete the pipeline during periods when key habitats are not occupied to limit human presence in and disturbance of key wildlife habitats during critical periods of use. The availability of adequate working space would accelerate construction.

In order to minimize surface disturbance, the operator will use wheel trenchers (ditchers) or ditch witches, where possible, to construct all pipeline trenches associated with this project. Track hoes or other equipment will be used where topographic or other factors require their use.

Trenches that are open for the installation of pipelines will have plugs placed no more than 1,000 feet apart to allow livestock and wildlife to cross the trench or walk out of it, if needed. Placement of plugs will be determined in consultation with BLM and any affected landowner.

Procedures will be implemented to prevent livestock or wildlife from falling into open excavations. Procedures could include temporary covers, fencing, or other means acceptable to BLM and any affected landowner.

Compressor Station

The compressor station will be sited to allow for the installation of one compressor initially, with the addition of up to two more compressors later in the life of the field. Each compressor would be sized to handle 5 million cubic feet per day (MMCFD) from 15 pounds per square inch (psi) suction pressure to 1,200 psi discharge pressure. Each compressor would be driven by a natural gas engine that would be designed to meet all specifications established by the Wyoming Department of Environmental Quality, Air Quality Division (WDEQ–AQD). Engines used to drive compressors would have emissions of less than 1.5 grams per brake horsepower per hour (g/bhp-hr), or less than 16.7 tons per year of nitrogen oxides (NO_x), and 0.5 g/bhp-hr, or less than 5.6 tons per year of carbon monoxide (CO). Additional equipment at the compressor station would include a tri-ethylene glycol (TEG) dehydration system, which would dry the gas to meet pipeline-quality specifications of the market pipeline.

The compressor station facility is expected to be constructed within a site area covering approximately 300 feet by 300 feet (see enclosed **Typical Compressor Station**). In addition to the facilities on the pad, the Companies will construct drainage ditches to divert stormwater away from the compressor station pad. About one-half of the compressor station site area will be affected by construction, maintenance, and operation of the facility. The compressor station facility will be of all-weather construction, having a thick layer of gravel surfacing over the pad site. Topsoil will be removed and conserved for later reclamation activities. The compressor station will consist of an insulated header building containing a separator or a separator and allocation meters for each well. The compressor station will also have a dehydrator that will remove water from the wet gas stream. The water will be pumped from the header building to an approved injection well. If different production facilities are required, plans will be submitted in a Sundry Notice.

Water Handling and Disposal Facilities and Injection Wells

Within 90 days of initial production start-up, the operator will submit an analysis of the produced water to the BLM's Authorized Officer. Approval of this POD includes approval for Onshore Order #7 to dispose of produced water. Produced water will be injected into an authorized injection well (**Table B-1**), except as noted below. Any changes in the produced water disposal method or location must receive written approval from BLM's Authorized Officer before the changes take place.

A small portion of the water produced from gas wells (about 5 gallons per minute at each location identified on the Project Map) may be dispensed for use by livestock at locations specified by BLM and the surface owners. The water will be piped into self-contained tire tanks that will not discharge produced water into surface drainages.

Water produced at the well sites will be gathered and transported to an injection well for disposal. Each injection well will be drilled, cased, and cemented from total depth (TD) to surface (see attached schematic of **Typical Injection Well**). Produced water will be injected in one of two deep injection wells completed in the Cherokee/Deep Creek Sandstones. One of the deep injection wells would be a federal well.

The deep injection wells would be drilled with the same equipment and personnel used for the gas wells. Depth of the injection wells, which would be completed in the Cherokee or Deep Creek sands, is expected to be between 3,800 and 4,600 feet. Drilling and completing each deep injection well would require approximately 7 to 14 days; installing surface equipment, holding tanks, and pumping equipment may require an additional 14 days.

The Companies' proposed activities within the Doty Mountain area have been subdivided by location to highlight water handling methods proposed in each area. All water used to test the integrity of gathering lines would be injected at a deep injection well.

Northern Area - Section 14 (N1/2) – Produced water from four proposed federal wells in this area would be injected at the deep injection well in Section 23 (AR Fee 17-91-23I).

Central Area – Section 14 (S1/2), Section 22 (E1/2E1/2), and Section 23 (All) – Produced water from 14 proposed wells (eight fee wells and six federal wells) in this area would be injected at the AR Fee 17-91-23I deep injection well in Section 23 or the deep injection well in Section 22 (AR Fed 17-91 22I).

Western Area – Section 22 (W1/2 and W1/2E1/2) – Produced water from six proposed federal wells in this area would be injected at the deep injection well in Section 22 (AR Fed 17-91 22I).

The source of the water to be disposed is the coals in the Mesaverde Group. Coal bed formation water (produced water) will be collected in a buried polyethylene flowline (pipeline) for transport to the water disposal facility location approved by the WOGCC and the BLM.

A typical water disposal facility would consist of a pad of approximately 200 feet by 200 feet that would disturb an estimated 1.0 acre, including cut and fill slopes. Each facility would contain four 400-bbl water tanks, pump house, piping, and well house (see attached schematic of **Typical Water Disposal Facility**). An approximate 3.5-foot berm would be constructed around the perimeter of the water tanks, excluding the pump shed, at each disposal facility to contain any potential spills on the pad. The pump shed would be excluded from the berm area to minimize the potential for electrical or safety hazards that could occur if water entered the pump shed and caused electrical shorts. The berm

would be constructed to contain the water from the largest tank, plus 10 percent, and maintain a freeboard (extra capacity) of 1 foot.

Transfer pumping stations, consisting of two 400-bbl water tanks with associated pump and piping, may be needed (see attached **Typical Water Transfer Facility**). Water transfer pumping stations may be used during production operations to transfer produced water from the gas wells to the injection facilities. The transfer pumping stations are needed in areas where differences in elevation require supplemental pumping to transfer the produced water. Each pumping station would contain up to two 400-bbl water tanks, an inlet separation vessel, and a small centrifugal water pump. A small pump shed would be constructed to enclose the pump. Each pumping station would consist of a pad of approximately 125 feet by 125 feet that would disturb an estimated 0.4 acre, including cut and fill slopes. An approximate 3.5-foot berm would be constructed around the perimeter of the water tanks, excluding the pump shed, at each pumping station to contain any potential spills on the pad. The pump shed would be excluded from the berm area to minimize the potential for electrical or safety hazards that could occur if water entered the pump shed and caused electrical shorts. The berm would be constructed to contain the water from the largest tank, plus 10 percent, and maintain a freeboard (extra capacity) of 1 foot. These transfer stations will be located near proposed disturbance areas, outside cultural sites, and, where possible, away from any known sensitive wildlife or resource areas. Final location of the water transfer facilities will be submitted in a Sundry Notice.

Tanks

The water tanks at transfer and disposal facilities will be constructed, maintained, and operated to prevent unauthorized surface or subsurface discharges of water. The tanks will be located away from the established drainage patterns in the area and will be constructed to prevent the entrance of surface water.

The closed-top water tanks will be fenced or capped to prevent livestock or wildlife entry.

The water tanks will be kept reasonably free from surface accumulations of liquid hydrocarbons and are not to be used for disposal of water from other sources without the prior approval of the BLM. Any discharge from the tanks will be reported to the BLM as required by NTL-3A.

All storage tanks and compressor facilities designed to contain oil, glycol, produced water, frac-ing fluids, or other fluid, which may constitute a hazard to public health or safety, will be surrounded by a secondary means of containment for the entire contents of the largest single tank in use, plus one foot of freeboard. The 3.5 foot berms planned for any closed produced water tanks used at well sites before flowlines are constructed, closed tanks to hold frac-ing fluids during well completion and testing, water disposal facilities, and water transfer facilities will contain the contents of the largest tank in use at that site, plus one foot of freeboard. The containment or diversionary structure will be impervious to any oil, glycol, produced water, or other toxic fluid for 72 hours and would be constructed so that any discharge from a primary containment system would not drain, infiltrate, or otherwise escape to groundwater, surface water, or navigable waters before cleanup is completed.

5. LOCATION AND TYPE OF WATER SUPPLY FOR DRILLING

Water to drill the first well will be trucked to the Doty Mountain project area from the AR Fee 20 89 SE29 well located in T20N R89W, Section 29.

Water produced from project wells will be transported to nearby drilling locations and used to drill subsequent wells.

Water for use in drilling the wells would be obtained from existing wells completed in the coal seams of the Mesaverde Group. Approximately 700 barrels of water (almost 30,000 gallons) would be needed to drill each well. The actual volume of water used in drilling operations would depend on the depth of the well and any losses that might occur during drilling. The proposed project also would require almost 70,000 gallons of water per well for preparation of cement and stimulation of the well (14,000 gallons) and control of dust (55,440 gallons). In all, nearly 100,000 gallons (about 0.3 acre-feet) of water per well would be used.

Any changes in the water source or method of transportation must receive written approval from BLM's Authorized Officer before the changes take place.

6. CONSTRUCTION MATERIALS

Construction materials (mineral material aggregate suitable for surfacing material) will be purchased from a nearby private source or a local supplier having a permitted source of materials in the area. No construction materials will be removed from federal and/or Indian lands without prior approval from the BLM.

7. METHODS FOR HANDLING WASTE DISPOSAL

Drill cuttings (rock fragments generated during drilling) will be produced during drilling of the borehole. Cuttings will be buried in the reserve pit upon closure of the reserve pit.

No oil or other oil-based drilling additives, chromium/metals-based muds, or saline muds will be used during drilling of these wells. Only fresh water, biodegradable polymer soap, bentonite clay, and non-toxic additives will be used in the mud system. Details regarding the mud program are incorporated within the MDP. These wells will not produce oil or salt water typical of oil production. Furthermore, other liquid hydrocarbons are not anticipated. Should unexpected liquid petroleum hydrocarbons (crude oil or condensate) be encountered during drilling or well testing, all liquid petroleum hydrocarbons will be contained in test tanks on the well site.

Dust abatement will comply with all applicable WOGCC, WDEQ, or BLM requirements. Only water suitable for livestock use will be used for dust abatement. Only disturbed areas will be sprayed. Spraying will be done to reduce runoff and channelized flow.

A portable, self-contained chemical toilet will be provided on location during drilling and completion operations. Upon completion of operations, or as required, the contents of toilet holding tanks will be disposed of at an authorized sewage treatment and disposal facility. Disposal will be in accordance with State of Wyoming, Carbon County, and BLM requirements regarding sewage treatment and disposal. The Companies will comply with all state and local laws and regulations pertaining to disposal of human and solid wastes.

No trash will be placed in the reserve pit. All refuse (trash and other solid waste including cans, paper, cable, etc.) generated during construction, drilling, and well testing activities will be contained in an enclosed receptacle, removed from the drill locations promptly, and hauled to an authorized disposal site.

Immediately after removal of the drilling rig, all debris and other waste materials not contained within trash barrels will be cleaned up and removed from the well location. No potentially adverse materials or substances will be left on the drill locations.

Hazardous Materials Management

All project-related activities involving hazardous materials will be conducted in a manner that minimizes potential environmental impacts. An on-site file will be maintained containing current Material Safety Data Sheets (MSDS) for all chemicals, compounds, or substances that are used in the course of construction, drilling, completion, production, and reclamation operations. Netting will be placed over any pits that may contain hazardous substances (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Section 101(14)), as determined by visual observation or testing. The mesh diameter shall be no larger than 1 inch.

No hazardous substance, as defined by CERCLA, will be used in the construction or drilling operations associated with these wells. No Resource Conservation and Recovery Act (RCRA) hazardous wastes will be generated by well-drilling operations. The term “hazardous materials” as used here means: (1) any substance, pollutant, or containment (regardless of quantity) listed as hazardous under CERCLA of 1980, as amended 42 U.S.C. 9601 et seq., and the regulations issued under CERCLA; (2) any hazardous waste as defined in RCRA of 1976, as amended; and (3) any nuclear or nuclear byproduct as defined by the Atomic Energy Act of 1954, as amended, 42 U.D.C. 2001 et seq. The operator will be required to provide a referenced list of hazardous materials that could be used, produced, transported, disposed of, or stored on the well location including a discussion on the management of the hazardous materials.

Any spills of oil, gas, or any other potentially hazardous substance will be reported immediately to the BLM, landowner, local authorities, and other responsible parties and will be mitigated immediately, as appropriate, through cleanup or removal to an approved disposal site.

8. ANCILLARY FACILITIES

Several self-contained travel-type trailers may be used onsite during drilling operations. No facilities other than those described in this MSUP will be constructed to support the operations associated with the wells.

9. WELL SITE LAYOUT

A schematic drawing of the **Typical Drill Site Layout** used for each well is enclosed with this MSUP. Information on each federal well is contained in the **BLM APD Form 3160-3, Well Survey Plat, and Drill Pad Cross Section** already on file with BLM. The cross section shows the orientation of the drill pad with respect to the topographic features (cut and fill), facilities, and access to the pad.

At each drill location, surface disturbance will be kept to a minimum. The areal extent of each drill pad is approximately 200 feet by 200 feet. Each drill pad will be leveled using cut and fill construction techniques where needed. Prior to constructing the drill pad the top 6 to 8 inches of soil (more if available) and associated vegetative material will be removed and stockpiled. Drainage ditches will be constructed to divert stormwater away from each pad. All surface disturbance related to drilling will be confined to each drill site.

The Companies plan to use one reserve pit at each drilling location. A reserve pit is used during drilling to circulate the drilling mud (mostly bentonite clay and fresh water) and rock cuttings out of the borehole and for holding drilling fluids. This pit will be designed and constructed according to WOGCC and BLM requirements.

Each reserve pit will be approximately 20 feet deep (including 2 feet of freeboard), and will be 40 feet wide and 40 feet long (at the surface). Each pit will be excavated within the “cut area” of the drill site to minimize any potential for slope failure. Each pit will be designed to prevent collection of surface runoff and will be closely monitored to ensure no pit overflows occur. The reserve pit will be open for an estimated 2 to 8 weeks to allow for evaporation of pit fluids. During this time the pit will be closed off from wildlife and livestock by two strands of barbed wire above a woven wire fence.

Each reserve pit will be constructed in a manner that minimizes the accumulation of surface precipitation runoff into the pit. This will be accomplished by appropriate placement of subsoil/topsoil storage areas or construction of berms or ditches.

Netting will be placed over any pits that have been identified as containing oil, as determined by visual observation or testing. The mesh diameter will be no larger than 1 inch. For the protection of livestock and wildlife, all pits and open cellars will be fenced. Fencing shall be in accordance with BLM specifications.

A conventional drilling rig would be used to drill the gas wells. Additional equipment and materials needed for drilling operations would be trucked to the drill location. Depending on the location of the coal seam, each producing well would be drilled to a depth of 2,275 feet to 3,100 feet or deeper. Methane gas in the coal seam would be

produced through perforations in the casing. The well control system will be designed to meet the conditions likely to be encountered in the hole and will conform to BLM and State of Wyoming requirements.

The drilling and completion operation for a shallow gas well normally requires a maximum of 10 to 15 workers at a time, including personnel for logging and cementing. Each well would be drilled within 7 to 10 days. A well completion program may be initiated to stimulate production of gas and to evaluate the characteristics of gas and water production in preparation for production of gas from a drilled, cased, and cemented well. Wells determined to be productive would be shut in until pipelines and other production facilities are constructed.

A mobile completion rig similar to the drill rig may be transported to the well site and used to complete each well. Completion operations are expected to average 2 to 5 days per well. When the applicable permits are received, methane gas may be vented or flared. Formation water may be temporarily contained in the reserve pit during drilling and well completion activities. All frac-ing fluids will be contained in closed tanks on location. During the testing period, produced water from the Mesaverde aquifer will be contained in closed tanks on location or trucked to an authorized disposal well, pending the completion of flowlines for produced water. All closed tanks on location will be encompassed by a 3.5 foot berm that will contain the entire contents of the largest tank in use, plus 10 percent, with one foot of freeboard, as authorized by BLM.

10. PROGRAMS FOR RECLAMATION OF THE SURFACE

BLM surface ownership lands that contain disturbed areas or facilities that are no longer needed would be reclaimed at the earliest opportunity in accordance with applicable regulations and agency guidance. Non-federal lands would be reclaimed in accordance with the requirements of the surface owner.

Roads, culverts, cattle guards, pipelines, stock water facilities, or other structures could be left in place at the end of the project for any beneficial use, as designated by the affected surface owners and BLM. Water wells and produced water would be available to the surface owners and BLM, provided that appropriations, diversions, and storage rights are properly filed with the WSEO.

As soon as practical after the conclusion of drilling and testing operations, unproductive drill holes will be plugged and abandoned and site reclamation will commence. The BLM will be notified prior to commencement of reclamation operations. A Notice of Intent to Abandon will be filed for final recommendations regarding surface reclamation.

Upon completion of drilling, the reserve pit will be dewatered and reclaimed in accordance with BLM guidance. Typically, this procedure involves allowing the contents to dry naturally, and then backfilling, re-contouring, and reclaiming the reserve pit area to approximate pre-drilling site conditions. The reserve pit will be backfilled with a minimum cover of 5 feet of soil or subsoil material.

After abandonment of productive wells, all wellhead equipment that is no longer needed will be removed, and the well sites will be restored.

Any areas, including the drilling locations, reserve pits, or access routes, that are disturbed by earthwork will be recontoured to a natural appearance as near to the original contour as possible as soon as practical after the conclusion of operations. Any flowline trenches that may be constructed will be backfilled completely.

Recontoured areas will be graded to be outsloped, and waterbreaks will be constructed where needed to avoid concentrating surface waters and producing gullies. The land surface will be left “rough” after recontouring to ensure that the maximum surface area will be available to support the reestablishment of vegetative cover.

All topsoil conserved during earthwork will be redistributed evenly and left “rough” over these recontoured areas. BLM goals for vegetative cover will guide revegetation efforts. Common goals are erosion control, weed control, palatable and nutritious forage for livestock and wildlife, and visual aesthetics.

Revegetation efforts will comply with BLM specifications on all BLM surface ownership lands. If no specifications are provided, the following specifications will be used. Seeding is expected to occur in the fall after September, prior to ground frost, or in the spring after frost has left the ground. The seed mixture, including fertilizer and mulching requirements, seeding depth, and seed drilling specifications, will be developed in consultation with the BLM. Seed will be drilled on the contour using a seed drill equipped with a depth regulator to ensure even depths of planting. Seed will be planted between one-quarter to one-half inch deep. The anticipated seed mix to be applied and rates of application are listed below in **Table B-4**. Soil material that will be stockpiled for 10 months or longer will be seeded according to BLM specifications, to the extent practicable. Prior to seeding, the stockpile will be protected from wind and water erosion by roughening the soil surface, covering the stockpile with vegetation that has been removed, and mulching, if necessary.

TABLE B-4 SEED MIX FOR RECLAMATION

| Species | Rate of Application* |
|--------------------|-----------------------------|
| Western Wheatgrass | 4 lbs./Acre |
| Green Needlegrass | 4 lbs./Acre |
| Indian Ricegrass | 4 lbs./Acre |
| Sandberg Bluegrass | 0.5 lbs./Acre |
| Gardner’s Saltbush | 1 lb./Acre |
| Winterfat | 0.5 lbs./Acre |

These rates of application apply to pure live seed (PLS) that is used for drill seeding. For broadcast seeding, the rates of application will be doubled.

11. SURFACE OWNERSHIP

U.S. Bureau of Land Management
Rawlins Field Office
1300 North Third
Rawlins, Wyoming 82301-2407
(307) 328-4200

Cecil Ray and Kathleen Weber (*Sections 23 & 27*)
P.O. Box 70
Baggs, Wyoming 82321
(307) 383-7213

12. OTHER INFORMATION

A [Water Management Plan](#) is enclosed with this MSUP.

The Companies are the lessee or operator for the federal oil and gas leases associated with this MSUP and these APDs.

No slopes in excess of 25 percent would be affected by this proposal. No activities are planned near existing highways, railroads, pipelines, or powerlines. There are no occupied buildings or residences within one-quarter mile of the proposed drill sites.

Any road crossings of dry drainages, riparian, or other wetland areas will use appropriate Best Management Practices (BMP) to minimize impacts to these areas.

The presence, distribution, and density of noxious weeds in the project area will be monitored. The well access roads and well pads will be inspected regularly to ensure that noxious weeds do not become established in newly disturbed areas. Control methods will be based on available technology, taking into consideration the weed species present. Methods of noxious weed control may include revegetation of disturbed areas to reduce the potential for and success of weed establishment, mowing, hand-pulling, or application of appropriate herbicides. All BLM requirements associated with the control of noxious weeds will be met.

The project area encompasses public lands that contain sagebrush/grassland vegetation communities on undulating uplands, terraces, and riparian areas along drainages. The existing stream channels are ephemeral and are partially vegetated with grasses and shrubs. Several perennial springs occur approximately 1 mile east of the project area. However, the springs are contained in stock ponds and do not form perennial streams. Muddy Creek, a perennial stream, occurs about a mile north of the project area.

Local flora consist primarily of needlegrass, western wheatgrass, prairie junegrass, blue grama grass, Indian rice grass, prickly pear cactus, and two varieties of big sagebrush intermixed with rabbitbrush, snakeweed, horsebrush, and occasionally dense greasewood. Local fauna consist primarily of mule deer, antelope, greater sage grouse, coyotes, rabbits, raptors, and various smaller vertebrate and invertebrate species.

Livestock graze on some of these lands. Oil and gas activities have occurred in the general area.

Soils have a fair reclamation potential provided the hazards of wind and water erosion are mitigated through the use of surface roughening, management of grubbed vegetation, surface mulch, adequate water breaks, and drainage structures in recontoured areas. With proper management, suitable soil material is available to reestablish vegetation at the conclusion of project activities.

A cultural/historical resource inventory has been conducted on the public lands by a qualified archaeologist permitted in Wyoming by the BLM. A block survey for cultural resources was required by the BLM for the Doty Mountain POD. The findings have been submitted under separate cover. Any additional areas of potential effect identified subsequent to the completion of these reports will be inventoried as specified by the BLM, and a supplemental report will be prepared.

Landowner Notification

The Companies would obtain a surface use agreement with the landowner.

13. SITE-SPECIFIC CONDITIONS OF APPROVAL

Wildlife Stipulations

Wells AR Federal 17-91-3-22, AR Federal 17-91-5-22, AR Federal 17-91-7-22, AR Federal 17-91-11-22, AR Federal 17-91-13-22, AR Federal 17-91-15-22, and AR Federal 17-91-22I

Construction, drilling, and other activities potentially disruptive to strutting and nesting of greater sage grouse or sharp tailed grouse are prohibited during the period of March 1 through June 30 for the protection of nesting areas.

Road and Well Pad Minimum Requirements

Culverts (minimum 18 inches in diameter) will be placed in drainages and draws that are shown on the enclosed [Project Map](#).

14. LESSEE'S REPRESENTATIVE AND CERTIFICATIONS

Representative for Anadarko E & P Company

Name: William M. Fowler
Title: Environmental and Regulatory Affairs Manager
Address: 1201 Lake Robbins Drive
City/State/Zip: The Woodlands, Texas 77380
Phone: (832) 636-3167

Bonding

BLM Nationwide Bond, WY 1280, \$150,000

Certification

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drill sites and access routes; that I am familiar with the conditions which currently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and that the work associated with the operations proposed herein will be performed by AEPC and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved. This statement is subject to the provisions of 18 U.S.C 1001 for the filing of a false statement.

I also certify that AEPC will comply with the provisions of the law or the regulations governing the Federal or Indian right of reentry to the surface under 43 CFR 3814.

I also certify that AEPC has reached or will reach an agreement with the surface owner(s) and surface lessee(s) regarding the requirements for the protection of surface resources and reclamation of disturbed areas and/or damages in lieu thereof, or if an agreement cannot be reached, will comply with the provisions of the law or the regulations governing Federal or Indian right of reentry to the surface under 43 CFR 3814.

I also certify that:

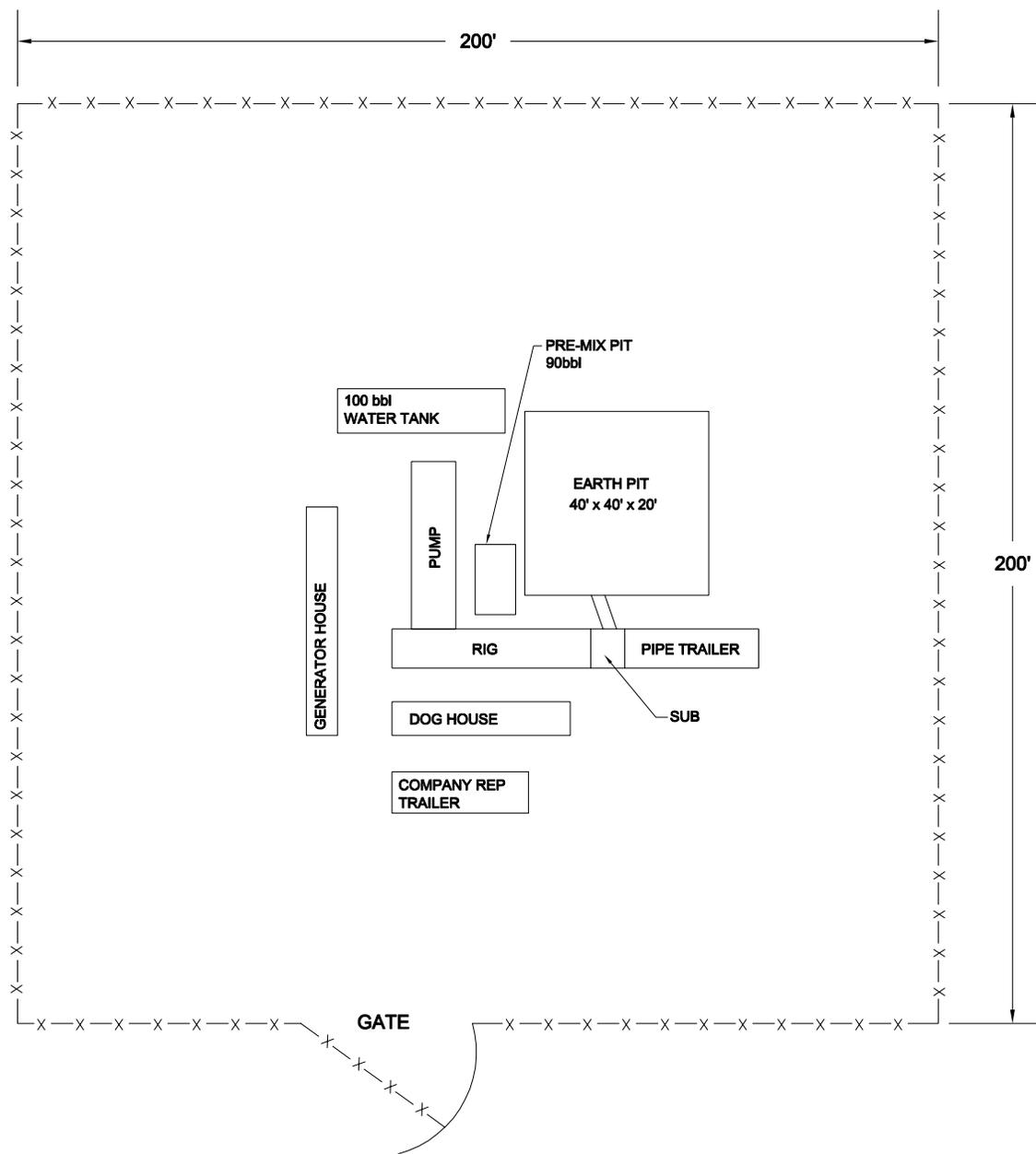
- A. All potentially affected landowners having properly permitted water wells with the WSEO within each producible well's Circle of Influence (one-half mile radius) will be offered a Water Well Agreement; and
- B. If a Water Well Agreement is not reached with the landowner, AEPC agrees to mitigate the impacts of its producible wells in accordance with State of Wyoming water laws; and
- C. Permits to Appropriate Groundwater have been applied for from the Wyoming State Engineer's Office, concurrently with these Applications for Permits to Drill.

I also certify that AEPC shall use its best efforts to conduct its approved operations in a manner that avoids adverse effects on any properties which are listed, or may be eligible for listing, in the National Register of Historic Places (NRHP). If historic or archaeological materials are uncovered during construction, the operator will immediately stop work that might further disturb such materials, and contact the authorized officer (or his/her representative) at the BLM Rawlins Field Office. Any paleontological resources or fossils discovered as a result of operations associated with these wells will be brought to the attention of the authorized officer or his/her representative immediately. All activities in the vicinity of such discoveries will be suspended until notified to proceed by the Authorized Officer.

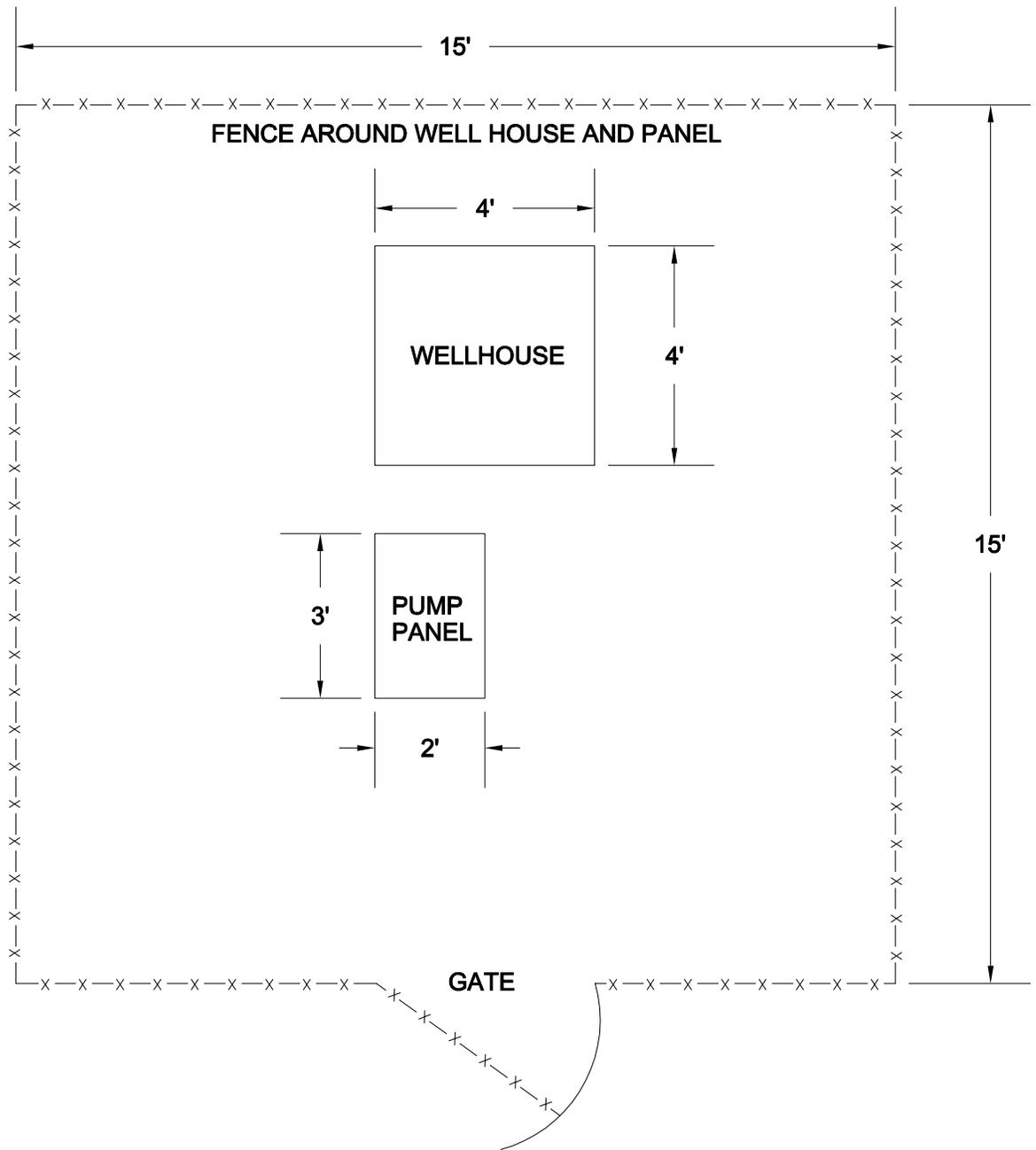
I also certify that AEPC shall use its best efforts to conduct its approved operations in accordance with the Project-wide Mitigation Measures and procedures outlined in Chapter 2 of the Environmental Assessment (EA) for this project.

By: _____
William M. Fowler
Environmental and Regulatory Affairs Manager
Anadarko E & P Company

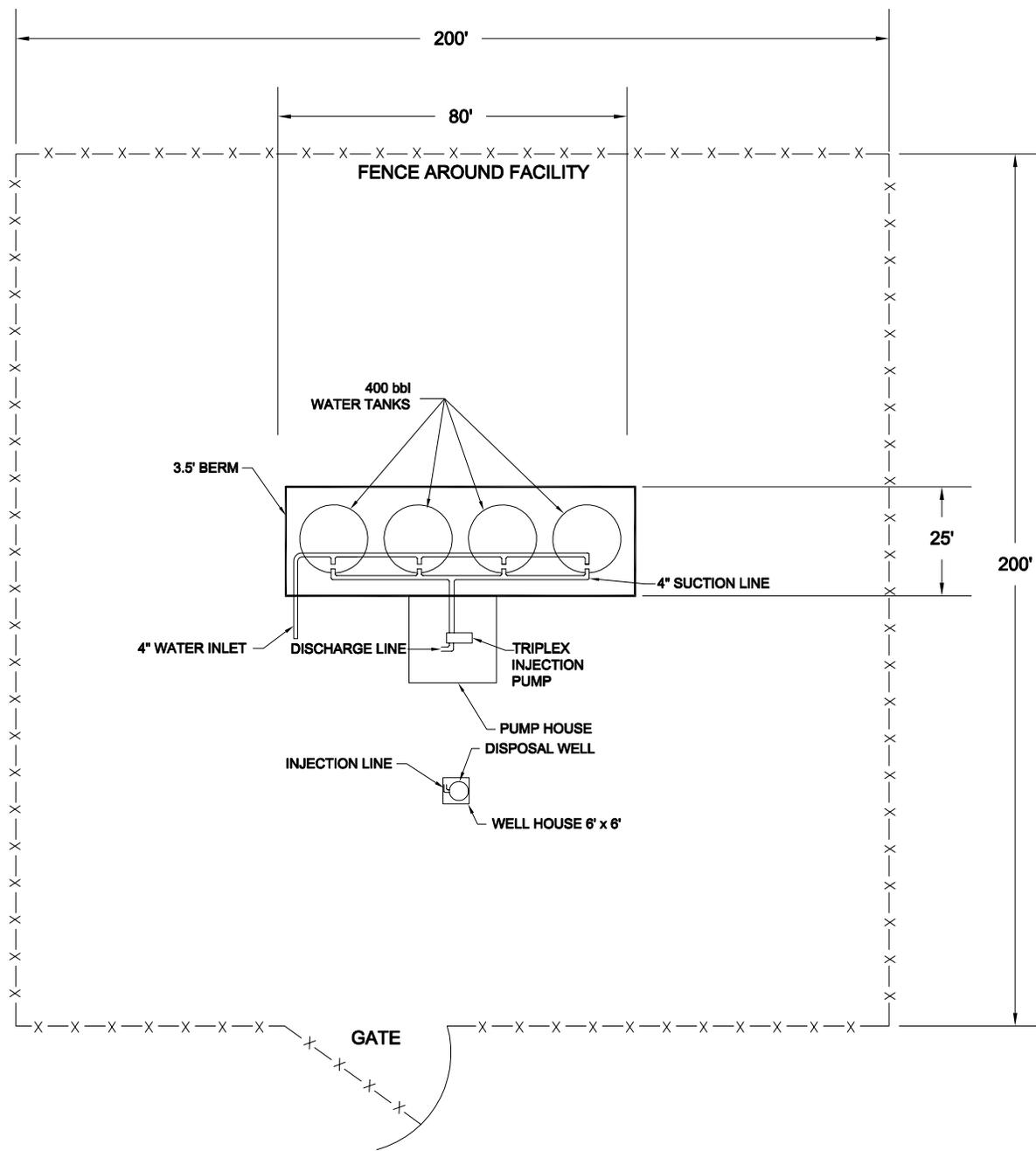
Date: _____



| | | | |
|---|----------------|---------------|--|
|  | | | |
| TYPICAL DRILL SITE LAYOUT | | | |
| | | | |
| SCALE: NTS | DATE: 10.08.03 | DRAWN BY: ETC | |

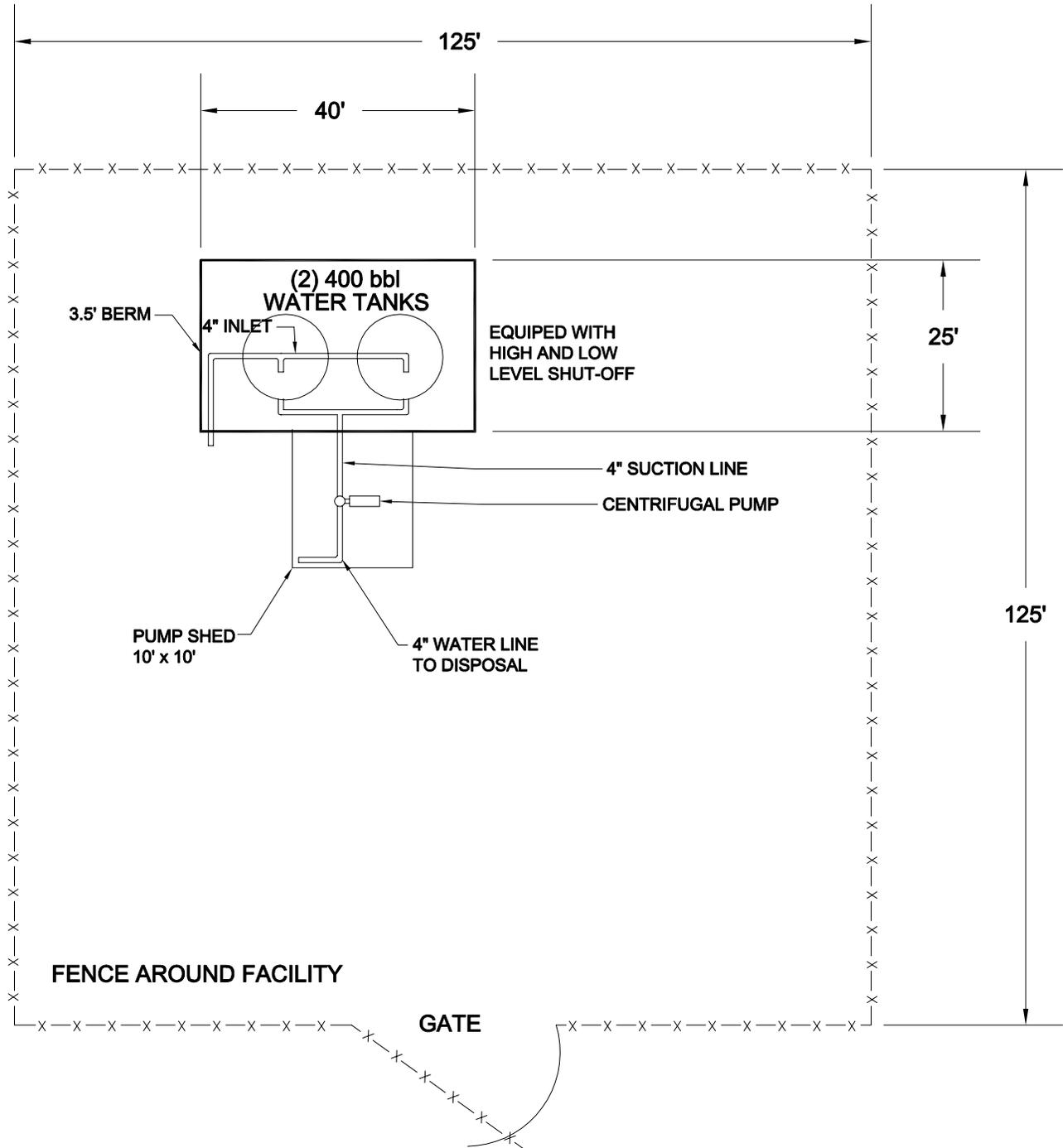


| | | | |
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| TYPICAL WELL SITE | | | |
| | | | |
| SCALE: NTS | DATE: 10.08.03 | DRAWN BY: ETC | FIGURE: |



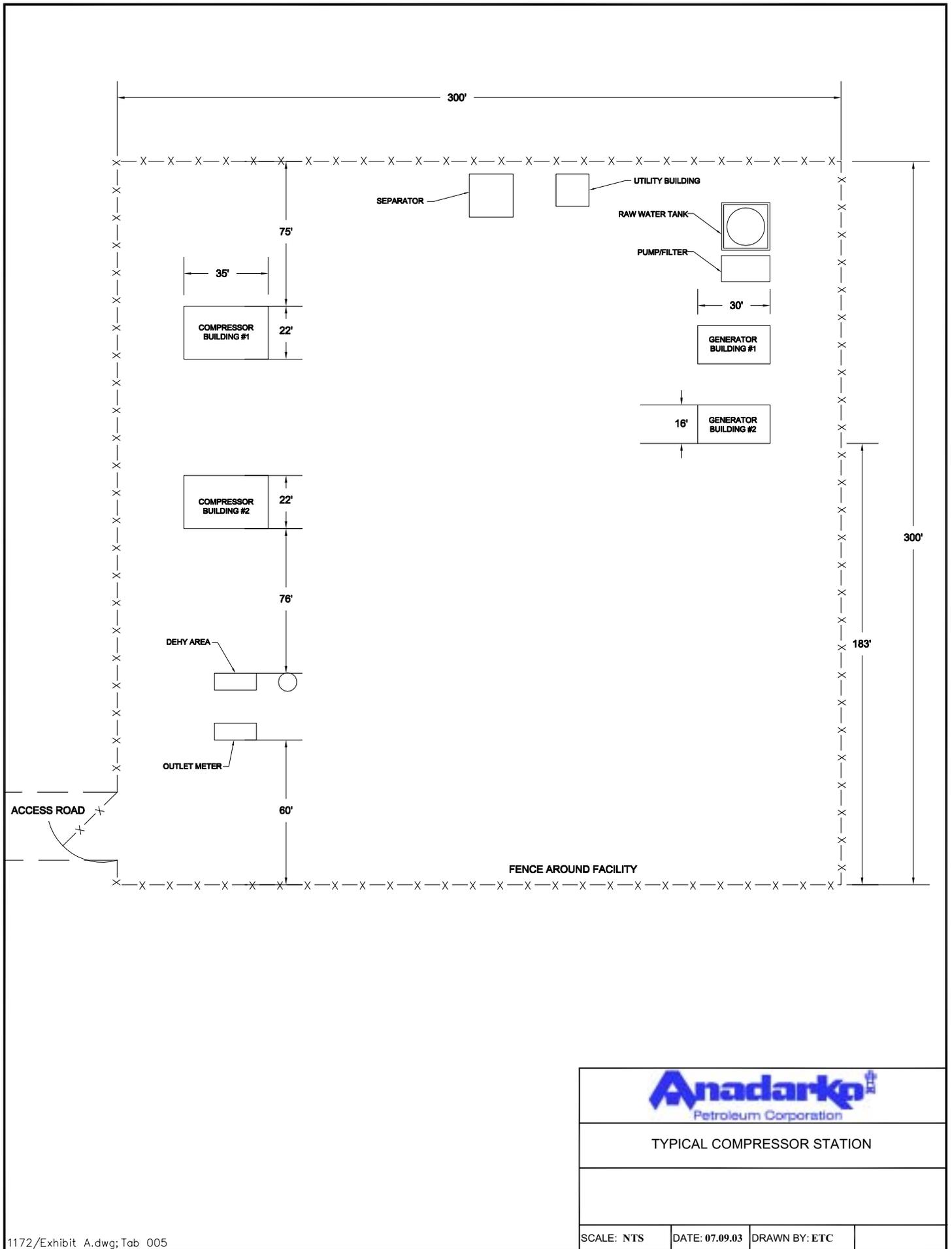
TYPICAL WATER DISPOSAL FACILITY

SCALE: NTS DATE: 09.02.03 DRAWN BY: ETC



TYPICAL WATER TRANSFER FACILITY

SCALE: NTS DATE: 08.21.03 DRAWN BY: ETC



TYPICAL COMPRESSOR STATION

SCALE: NTS DATE: 07.09.03 DRAWN BY: ETC

Appendix C

MASTER DRILLING PLAN (MDP) DOTY MOUNTAIN PLAN OF DEVELOPMENT (POD)

OPERATORS (The Companies):

Warren E & P, Inc. (Warren)

Double Eagle Petroleum Company (Double Eagle)

Anadarko E & P Company (Anadarko)

Sections 14 & 22, T17N R91W, 6th PM, Carbon County, Wyoming

BLM Leases: WYW116179, WYW133658, WYW137692, WYW141686

Drilling Plan for the subject wells listed below:

Gas Wells in Section 14

- | | |
|--------------------------------------|---------------------------------------|
| 1. AR Federal 17-91-1-14 (WYW133658) | 5. AR Federal 17-91-9-14 (WYW116179) |
| 2. AR Federal 17-91-3-14 (WYW133658) | 6. AR Federal 17-91-11-14 (WYW116179) |
| 3. AR Federal 17-91-5-14 (WYW133658) | 7. AR Federal 17-91-13-14 (WYW116179) |
| 4. AR Federal 17-91-7-14 (WYW133658) | 8. AR Federal 17-91-15-14 (WYW116179) |

Gas Wells in Section 22

- | | |
|---------------------------------------|--|
| 9. AR Federal 17-91-1-22 (WYW137692) | 13. AR Federal 17-91-9-22 (WYW116179) |
| 10. AR Federal 17-91-3-22 (WYW141686) | 14. AR Federal 17-91-11-22 (WYW141686) |
| 11. AR Federal 17-91-5-22 (WYW141686) | 15. AR Federal 17-91-13-22 (WYW141686) |
| 12. AR Federal 17-91-7-22 (WYW141686) | 16. AR Federal 17-91-15-22 (WYW141686) |

Deep Injection Well in Section 22

AR Federal 17-91-22I (WYW141686)

1. ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS

| Formation | Depth |
|--------------------------------|---------------|
| Lewis Shale | Surface |
| Isolated Sands in Lewis Shale | 1000' |
| Almond | 1490' – 1995' |
| Pine Ridge | 1940' – 2445' |
| Allen Ridge | 2065' – 2570' |
| TD (Gas Wells) | 2275' – 2790' |
| Cherokee/Deep Creek Sandstones | 3800' - 4600' |

2. ESTIMATED DEPTH OF ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS

| | |
|-------------|-------------|
| Almond | Methane gas |
| Pine Ridge | Methane gas |
| Allen Ridge | Methane gas |

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesaverde Group capable of producing fresh water, including the coal seams. The Companies propose to test the productive formations between 1,490' and 2,570.' Several coal seams may be tested for gas production to total depth. All shallow water zones will be protected with casing and cement. Cement will be brought above the base of the Lewis Shale to isolate all formations in the Mesaverde Group.

Planned Objective for CBM Wells: Mesaverde

3. MINIMUM BLOW OUT PREVENTOR (BOP) REQUIREMENTS (refer to attached schematics)

1. The BOPE will conform to Onshore Shore Order #2. The blowout preventer equipment will consist of a 2000 psi W.P. Double Ram, Hydraulic Preventer (enclosed). All fill and kill lines will be 2000 psi W.P. From 0-160' there will be no pressure control. From 160'-1,600' the 2,000# system will provide control. Note: These wells are proposed as coal bed natural gas (CBNG) wells. Data from a number of wells drilled in the area to test for CBNG indicate that the maximum anticipated surface pressure will not exceed 250 psi, thus the BOP will be tested to 1,000 psi. (see attached schematic).
2. The BOP shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
3. The Companies shall notify the Rawlins BLM office 24 hours prior to the BOP test.

4. SUPPLEMENTAL INFORMATION

The primary objective of this project is to drill, stimulate, and produce natural gas from coal seams in recognized gas-producing formations of the Mesaverde Group. The coal seams are overpressured and are very unlikely to be in communication with overlying layers. Produced water will be injected in one of two deep injection wells completed in the Cherokee/Deep Creek Sandstones. The coal seams will be perforated and stimulated by hydraulic enhancement or fracturing during testing. Fresh water, gelled water, and/or foam fracturing techniques will be used.

The following schematics that show typical facilities, operating standards, and methodologies, are attached to this MDP: [B.O.P.](#); [Bottom Flange](#); [Configuration Options](#); [Completed Well](#); and [Injection Well](#). Additional schematics for this POD are attached to the [Master Surface Use Program \(MSUP\)](#): [Drill Site Layout](#); [Well Site](#); [Water Disposal Facility](#); [Water Transfer Facility](#); and [Compressor Station](#).

5. CASING PROGRAM

| <u>Hole Size</u> | <u>Casing Size</u> | <u>Casing Wt.</u> | <u>Grade</u> | <u>Joint</u> | <u>Depth Set</u> | <u>New/Used</u> | <u>Rng</u> | |
|------------------------|--------------------|-------------------|--------------|--------------|-------------------|-----------------|------------|---------|
| 12 ¼" | 9 " | 32.3# | H-40 | ST&C | 10% of well depth | New | 3 | |
| 9 " | 7" | 23# | MC-50 | LT&C | 0-TD | New | 3 | |
| Surface Casing: | | 9 " | 32.3 ppf. | H-40 | STC | Collapse | Burst | Tension |
| | | | | | Ratings: | 1370 | 2270 | 2254M |

A. Burst = [0.052 * FG * TVD (shoe)] – [Gas Gradient * TVD]
 = [0.052 * 9.3ppg * 280'] – [0.1psi/ft * 280']
 = 107.4psi
 Safety Factor = Rating/Burst
 = 2270/107.4
 = 21.14

B. Collapse = 0.052 * MW * TVD (shoe)
 = 0.052 * 8.8ppg * 280'
 = 128psi
 Safety Factor = Rating/Collapse
 = 1370/128
 = 10.70

C. Tension = Weight * MD * [1 – (MW/65.5ppg)]
 = 32.3ppf * 280' * [1 – (8.8ppg/65.5ppg)]
 = 10447 lbs.

$$\begin{aligned} \text{Safety Factor} &= \text{Rating/Tension} \\ &= 254,000/10447 \\ &= 24.31 \end{aligned}$$

Surface casing shall have centralizers on the bottom 3 joints of the casing, starting with the shoe joint.

| | | | | | | | |
|---------------------------|----|---------|-------|-----------------|----------|-------|---------|
| Production Casing: | 7" | 23 ppg. | MC-50 | STC | Collapse | Burst | Tension |
| | | | | Ratings: | 3110 | 3960 | 273M |

$$\begin{aligned} \text{A. Burst} &= [0.052 * 8.4\text{ppg} * 2700'] - [0.1\text{psi/ft} * 2700'] \\ &= 909.4\text{psi} \\ \text{Safety Factor} &= \text{Rating/Burst} \\ &= 3960/909.4 \\ &= 4.35 \end{aligned}$$

$$\begin{aligned} \text{B. Collapse} &= 0.052 * 12.5\text{ppg} * 2700' \\ &= 1755\text{psi} \\ \text{Safety Factor} &= \text{Rating/Collapse} \\ &= 3110/1755 \\ &= 1.77 \end{aligned}$$

$$\begin{aligned} \text{C. Tension} &= 23\text{lbs./ft} * 2700' * [1 - (12.5\text{ppg}/65.5\text{ppg})] \\ &= 23\text{lbs./ft} * 2700' * .8092 \\ &= 50,248.8 \text{ lbs.} \\ \text{Safety Factor} &= \text{Rating/Tension} \\ &= 273,000/50,248.8 \\ &= 5.43 \end{aligned}$$

6. MUD PROGRAM

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.5–13 ppg. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

7. CEMENTING PROGRAM

The following is the proposed procedure for cementing the 9" surface pipe and 7" long string:

Surface Casing:

Lead: Class "C" Type III, 14.4 ppg, yield 1.44ft³/sk @ 101% excess. Compressive strength in 24 hours at 80°F 3100psi.

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

Long String:

Lead: Class "C" Type III, 14.4 ppg, yield 1.44ft³/sk @ 35% excess. Compressive strength in 24 hours at 95°F 3200psi.

Estimated top of cement back to surface.

8. LOGGING PROGRAM

Cores: Rotary Cores will be taken as needed to evaluate the coal seams.

DSTs: None Planned

Logs: Induction, GR, SP, Density, Neutron and Caliper – From surface to TD
Cement Bond Log – From 9" casing shoe to TD
Mud Logger – As needed.

9. PRESSURE DATA AND POTENTIAL HAZARDS

Bottom hole pressures anticipated @ 1000 – 1100 psi.

There is no history of hydrogen sulfide gas in the area and none is anticipated.

10. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS

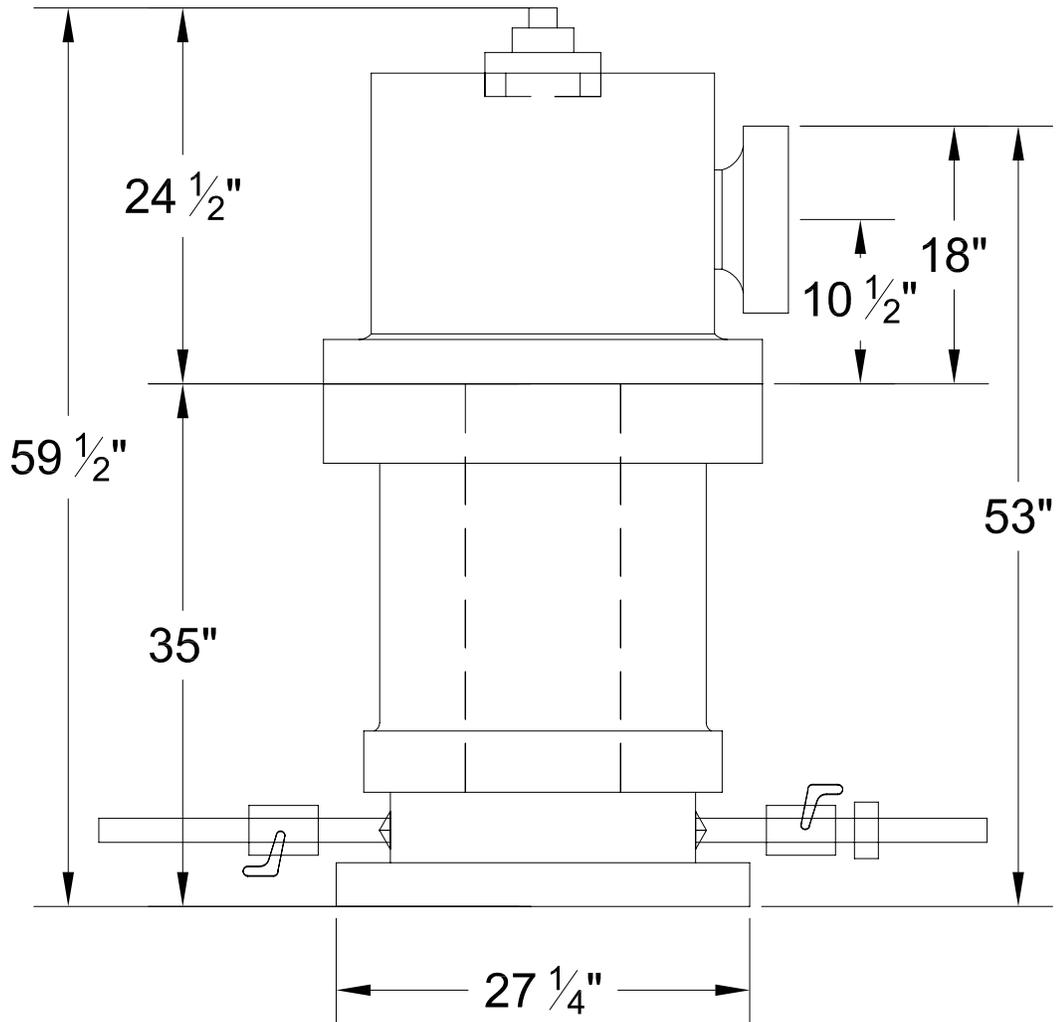
A. Anticipated Starting Dates:

| | |
|-------------------------------|--------------------------------------|
| Anticipated Commencement Date | - Fall 2003, or upon approval |
| Drilling | - Approximately 7 days per well |
| Completion | - Approximately 2 days per well |
| Initial Testing | - Approximately 7-14 days per well |
| Production Testing | - Approximately 6-12 months per well |

Note: Drilling operations will commence as soon as practical after approval of all necessary permits including the Applications for Permits to Drill (APDs).

B. Notification of Operations:

Rawlins Field Office, BLM
1300 North Third St.
Rawlins, Wyoming 82301
(307) 328-4200

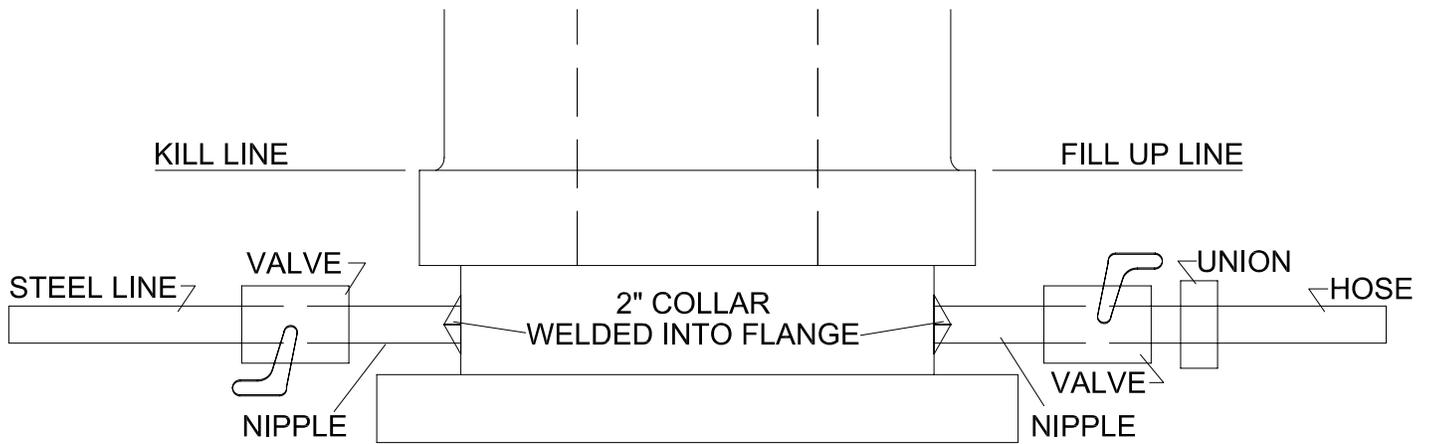


SPECIFICATIONS

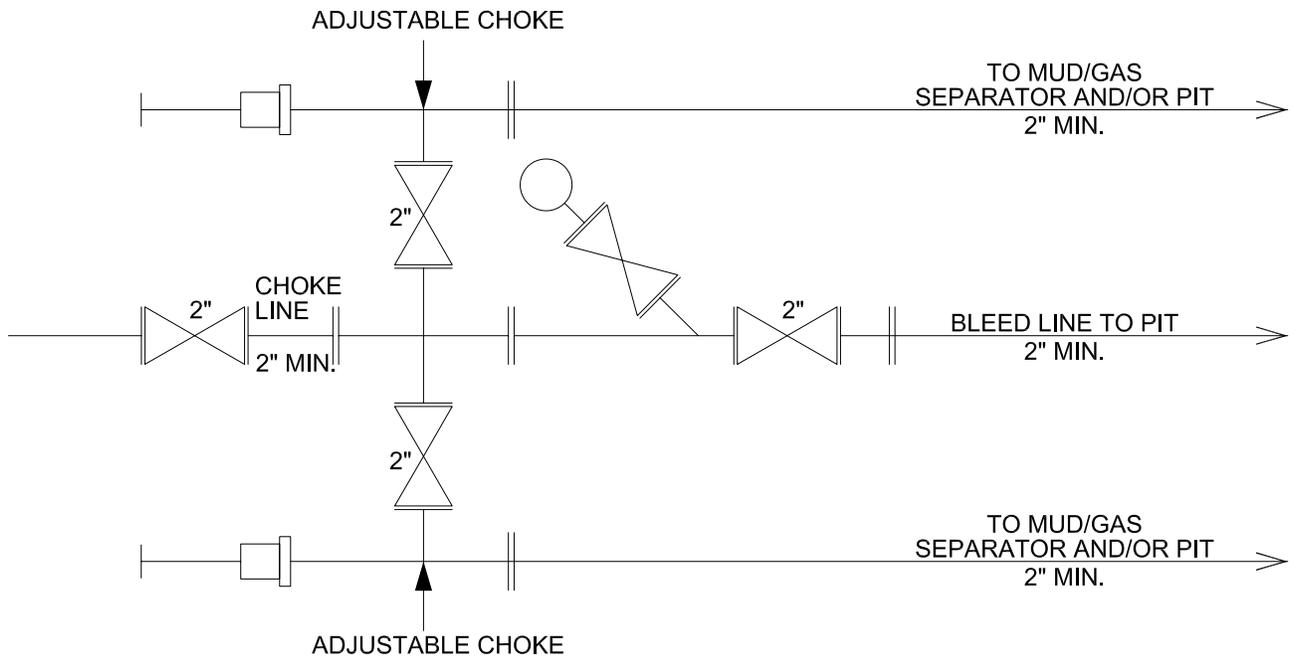
- 10" - 900 FLANGES ON B.O.P.
- 10" - 900 FLANGE ON ROTATING HEAD
- 6" - 600 FLANGE ON FLOWLINE
- 2" - COLLAR ON EACH SIDE OF B.O.P. AT BOTTOM

| | | | |
|---|----------------|---------------|---------|
|  | | | |
| SCHEMATIC | | | |
| 1500 P.S.I. REAGAN ANNULAR B.O.P | | | |
| SCALE: as noted | DATE: 05.04.01 | DRAWN BY: MTM | FIGURE: |

BOTTOM FLANGE ON ANNULAR B.O.P.



2M CHOKE MANIFOLD EQUIPMENT



SPECIFICATIONS

- 10" - 900 FLANGES ON B.O.P.
- 10" - 900 FLANGES ON ROTATING HEAD
- 6" - 600 FLANGES ON FLOWLINE
- 2" - COLLAR ON EACH SIDE OF B.O.P. AT BOTTOM

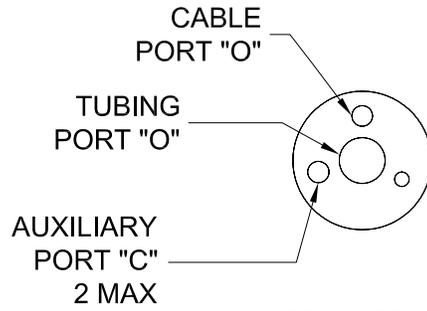


SCHEMATIC

BOTTOM FLANGE ON ANNULAR B.O.P. &
2M CHOKE MANIFOLD EQUIPMENT

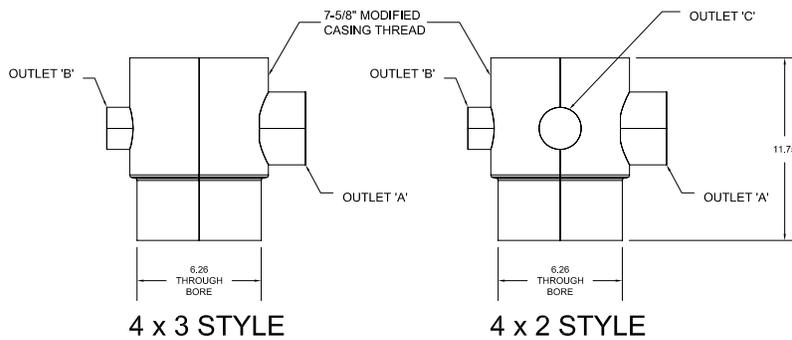
| | | | |
|-----------------|----------------|---------------|---------|
| SCALE: as noted | DATE: 05.04.01 | DRAWN BY: MTM | FIGURE: |
|-----------------|----------------|---------------|---------|

MANDREL STYLE



GS-3 / GS-4
CENTERED HANGER
WITH CABLE PORT &
UP TO 2 AUX PORTS

BODY STYLES

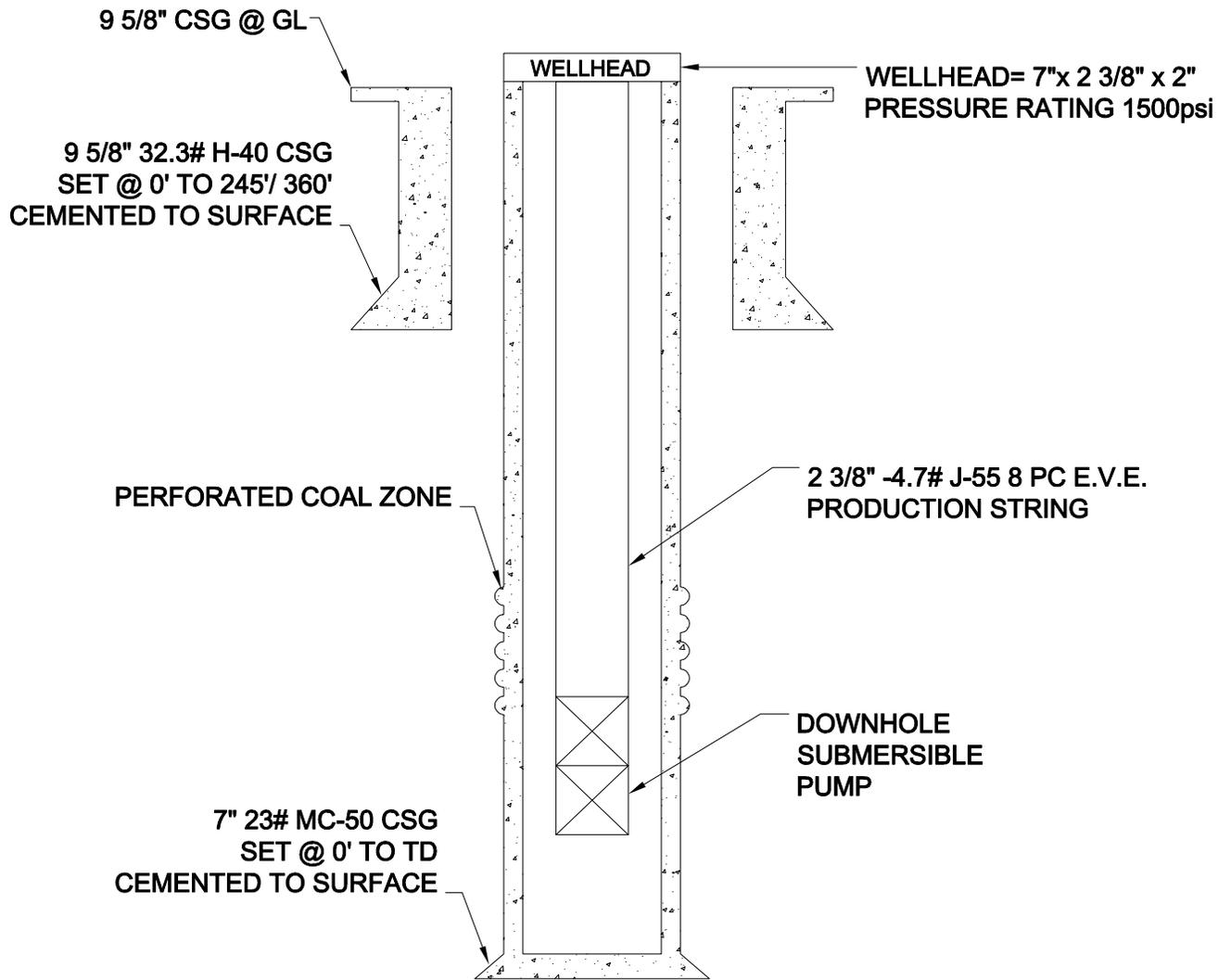


| Standard Body Configurations | | | | |
|------------------------------|----------------------------------|--------------|--------------|--------------|
| Body Style | Bottom Connection | Outlet "A" | Outlet "B" | Outlet "C" |
| 4 x 2 | 7" Short Casing (Male or Female) | 4" LP Female | 2" LP Female | NA |
| 4 x 3 | 7" Short Casing (Male or Female) | 4" LP Female | 3" LP Female | NA |
| 4 x 2 x 2 | 7" Short Casing (Male or Female) | 4" LP Female | 2" LP Female | 2" LP Female |

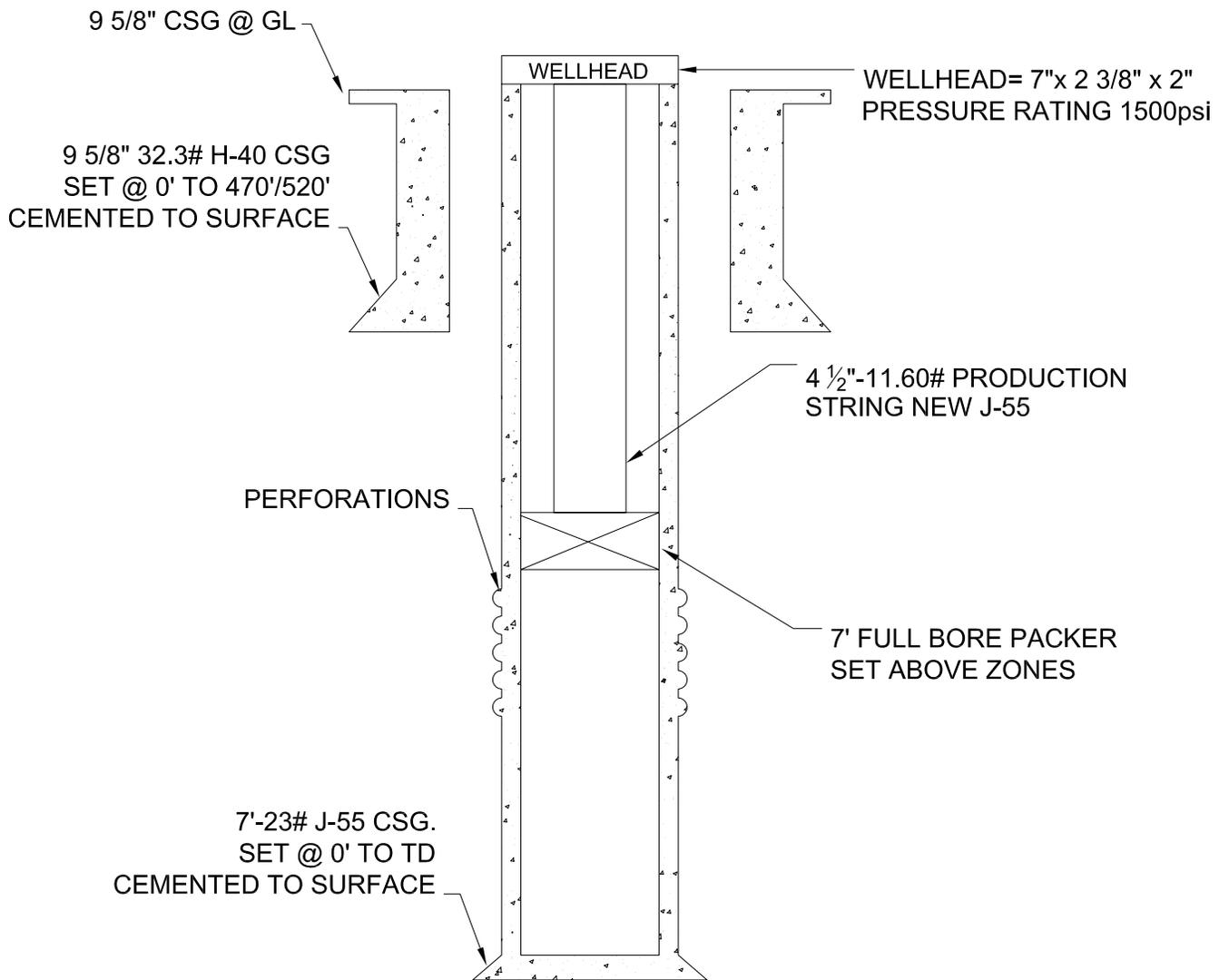
| Standard Mandrel Configurations | | | | |
|---------------------------------|-------------------------|----------|--------------------|-----------------|
| Mandrel Style | Port "C" | Port "D" | Port "E" | Approx Wt - LBS |
| GS-3 | 2-3/8" UPTBG Box Down X | 1" LP | (1) 1/2" LP Box Up | 26 |
| GS-4 | 2-3/8" UPTBG Box Up | Box Up | (2) 1/2" LP Box Up | 26 |



CONFIGURATION OPTIONS



TYPICAL COMPLETED WELL



TYPICAL INJECTION WELL

**APPENDIX D
WATER MANAGEMENT PLAN**

**ATLANTIC RIM INTERIM DRILLING PROJECT
DOTY MOUNTAIN PROPOSED ACTION**

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INTRODUCTION AND GEOGRAPHIC SETTING

Warren E&P, Inc. (Warren), Double Eagle Petroleum Company (Double Eagle) and Anadarko E&P Company (AEPC), collectively referred to as “the Companies,” propose to explore for and potentially develop coal bed natural gas (CBNG) resources in the Doty Mountain area (Project Area) in southwestern Carbon County, Wyoming (**Figures 1-1 and 2-1** of the EA). Exploration and development in the Project Area would occur as part of the Doty Mountain Plan of Development (POD) for the Atlantic Rim Interim Drilling Project. Wells in the Project Area, which encompasses approximately 1,920 acres, would be located about 25 miles southwest of Rawlins, Wyoming, near the intersection of Wyoming State Highway (WY) 789 and Carbon County Road 608 (Wild Cow Road). The Project Area is within the Upper Colorado River Basin.

This water management plan (WMP) for the Doty Mountain POD addresses handling of produced water during testing and production of the wells in the Doty Mountain area. The project consists of constructing, drilling, completing, testing, operating, and reclaiming 24 exploratory wells and two deep injection wells to dispose of produced water that would be located on both private and federal leases. There are no existing or plugged and abandoned wells in the Doty Mountain POD. Of the 24 proposed well locations, 16 wells would be located on surface ownership lands administered by the Bureau of Land Management (BLM) Rawlins Field Office (RFO) and would develop federal minerals. The remaining proposed wells (eight) would develop fee minerals on fee surface. One proposed deep injection well would be located on lands administered by RFO. The remaining proposed deep injection well and the compressor station would be located on fee lands. **Table D-1** summarizes the proposed wells addressed in this WMP.

Produced water from the 24 proposed shallow gas wells would be disposed of by injection. Two deep injection wells would be used.

TABLE D-1 WELLS PROPOSED IN DOTY MOUNTAIN POD

| Proposed Gas Wells | | | |
|--------------------------------------|------------------|--------------------|------------------------|
| Lease Number | Well Name | Well Number | Location |
| WYW-116179 (Pedco/Anadarko) | AR Federal | 17-91-9-14 | T17N R91W Sec. 14 NESE |
| | AR Federal | 17-91-11-14 | T17N R91W Sec. 14 NESW |
| | AR Federal | 17-91-13-14 | T17N R91W Sec. 14 SWSW |
| | AR Federal | 17-91-15-14 | T17N R91W Sec. 14 SWSE |
| | AR Federal | 17-91-9-22 | T17N R91W Sec. 22 NESE |
| WYW-137692 (Pedco/Anadarko) | AR Federal | 17-91-1-22 | T17N R91W Sec. 22 NENE |
| WYW-141686 (Double Eagle) | AR Federal | 17-91-3-22 | T17N R91W Sec. 22 NENW |
| | AR Federal | 17-91-5-22 | T17N R91W Sec. 22 SWNW |
| | AR Federal | 17-91-7-22 | T17N R91W Sec. 22 SWNE |
| | AR Federal | 17-91-11-22 | T17N R91W Sec. 22 NESW |
| | AR Federal | 17-91-13-22 | T17N R91W Sec. 22 SWSW |
| | AR Federal | 17-91-15-22 | T17N R91W Sec. 22 SWSE |
| WYW-133658 (Double Eagle) | AR Federal | 17-91-1-14 | T17N R91W Sec. 14 NENE |
| | AR Federal | 17-91-3-14 | T17N R91W Sec. 14 NENW |
| | AR Federal | 17-91-5-14 | T17N R91W Sec. 14 SWNW |
| | AR Federal | 17-91-7-14 | T17N R91W Sec. 14 SWNE |
| Fee Lease | AR Fee | 17-91-1-23 | T17N R91W Sec. 23 NENE |
| | AR Fee | 17-91-3-23 | T17N R91W Sec. 23 NENW |
| | AR Fee | 17-91-5-23 | T17N R91W Sec. 23 SWNW |
| | AR Fee | 17-91-7-23 | T17N R91W Sec. 23 SWNE |
| | AR Fee | 17-91-9-23 | T17N R91W Sec. 23 NESE |
| | AR Fee | 17-91-11-23 | T17N R91W Sec. 23 NESW |
| | AR Fee | 17-91-13-23 | T17N R91W Sec. 23 SWSW |
| | AR Fee | 17-91-15-23 | T17N R91W Sec. 23 SWSE |
| Proposed Deep Injection Wells | | | |
| Lease Number | Well Name | Well Number | Location |
| WYW-141686 (Double Eagle) | AR Federal | 17-91-22I | T17N R91W Sec. 22 NESW |
| Fee Lease (Anadarko) | AR Fee | 17-91-23I | T17N R91W Sec. 23 NENW |

DESCRIPTION OF WATERSHED

The Project Area is located in Muddy Hydrologic Unit Code (HUC) 14050004, upstream of the Little Snake (HUC 14050003) in the Upper Colorado River Basin. The nearest perennial stream is Muddy Creek, located 1.5 miles north of the Project Area. Muddy Creek originates in the Sierra Madre Range. It flows west and south near the western border of the Project Area toward its confluence with the Little Snake River near Baggs. Four unnamed ephemeral drainages that are tributary to Dry Cow Creek traverse the Project Area. Dry Cow Creek is an intermittent stream that flows southwesterly for about 9 miles to its confluence with Cow Creek. Cow Creek is a perennial stream that is tributary to Muddy Creek.

The average annual precipitation collected at Baggs, Wyoming, from September 1, 1979, to December 31, 2002, is 10.7 inches (WRCC 2003). Precipitation is greatest during the summer, although minor peaks occur in May, July, and October. Annual precipitation increases with elevation to more than 20 inches in the Sierra Madres.

There are no designated floodplains within the Project Area. No special aquatic sites or wetlands have been identified in or near the Project Area, including the route for the lateral sales pipeline. The nearest potential riparian habitat is located along Dry Cow Creek, southwest of the Project Area. Agriculture (primarily grazing by cattle, horses, or sheep) is a primary land use in the Project Area. Other uses within and adjacent to the Project Area include wildlife habitat; oil and gas exploration, development, and transmission; and dispersed outdoor recreation.

No depletions to the Colorado River system will likely occur as a result of this project. Due to the volumes of water that will be removed from the producing formations, a dating method will be used to determine if water has entered the coal formation recently from surface sources. Water produced from the coal formation will be tested for tritium, a radioactive isotope that is present at higher levels in water exposed to the atmosphere since nuclear testing began in the 1940s. Results of less than 1 tritium unit will be considered sufficient evidence that water in the coal formation was not recently exposed to the atmosphere and is therefore unlikely to have a significant connection to surface waters in the Colorado River system. The tritium sample will be taken and analyzed before significant water production for the project begins.

Stormwater discharges during construction would be managed in accordance with a stormwater permit issued by the WDEQ.

PRODUCED WATER DISPOSAL

Aquifers and groundwater quality are not anticipated to be affected by the project provided the mitigation measures that are described in Chapter 2 of the EA are implemented. Water from the Cherokee or Deep Creek Sandstones will be analyzed and the results provided to all necessary regulatory agencies before injection begins. The proposed exploratory wells would produce water that would be disposed of by injection; therefore, no discharge of produced water to surface waters would occur under the project.

Produced water from individual wells would be gathered and routed to water disposal facilities for deep injection. The water disposal facilities would be approved by the BLM and Wyoming Oil and Gas Conservation Commission (WOGCC) or the Wyoming Department of Environmental Quality (WDEQ), and the private surface owner, as needed. Best Management Practices (BMPs) would be used to control erosion and divert overland flows away from the facilities. Centrifugal pumps, reciprocating pumps, filter systems, and tanks at the disposal facility would be used to remove solids from the water stream and pump water under pressure sufficient to allow for downhole disposal. If it is not possible to safely inject the volume of produced water projected into the proposed injection wells, some or all of the exploratory wells would be shut in temporarily while alternative plans are developed and approved. These alternative plans would include additional injection wells.

BENEFICIAL USE OF PRODUCED WATER

Produced water from the 24 gas wells proposed in the Doty Mountain POD could be available for potential beneficial use if authorized separately by BLM. Before the injection wells are complete, produced water may be utilized as make-up water for nearby drilling and completion operations. Any water produced during drilling or well completing would be contained on each drilling location in the reserve pit. During well testing, water produced from the Mesaverde aquifer will be collected on location in closed tanks and trucked to an authorized disposal facility until the injection wells are operational. Once all wells have been drilled, water produced at the exploratory wells would be gathered and transported to the injection wells for disposal.

In addition, a small portion of the water produced from the wells (about 5 gallons per minute at each location shown on the Project Map) could be dispensed for use by livestock at locations specified by BLM and the surface owners. The water would be piped into tire tanks with shut-off valves that would not discharge produced water into surface drainages.

All waters used to test the integrity of the gas gathering pipelines would be injected into an authorized water disposal facility (deep injection well) in compliance with all applicable requirements.

Dust abatement would comply with all applicable WOGCC requirements. Only water suitable for livestock use would be used for dust abatement.

HYDROLOGIC ANALYSIS OF WATERSHED

A *Hydrologic Watershed Field Analysis Summary Sheet* was not completed for the drainages within the Doty Mountain Project Area. Produced water from the proposed wells will be injected; therefore, surface water within the Project Area would not be affected by the project.

GROUNDWATER RESOURCES

Water would be produced from coals in the Mesaverde Group. Groundwater would be removed from the coal seam aquifers within the Allen Ridge and Almond Formations, members of the Upper Cretaceous Mesaverde Group. Groundwater quality is variable in the Project Area. Groundwater quality is related to the depth of the aquifers, flow between aquifers, and rock type. Total dissolved solids (TDS) are generally less than 2,000 milligrams per liter (mg/L), considered slightly saline to saline, in the Project Area, with local concentrations less than 500 mg/L (meeting U.S. Environmental Protection Agency [EPA] National Secondary Drinking Water Regulations).

The targeted coal seams in the Mesaverde Group are classified as confined to semi-confined aquifers because they are bounded by confining layers that consist of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the coal seams and any aquifer stratigraphically above or below the coal seams is limited. The hydrostatic head of the water measured in test wells completed in coal seams in the Project Area can be considerably higher than the aquifer or even the elevation of the ground level at a specific well location. Confined, or artesian, aquifer conditions of this type indicate an effective seal above and below the aquifer. However, lowering the hydraulic head in the coal seam aquifers by removing water may induce a slight leakage through the semi-pervious shale layers into the pumped aquifer. Because of the extremely low hydraulic conductivity of the confining layers and the limited number of wells proposed (24), enhanced leakage from an aquifer stratigraphically above or below the affected coal seams would be minimal.

As most existing groundwater wells and the proposed gas wells of the Project Area target aquifers in the Mesaverde Group, the results of a detailed analysis of groundwater from this unit have been included in **Table D-2**. Sodium and bicarbonate dominate as the major ionic species. Collentine et al. (1981) offer three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction, resulting in generation of bicarbonate; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde or adjacent aquifers.

TABLE D-2 MAJOR ION COMPOSITION OF MESAVERDE GROUNDWATER

| Cation | Concentration (mg/L) | Anion | Concentration (mg/L) |
|------------------------|----------------------|--------------------------|----------------------|
| Sodium | 513 | Bicarbonate ^a | 1,284 |
| Calcium | 7 | Carbonate ^b | 9 |
| Magnesium | 3 | Chloride | 56 |
| Potassium ^a | 5 | Sulfate | 11 |

^a Bicarbonate was not measured; value shown was calculated from ion balance.

^b Concentrations of potassium and carbonate were not measured in samples from gas wells; values represent composite of U.S. Geological Survey (USGS) data for samples from Mesaverde wells in the vicinity of the project (USGS 1980).

Table D-3 presents a comparison of Mesaverde groundwater with WDEQ suitability standards. The composite results of the samples from the three gas wells analyzed indicate that the water is generally suitable for livestock but is unsuitable for domestic supply or irrigation without treatment. Parameters measured at concentrations that exceed Wyoming drinking water standards include iron, manganese, and TDS. Calculated sodium absorption ratio (SAR) (47.3) and residual sodium carbonate (41 milliequivalents per liter [meq/L]) exceed the agriculture suitability limits of 8.00 for SAR and 1.25 residual sodium carbonate.

**TABLE D-3 GROUNDWATER QUALITY OF
MESAVERDE WELLS IN THE PROJECT AREA**

| Parameter | Concentration ^a | Unit | Groundwater Suitability Standards ^b | | |
|---------------------------|----------------------------|--------|--|-------------|-----------|
| | | | Domestic | Agriculture | Livestock |
| Aluminum | 0.045 | mg/L | --- | 5 | 5 |
| Ammonia | 0.9 | mg/L | 0.5 | --- | --- |
| Arsenic | 0.0006 | mg/L | 0.05 | 0.1 | 0.2 |
| Barium | 0.36 | mg/L | 1 | --- | --- |
| Beryllium | <0.002 | mg/L | --- | 0.1 | --- |
| Boron | 0.25 | mg/L | 0.75 | 0.75 | 5 |
| Cadmium | <0.0002 | mg/L | 0.01 | 0.01 | 0.05 |
| Chloride | 56 | mg/L | 250 | 100 | 2,000 |
| Chromium | 0.002 | mg/L | 0.05 | 0.1 | 0.05 |
| Cobalt | NM | mg/L | --- | 0.05 | 1 |
| Copper | 0.03 | mg/L | 1 | 0.2 | 0.5 |
| Cyanide | <5 | mg/L | 0.2 | --- | --- |
| Fluoride | 1.0 | mg/L | 1.4 - 2.4 | --- | --- |
| Hydrogen Sulfide | NM | mg/L | 0.05 | --- | --- |
| Iron | 3.06 | mg/L | 0.3 | 5 | --- |
| Lead | 0.004 | mg/L | 0.05 | 5 | 0.1 |
| Lithium | NM | mg/L | --- | 2.5 | --- |
| Manganese | 0.102 | mg/L | 0.05 | 0.2 | --- |
| Mercury | <0.0004 | mg/L | 0.002 | --- | 0.00005 |
| Nickel | 0.041 | mg/L | --- | 0.2 | --- |
| Nitrate | <0.03 | mg/L | 10 | --- | --- |
| Nitrite | <0.03 | mg/L | 1 | --- | 10 |
| Oil & Grease ^c | <1 | mg/L | Virtually Free | 10 | 10 |
| Phenol | 65 | mg/L | 0.001 | --- | --- |
| Selenium | <0.005 | mg/L | 0.01 | 0.02 | 0.05 |
| Silver | <0.003 | mg/L | 0.05 | --- | --- |
| Sulfate | 11 | mg/L | 250 | 200 | 3000 |
| TDS | 1,322 | mg/L | 500 | 2000 | 5000 |
| Uranium | NM | mg/L | 5 | 5 | 5 |
| Vanadium | NM | mg/L | --- | 0.1 | 0.1 |
| Zinc | 0.3 | mg/L | 5 | 2 | 25 |
| pH | 8.2 | s.u. | 6.5 - 9.0 | 4.5 - 9.0 | 6.5 - 8.5 |
| SAR | 47.3 | <none> | --- | 8 | --- |
| RSC ^d | 41 | meq/L | --- | 1.25 | --- |

**TABLE D-3 GROUNDWATER QUALITY OF
MESAVERDE WELLS IN THE PROJECT AREA**

| Parameter | Concentration ^a | Unit | Groundwater Suitability Standards ^o | | |
|-------------------------|----------------------------|-------|--|-------------|-----------|
| | | | Domestic | Agriculture | Livestock |
| Radium 226 + Radium 228 | 0.9 | pCi/L | 5 | 5 | 5 |
| Strontium 90 | NM | pCi/L | 8 | 8 | 8 |
| Gross alpha | NM | pCi/L | 15 | 15 | 15 |

a Concentrations of boron, ammonia, fluoride, and nitrate/nitrite in samples from 11 Mesaverde groundwater wells (USGS 1980); remaining concentrations from three Mesaverde gas wells in Project Area.

b From WDEQ Water Quality Rules and Regulations, Chapter VIII.

c Reported as total petroleum hydrocarbons.

d Residual sodium carbonate calculated from measured calcium and magnesium concentrations and calculated concentration of bicarbonate.

Notes:

meq/L = Milliequivalents per liter

mg/L = Milligrams per liter

NM = not measured

pCi/L = Picocuries per liter

s.u. = Standard units

TDS = Total dissolved solids

Seven water wells permitted by WSEO have been completed within 1 mile of the Project Area. Six of these wells are located within a 1/2-mile radius of individual gas wells. Two of these wells yield water used for stock ponds; the remaining four are monitoring wells. Information on permitted water wells that was obtained from WSEO is shown in **Table D-4**. The maximum depth of all permitted wells is 419 feet. The water wells are much shallower than the proposed gas wells and proposed injection zones.

**TABLE D-4 PERMITTED WATER WELLS WITHIN
1 MILE OF THE DOTY MOUNTAIN PROJECT AREA**

| Permit No. | Sec | Qtr/Qtr | Applicant | Facility Name | Use | Yield (gpm) | Well Depth | Static Depth |
|------------|-----|---------|---|---------------|------------------|-------------|------------|--------------|
| P33768W | 15 | SWNW | Union Pacific Minerals Inc. | ARW 1 | Monitoring Misc. | 0 | 280 | 144.88 |
| P54262W | 23 | NWNW | Union Pacific Minerals Inc. | AR 201 OW | Monitoring Misc. | 0 | 220 | 64 |
| P54264W | 23 | SESW | Union Pacific Minerals Inc. | AR 200 OW | Monitoring Misc. | 0 | 419 | 107 |
| P56613W | 23 | SWNW | P H Livestock Co. | Y Pasture #1 | Storage | 5 | 120 | 35 |
| P59801W | 23 | NENW | Wyoming Board of Land Commissioners — Pan Artic Exploration LTD | 9C-16-19-89 | Monitoring Misc. | Unk | Unk | Unk |
| P59802W | 23 | SWNW | Wyoming Board of Land Commissioners — Pan Artic Exploration LTD | 1-16-19-89 | Monitoring Misc. | Unk | Unk | Unk |
| P17356W | 28 | NENE | BLM | #4139 | Storage | 5 | 100 | Unk |

Deep Injection Wells for Produced Water

The proposed injection targets for the deep injection wells are the Cherokee and Deep Creek Sandstones, that occur about 3,850 feet to 4,600 feet below the surface. These sandstones are isolated above and below by competent shale barriers that would prevent initiation and propagation of fractures through overlying strata to any zones of fresh water, provided the Companies adhere to injection limits established in permits. The Cherokee and Deep Creek Sandstones consist of clean, medium to coarse-grained sandstone.

The injection wells would be drilled, cased, and cemented from total depth (50 feet below the base of the Cherokee or Deep Creek Sandstone) to the surface. The Cherokee or Deep Creek Sandstone would be tested to evaluate its suitability for disposal before any water is injected. The results of the open-hole log and injectivity test would be provided to the regulatory agencies. In addition, water from the Cherokee or Deep Creek Sandstone (or both) would be analyzed and the results would be provided to the regulatory agencies before produced water is injected. Produced water would come from coals in the Mesaverde Group.

Aquifer Protection

The injection formations for all proposed injection wells are stratigraphically below the groundwater sources that are developed by existing water wells. It is anticipated that the produced water that would be injected would be of equal or higher quality in regards to class of use as defined by WDEQ Ground Water Division regulations. Injection of the produced water is not expected to result in any deterioration in groundwater quality within the injection horizon. These sandstones are isolated above and below by competent shale barriers that would prevent initiation and propagation of fractures through overlying strata to any zones of fresh water. Maximum pressure requirements for the injection zone would be established through injectivity tests that would identify fracture pressure limits to prevent the overlying shale from being breached by fractures. Injection horizons will not be exceeded based on injectivity tests and applicable permit limits, as regulated by the State of Wyoming and BLM. The only effect on the injection horizons would consist of an increase in the hydraulic head at the injection wells. This effect would attenuate with distance from the wellbore. There are no anticipated effects in terms of groundwater quantity and quality. Effects on the injection horizon would be minimal.

To avoid or mitigate potential impacts to existing water wells, the Companies would offer a water well agreement to all potentially affected landowners with properly permitted water wells within the circle of influence for each proposed gas well (a 1/2-mile radius). If a water well agreement is not reached with the landowner, the Companies have agreed to mitigate the impacts of the proposed wells in accordance with State of Wyoming water laws. Furthermore, the Companies have applied for the permits to appropriate groundwater for each well from WSEO, concurrently with the Applications for Permit to Drill. The Companies would provide copies of all groundwater appropriation permits approved by WSEO to BLM.

DESCRIPTIONS OF FACILITIES

Multiple facilities would be installed to accomplish water management for the Doty Mountain POD. These proposed facilities include two deep injection, temporary reserve pits on drill locations (off-channel), and necessary culverts. Each facility is explained below and is shown in [Figure 2-1](#).

The Companies would operate all wells, pipelines, and ancillary production facilities in a safe manner, as set forth in standard industry operating guidelines and procedures.

FACILITIES FOR INJECTION

Produced water from individual wells would be gathered and routed to an interconnected system that would provide for the transfer of water between injection facilities, as needed. The system would route the water to central injection facilities and on to one of two deep injection wells. Produced water-gathering pipelines would be constructed from the wellhead to the injection facilities along the well access road wherever feasible. The water flowlines would be installed together in the same trench or ditch as the gas-gathering lines wherever practical, and would be buried.

The deep injection wells and facilities would be approved by the BLM, WDEQ, and WOGCC as needed and would be located in Sections 22 and 23 of T17N R91W.

The approximate minimum injection capacity of the AR Federal 17-91-22I and the AR Fee 17-91-23I injection wells would be 5,000 barrels per day (bbls/day) for each well. The approximate maximum injection capacity for each well would be 20,000 bbls/day.

Transfer pumping stations may be used during production operations to transfer produced water from the gas wells to the injection facilities. The transfer pumping stations would be needed in areas where differences in elevation require supplemental pumping to transfer the produced water. If transfer pumping stations are required, they will be identified in the MSUP. Each pumping station would contain up to two 400-barrel water tanks, an inlet separation vessel, and a small centrifugal water pump. Each pumping station would consist of a pad that is about 125 feet by 125 feet that would disturb an estimated 0.4 acre, including cut and fill slopes. A berm would be constructed to contain any potential spills. A small pump house would be constructed immediately outside the bermed area to enclose the pump. A typical water transfer facility is illustrated in [Appendix B](#).

RESERVE PITS

Temporary reserve pits would be constructed at each drill location to contain drilling fluids and initial pressure testing. These pits would be reclaimed after well completion operations and no discharge of produced water would occur in these pits after the initial well completion operations. The Companies estimate that each reserve pit would be open for 2 to 8 weeks to allow pit fluids to evaporate.

The reserve pits would be constructed in cut rather than fill materials. Fill material would be compacted and stabilized, as needed. The subsoil material of the pits would be inspected to assess stability and permeability and to evaluate whether reinforcement or lining would be required. If lining is required, the reserve pit would be lined with reinforced synthetic liner at least 12 mils thick and with a bursting strength of 175 by 175 pounds per inch (American Society for Testing and Materials [ASTM] Standard D 75179). Use of closed or semi-closed drilling systems would be considered in situations where a liner may be required.

Two feet of freeboard would be maintained in all reserve pits to ensure they are not in danger of overflowing. Drilling operations would be shut down if leakage is found outside the pit until the problem is corrected.

CULVERTS

The main access road and existing improved and unimproved roads within the Project Area cross channels at a number of locations. Some proposed road improvements would cross drainages that may require culverts to be installed. The proposed access road to the Project Area uses existing improved, unimproved, and proposed roads that avoid channel crossings where possible to minimize environmental effects. Proposed culverts will be a minimum of 18 inches in diameter and will be sized according to BLM requirements to adequately manage existing and potential flows. The locations of proposed culverts are shown in [Figure 2-1](#). These culverts will be monitored to evaluate whether capacity is adequate and the potential for buildup of ice during winter.

Culverts in roads will be covered with a minimum of 12 inches of fill or one-half the diameter of the pipe, whichever is greater, as per BLM requirements. The inlet and outlet will be set flush with the existing ground surface and aligned in the center of the draw. Before the area is backfilled, the bottom of the pipe will be bedded on stable ground that does not contain expansive or clay soils, protruding rocks that would damage the pipe, or unevenly sized material that would not form a good seat for the pipe. The site will be backfilled with unfrozen material and rocks no larger than 2 inches in diameter. Care would be exercised to thoroughly compact the backfill under the haunches of the conduit. The backfill would be brought up evenly in 6-inch layers on both sides of the conduit. Additional culverts would be installed in the existing access road as needed or as directed by BLM.

POTENTIAL EROSION

Surface disturbance associated with road construction, drilling, and installing pipelines or utilities could increase the potential for erosion. These disturbances would include removing vegetation and stockpiling topsoil, constructing roads, and digging shallow excavations for drill pads or facilities. The Companies would implement the mitigation measures described in Chapter 2 of the EA to control wind and water erosion at disturbed sites so that interim drilling and development in the Project Area would not affect surface drainages. The Companies have committed to the practices described in Chapter 2 that, when combined with existing regulatory requirements, would provide for design and implementation of surface-disturbing activities in a manner that would divert and control runoff and provide for re-establishment of vegetation in disturbed areas. All concentrated water flows would be discharged within the right of way for an access road onto or through structures that would dissipate energy (such as riprapped aprons and culvert outflows) and into established vegetation. These measures, collectively, would represent best management practices (BMPs) for erosion control.

Increased surface water runoff and off-site sedimentation caused by soil disturbance, impairment to surface water quality, and changes in stream channel morphology may be caused by construction of roads, drill locations, and pipeline crossings. Construction would occur over a relatively short period, however. Impacts from construction would likely be greatest in the short term and would decrease over time as a result of stabilization, reclamation, and revegetation. Construction disturbance would not be uniformly distributed across the Project Area, but instead would be concentrated near the drill locations and access or utility routes.

MONITORING AND MITIGATION

Aquifers and groundwater quality are not anticipated to be affected by the project provided the mitigation measures that are described in Chapter 2 of the EA are implemented. A groundwater monitoring program is being established for the Atlantic Rim EIS study area. Water from the Cherokee or Deep Creek Sandstones will be analyzed and the results provided to all necessary regulatory agencies before injection begins. It is anticipated that the produced water that would be injected would be of equal or higher quality in regard to class of use as defined by WDEQ Ground Water Division regulations.

Testing of CBNG resources likely would lower the hydraulic head in the affected coal seam aquifer. (The reduction of hydraulic head in an aquifer also is referred to as drawdown.) Relative to the available drawdown within the aquifer, the effect on the coal aquifer during the interim drilling project is expected to be small. BLM has requested that three to six groundwater monitoring wells be installed within the Atlantic Rim EIS study area during the interim drilling project. The locations of these monitoring wells have not yet been finalized, however. The effects of interim drilling and development on the coal aquifer, including drawdown, will be monitored by these wells and they will provide data for a groundwater model to look at potential impacts from alternatives in the EIS. Monitoring wells do not count toward the limit of 24 proposed wells in a POD under the Interim Drilling Policy.

The water level also may be lowered or drawn down in existing wells within the 1/2-mile radius of individual exploratory wells completed in the Mesaverde aquifer. The potential yield from the nearby water wells may be affected by removal of groundwater. Other wells completed in the coal seams could be affected by the project; however, no other wells permitted by the WSEO are known to occur within 1 mile of the Project Area. Potential effects on water wells would be minimized by a water well agreement, as described in the Master Surface Use Program (MSUP) ([Appendix B](#) of the EA) and the other mitigation measures described in Chapter 2 of the EA.

Appendix E

Sensitive Plant, Wildlife, and Fish Species Potentially Present Doty Mountain Project Area.¹

| Plant Species | | | | |
|------------------------------|--|---------------------------------|---|-----------------------------------|
| Common Name | Scientific Name | Sensitivity Status ² | Habitat | Occurrence Potential ³ |
| Laramie columbine | <i>Aquilegia laramiensis</i> | G2/S2, FSR2 | Crevices of granite boulders and cliffs, 6,400-8,000' | unlikely |
| Nelson's milkvetch | <i>Astragalus nelsonianus</i> | G2/S2 CO | Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, and cushion plant communities at 5,200-7,600' | possible |
| Cedar Rim thistle | <i>Cirsium aridum</i> | G2Q/S2 | Barren, chalky hills, gravelly slopes and fine textured, sandy-shaley draws 6,700-7,200' | possible |
| Weber's scarlet gilia | <i>Ipomopsis aggregata</i> <i>ssp. weberi</i> | G5T1T2Q/S1,FSR2 | Openings in coniferous forests and scrub oak woodlands 8,500-9,600' | unlikely |
| Gibbens' beardtongue | <i>Penstemon gibbensii</i> | G1, S1, BLM | Sandy or shaley (often Green River Shale) bluffs and slopes, 5,500-7,500 ft. Associated vegetation: <i>Juniperus</i> spp., <i>Cirsium</i> spp., <i>Eriogonum</i> spp., <i>Elymus</i> spp., <i>Amelanchier alnifolia</i> , <i>Chrysothamnus</i> spp., <i>Thermopsis</i> spp., <i>Arenaria</i> spp., and <i>Astragalus</i> spp. | possible |
| Persistent sepal yellowcress | <i>Rorippa calycina</i> | G3/S2S3 | Riverbanks and shorelines, usually on sand soils near high water line | unlikely |
| Laramie false sagebrush | <i>Sphaeromeria simplex</i> | G2/S2 | Cushion plant communities on rocky limestone ridges and gentle slopes 7,500 - 8600' | unlikely |
| Wildlife Species | | | | |
| Common Name | Scientific Name | Sensitivity Status ² | Occurrence Potential ³ | |
| Mammals | | | | |
| Wyoming pocket gopher | <i>Thomomys clusius</i> | R2, G2/S1S2, NSS4 | Possible | |
| White-tailed prairie dog | <i>Cynomys leucurus</i> | G4/S2S3, NSS7 | Present | |
| Swift fox | <i>Vulpes velox</i> | R2, G2/S2S3, NSS3 | Likely | |
| Fringed myotis | <i>Myotis thysanodes</i> | R2, G5/S1B, S1N, NSS2 | Possible | |
| Long-eared myotis | <i>Myotis evotis</i> | G5/S1B, S1?N, NSS2 | Possible | |
| Townsend's big-eared bat | <i>Corynorhinus townsendii</i> | R2/R4, G4/S1B, S2N, NSS2 | Possible | |
| Birds | | | | |
| Baird's sparrow | <i>Ammodramus bairdii</i> | G4/S1B, SZN, R2, NSS4 | Unlikely | |
| Sage sparrow | <i>Amphispiza belli</i> | G5/S3B, SZN | Present | |
| Brewer's sparrow | <i>Spizella breweri</i> | G5/S3B, SZN | Likely | |
| Long-billed curlew | <i>Numenius americanus</i> | G5/S3B, SZNR2, NSS3 | Unlikely | |
| Sage thrasher | <i>Oreoscoptes montanus</i> | G5/S3B, SZN | Present | |

| | | | |
|--------------------------------|---|---------------------------|----------|
| Mountain Plover | <i>Charadrius montanus</i> | G2/S2B, SZN | Unlikely |
| Western burrowing owl | <i>Athene cunicularia</i> | R2, G4/S3B, SZN, NSS4 | Possible |
| Yellow-billed cuckoo | <i>Coccyzus americanus</i> | G5/S2B, SZN, R2, NSS2 | Unlikely |
| Loggerhead shrike | <i>Lanius ludovicianus</i> | G5/S4B, SZN, R2 | Present |
| Columbian sharp-tailed grouse | <i>Tympanuchus phasianellus columbianus</i> | R2/R4, G4T3/S1 | Possible |
| Greater sage-grouse | <i>Centrocercus urophasianus</i> | G5/S3 | Present |
| White-faced ibis | <i>Plegadis chihi</i> | G5/S1B, SZN, R2, NSS3 | Unlikely |
| Trumpeter swan | <i>Cygnus buccinator</i> | R2/R4, G4/S1B, S2N, NSS2 | Unlikely |
| Peregrine falcon | <i>Falco peregrinus</i> | G4/T3/S1B, S2N, R2, NSS3 | Possible |
| Ferruginous hawk | <i>Buteo regalis</i> | R2, G5/S23B, S4N, NSS3 | Present |
| Northern goshawk | <i>Accipiter gentilis</i> | R2/R4, G5/S23B, S4N, NSS4 | Possible |
| Fish | | | |
| Roundtail chub | <i>Gila robusta</i> | G2G3/S2,NSS1 | Unlikely |
| Bluehead sucker | <i>Catostomus discobolus</i> | G4/S2S3, NSS1 | Unlikely |
| Flannelmouth sucker | <i>Catostomus latipinnis</i> | G3G4/S3, NSS1 | Unlikely |
| Colorado River cutthroat trout | <i>Oncorhynchus clarki pleuriticus</i> | R2/R4, G4T2T3/S2, NSS2 | Unlikely |
| Amphibians | | | |
| Boreal toad | <i>Bufo boreas boreas</i> | G4T4/S2, R2, R4, NSS1 | Unlikely |
| Great Basin spadefoot toad | <i>Spea intermontanus</i> | G5/S4, NSS4 | Possible |
| Northern leopard frog | <i>Rana pipiens</i> | G5/S3, R2, NSS4 | Likely |

¹ - Source: USDI-BLM (2002) and Hayden-Wing Associates (2003)

² - Definition of status:

G Global rank: Rank refers to the range-wide status of a species.

T Trinomial rank: Rank refers to the range-wide status of a subspecies or variety.

S State rank: Rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.

1 Critically imperiled because of extreme rarity (often known from 5 or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.

2 Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.

3 Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).

4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.

5 Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.

H Known only from historical records. 1950 is the cutoff for plants; 1970 is the cutoff date for animals.

X Believed to be extinct.

A **Accidental or vagrant:** A taxon that is not known to regularly breed in the state or which appears very infrequently (typically refers to birds and bats).

B **Breeding rank:** A state rank modifier indicating the status of a migratory species during the breeding season (used mostly for migratory birds and bats)

N **Nonbreeding rank:** A state rank modifier indicating the status of a migratory species during the non-breeding season (used mostly for migratory birds and bats)

ZN or ZB Taxa that are not of significant concern in Wyoming during breeding (ZB) or non-breeding (ZN) seasons. Such taxa often are not encountered in the same locations from year to year.

U Possibly in peril, but status uncertain; more information is needed.

Q Questions exist regarding the taxonomic validity of a species, subspecies, or variety.

? Questions exist regarding the assigned G, T, or S rank of a taxon.

WGFD Native Species Status Codes - Fish and Amphibians

NSS1 - Populations are physically isolated and/or exist at extremely low densities throughout range. Habitats are declining or vulnerable. Extirpation appears possible. The Wyoming Game and Fish Commission mitigation category for Status 1 species is "Vital". The mitigation objective for this resource category is to realize "no loss of habitat function". Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.

NSS2 - Populations are physically isolated and/or exist at extremely low densities throughout range. Habitat conditions appear to be stable. The Wyoming Game and Fish Commission mitigation category for Status 2 species is also "Vital". The mitigation objective for this resource category is to realize "no loss of habitat function". Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.

NSS3 - Populations are widely distributed throughout its native range and appear stable. However, habitats are declining or vulnerable. The Wyoming Game and Fish Commission mitigation category for Status 3 species is "High". The mitigation objective for this resource category is to realize "no net loss of habitat function within the biological community which encompasses the project site". Under these guidelines, it will be important that the project be conducted in a manner that either avoids the impact, enhances similar habitat or results in the creation of an equal amount of similarly valued fishery habitat.

NSS4-7 - Populations are widely distributed throughout native range and are stable or expanding. Habitats are also stable. There is no special concern for these species.

WGFD Native Species Status Codes - Birds and Mammals

NSS1 - Populations are greatly restricted or declining, extirpation appears possible. AND On-going significant loss of habitat.

NSS2 - Populations are declining, extirpation appears possible; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; ongoing significant loss of habitat.

NSS3 - Populations are greatly restricted or declining, extirpation appears possible; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Species is widely distributed;

population status or trends are unknown but are suspected to be stable; on-going significant loss of habitat.

NSS4 - Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance.

NSS5 - Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is stable and not restricted. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

NSS6 - Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is stable and not restricted.

NSS7 - Populations are stable or increasing and not restricted in numbers and/or distribution; habitat is stable and not restricted.

³ - Occurrence potential based upon presence of habitat and known distribution.