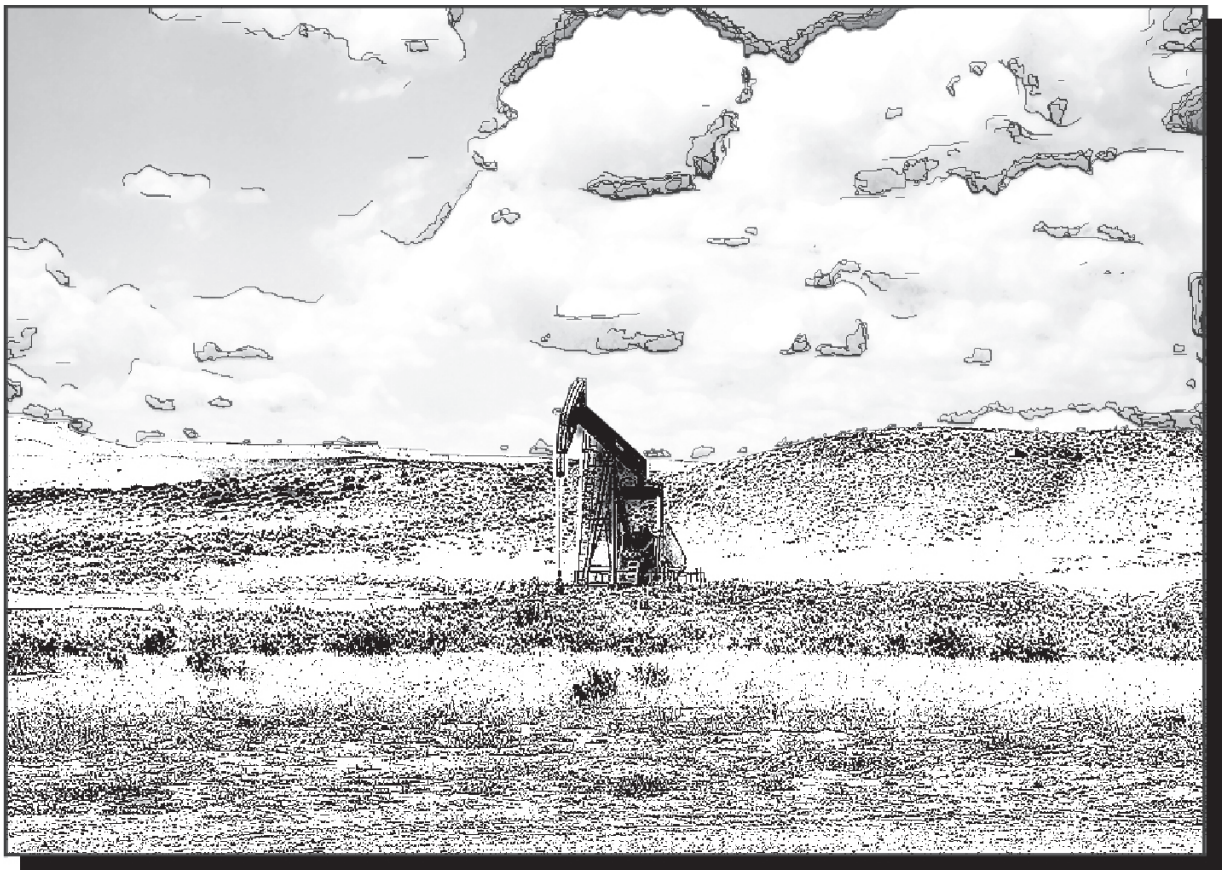
Monell Enhanced Oil Recovery Project Environment Assessment

EA No. WY-040-EA05-161



BLM

Wyoming State Office — Rock Springs Field Office

February 2006

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WY-040-EA05-161

MONELL ENHANCED OIL RECOVERY PROJECT

ENVIRONMENTAL ASSESSMENT
EA NO. WY-040-EA05-161

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Rock Springs Field Office

February 2006

ACRONYMS

$\mu g/m^3$	micrograms per cubic meter
6840 Policy	BLM's Special Status Species Management Policy 6840
AIRFA	American Indian Religious Freedom Act of 1978
amsl	above mean sea level
Anadarko	Anadarko E & P Company
APD	Application for Permit to Drill
AQD	Air Quality Division
AQRV	air quality related values
ARPA	Archaeological Resources Protection Act of 1979
AUM	animal unit month
BACT	Best Available Control Technology
BBCC	Black Butte Coal Company
bbl	barrels
BLM	Bureau of Land Management
BMP	Best Management Practices
Btu	British thermal unit
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CGF	Central Gathering Facility
CIAA	Cumulative Impact Assessment Area
CO	carbon monoxide
CO_2	carbon dioxide
CR	Community Relations
CWA	Clean Water Act
dBA	decibels on the A-weighted scale
DOI	Department of the Interior
EA	Environmental Assessment
EO	Executive Order
EOR	Enhanced Oil Recovery
EPCRA	Emergency Planning and Community Right-to-Know Act
ESA	Endangered Species Act
FCR	fire-cracked rock
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
GAP	Gap Analysis Project

ACRONYMS (Cont'd)

GLO	Government Land Office
Hazcom	Hazard Communication
HDPE	high density polyethylene
hp	horsepower
kV	kilovolt
lb	pound
LOD	limits of detection
LOP	Life-of-project
LOS	level of service
mg/L	milligrams per liter
MOU	Memorandum of Understanding
mph	miles per hour
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Grave Protection and Repatriation Act of 1990
NEPA	National Environmental Policy Act
NGL	Natural Gas Liquids
NHPA	National Historic Preservation Act of 1986
NO_2	nitrogen dioxide
NOS	Notice of Staking
NO_x	nitrogen oxides
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
NWP	Nationwide Permit
NWS	National Weather Service
O_3	ozone
OPA 90	Oil Pollution Act of 1990
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
PFYC	Probable Fossil Yield Classification
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PSD	Prevention of Significant Deterioration
PUP	Pesticide Use Proposal
RCRA	Resource Conservation and Recovery Act
RFD	Reasonably Foreseeable Development
RMP	Resource Management Plan
ROS	Recreation Opportunity Spectrum

ACRONYMS (Cont'd)

ROW	Right-of-Way
RSGA	Rock Springs Grazing Association
SARA	Superfund Amendments and Reauthorization Act
SCEMA	Sweetwater County Emergency Management Agency
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SPCC Plan	Spill Prevention, Control, and Countermeasures Plan
SUPO	Surface Use Plan of Operations
SWPPP	Storm Water Pollution Prevention Plan
TDS	total dissolved solids
tpy	tons per year
TSS	total suspended solids
U.S.C.	United States Code
UPLR	Union Pacific Land Resources
USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VMT	Vehicle Miles Traveled
VOC	volatile organic compound
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards
WAG	water alternating gas
WAQS&R	Wyoming Air Quality Standards and Regulations
WAS	Western Archaeological Services
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WHHMA	Wild Horse Herd Management Area
WNDD	Wyoming Natural Diversity Database
WOGCC	Wyoming Oil and Gas Conservation Commission
WQD	Water Quality Division

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FINDING OF NO SIGNIFICANT IMPACT – MONELL ENHANCED OIL RECOVERY PROJECT

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1.0 PURPOSE OF AND NEED FOR THE ACTION

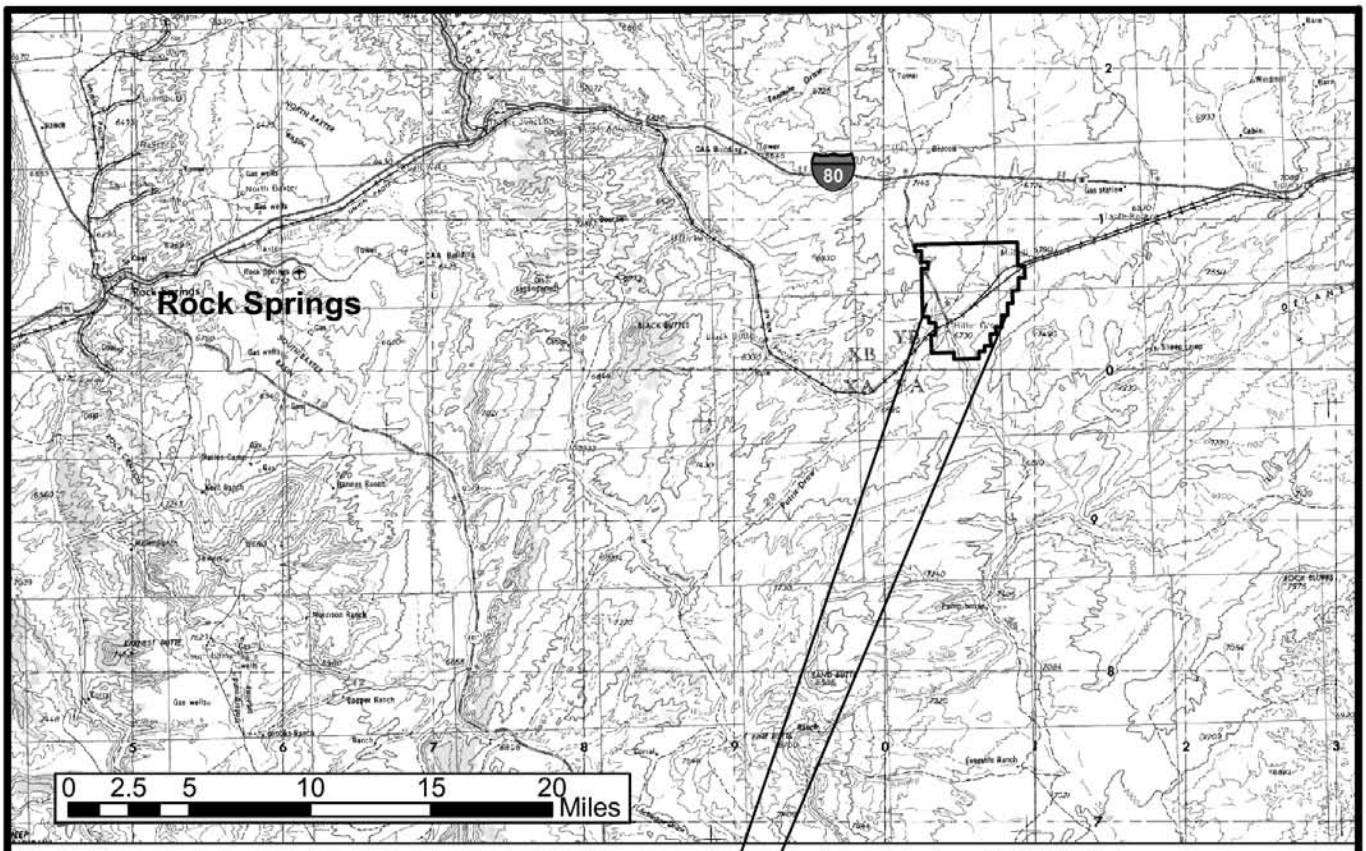
1.1 Introduction

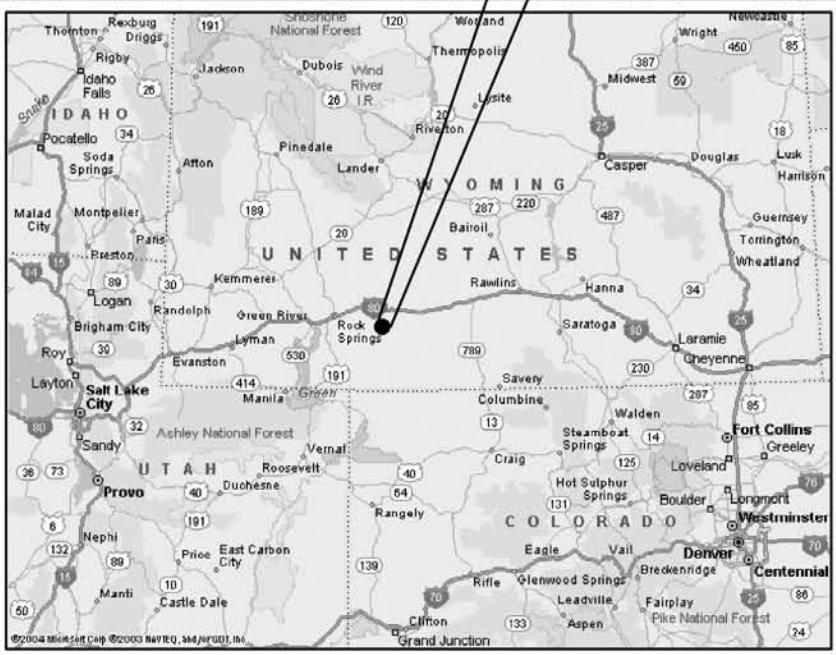
Anadarko E & P Company (Anadarko) proposes to develop an Enhanced Oil Recovery (EOR) Project in the Patrick Draw Field Monell Unit in Sweetwater County, Wyoming (**Figure 1-1**). Anadarko's activities in the Monell Unit involve 12 federal leases. The EOR process would be accomplished using tertiary methods involving carbon dioxide (CO_2) flooding. Oil would be the primary product, but natural gas also would be recovered as part of the process. The EOR would occur in an existing oil and gas production area of the Monell Unit, which contains a mixture of private, state, and public lands administered by the Bureau of Land Management (BLM), Rock Springs Field Office. In total, a maximum of 126 wells including 46 on BLM public land would be drilled and developed over the 20- to 25-year life-of-project (LOP) (**Table 1-1**). Of the total area encompassed within the project area, approximately 46 percent is on federal land (4,630 acres), 51 percent is on private land (5,130 acres), and 3 percent is on state land (360 acres). Generally, the mineral ownership pattern matches the surface ownership pattern. Wells on private land are included in the analysis because of connected actions involving construction of new roads and pipelines across public lands to access the private wells. Drilling is expected to begin in 2006 and continue for approximately 3 to 6 years.

The first phase of drilling was completed in 2003 and 2004 involving 79 wells (15 on BLM public land). As part of the initial steps in implementing this process in the Monell Unit, the National Environmental Policy Act (NEPA) analysis and permits were completed for a pipeline to transport CO_2 to the Monell Unit under ROW Serial No. 156096 (BLM 2003b). The pipeline was constructed in 2003. As of December 2004, CO_2 flooding has been used in 67 active wells (15 on BLM public land, 3 on state land, and 49 on private land) as part of the initial drilling program to evaluate the feasibility of this tertiary EOR process. Results from the pilot program indicated that CO_2 flooding would be an effective method of recovering additional oil resources in the Monell Unit.

Table 1-1
Completed and Proposed Development for the Monell EOR Project

	Drilling Time Frame	Total No. of Wells	Non-BLM Wells	BLM Wells
Completed	2003-2004	79	64	15
Proposed Action	2006 or later	126	80	46
Total		**205**	**144**	**61**





Legend

Project Area

N
W E
S

Anadarko Monell EOR Project

Figure 1-1

Project Location

9/2/05

Development activities would include construction of pads, drilling, completion and production, testing, and construction of ancillary facilities. Other project components would include access roads; CO_2 distribution pipelines; gathering pipelines for oil, gas, and water; 3-mile transmission line; central gathering, treating, and metering facility; recycle compressor station; booster compressor station; three test facilities; and an underground electrical distribution system. Each Application for Permit to Drill (APD) and right-of-way (ROW) application would be subject to further NEPA compliance as appropriate.

The Monell Unit was initially developed in 1964. In total, 146 producing wells (143 oil and 3 gas) have been drilled and developed in the Monell Unit prior to EOR activities. In addition, 123 non-producing wells (58 on BLM public land) have been plugged, abandoned, or reclaimed. Infrastructure in the Monell Unit consists of access roads, pipelines, storage tanks, producing oil and gas wells, and other surface facilities. Of the 23 wells that remain from the original Monell Unit, 9 are active oil and gas wells and 14 are monitoring wells.

To date, oil production in the Monell Unit has resulted from primary and secondary production methods. Primary production methods use natural pressure or pumping to bring oil to the surface. As oil is produced, natural reservoir pressure declines over time, which results in decreased oil production from the field. Typically, primary production results in the recovery of approximately 15 percent of the original-oil-in-place (BLM 1989). The most common type of secondary recovery used in Wyoming is waterflooding, where water is injected into the field to displace additional oil and increase pressure. Waterflooding can result in an incremental increase of up to approximately 25 percent recovery, or a total recovery (primary plus secondary) of approximately 40 percent of the original-oil-in-place (BLM 2003a).

Enhanced oil recovery, in particular CO_2 flooding (tertiary method), is beginning to play an important role in Wyoming's oil industry. The additional increase in oil recovery for CO_2 flooding is approximately 20 percent, or a total recovery of approximately 60 percent. The process utilizes the same type of equipment as waterflooding. The tertiary method involves the injection of CO_2 into the reservoir through a series of injection wells. After a slug (a predetermined volume) of CO_2 is injected to maintain a solvent bank between the CO_2 and the oil, a slug of water is introduced behind the CO_2. The water pushes the CO_2 slug and oil bank to the producing wells where it can be recovered. Additional information on the CO_2 flooding process is provided in Appendix A.

1.2 Brief Description of the Proposed Action

Anadarko proposes to drill and develop a maximum of 126 wells within the Monell EOR project area, with 46 wells and well pads on public lands. These wells would utilize as much of the existing infrastructure (e.g., access roads and pipelines) as possible. The Monell EOR project

area includes approximately 10,120 acres in portions of T18N, T19N, R98W, and R99W, 6th Principal Meridian, in central Sweetwater County near the community of Bitter Creek, Wyoming. The Monell EOR project area is located immediately south of Interstate 80 (I-80) approximately 35 miles east of Rock Springs and approximately 70 miles west of Rawlins. The surface ownership pattern within and adjacent to the Monell EOR project area is checkerboard, where even-numbered sections are typically owned by the federal government, odd-numbered sections are typically privately owned, and a select even-numbered sections are owned by the State of Wyoming. Ownership percentages are provided in Section 1.1.

Access into the Monell Unit would be provided by I-80, Sweetwater County roads (CR) No. 4-24 and CR 4-26, and existing lease roads. Public access into the interior of the Monell project area is available on numerous unnamed unpaved roads and two-track roads.

Development of the 126 wells would require new construction and upgrade of approximately 32 miles of access roads and 95 miles of gathering lines (facility corridors). An estimated 12 miles of new roads would be built on federal land and 20 miles of roads would be built on private or state land. Ancillary facilities would include oil, gas, and water gathering lines; a power source; a central gathering/treating/metering facility (Main Gathering Battery); recycle compressor station within the Main Gathering Battery; three test facilities; a Booster compressor station; and an underground electrical distribution system. Existing aboveground power lines within the Monell Unit would be dismantled.

Well pads would be 360 feet x 240 feet, including a 100-foot x 50-foot reserve pit. Reserve pits would be lined with impermeable liners when required on BLM sections to temporarily contain drilling fluids, cuttings, and produced water. The average surface disturbance per well would be approximately 2 acres. After reclamation of disturbed areas no longer needed for production, each producing location would occupy an area of approximately 1 acre.

It is anticipated to take approximately 8 days to drill, log, and case each well utilizing a conventional rotary drilling rig and associated rig equipment. Six additional days would be required to run a bond log, perforate, fracture, and set a pump with a completion rig. Wells would be drilled to sandstones in the Almond Formation at depths varying between 4,000 and 5,500 feet. As the project develops, road and infrastructure construction would occur concurrently with well drilling and testing (access roads to a given well would be constructed prior to drilling and testing). Although some level of activity would be continual, peak drilling and construction would be scheduled for the second and third quarters of 2006 but could be earlier or later depending on circumstances.

Water for drilling would come from existing water wells. Water used to drill one well would be recycled to drill subsequent wells where practical. Produced water would be injected into existing disposal wells approved by the Wyoming Oil and Gas Conservation Commission (WYOGCC). Produced water would be transported from well locations to the injection wells via buried water pipelines.

Production collection lines for in-field fluid collection (gathering system) would be installed to bring oil/water/gas/CO_2 from individual well sites to the Central Gathering Facility (CGF) and the interconnect pipeline. Production collection lines would generally be located adjacent to roads or under access road travel ways, where feasible, and all necessary authorizing actions for the lines would be addressed prior to installation. A total of approximately 95 miles of oil, gas, CO_2, and water collection lines would be installed.

A CO_2 recompression facility would be constructed within the Main Battery Area, located in Section 35 (Sec. 35), Township 19 North (T19N), Range 99 West (R99W) on private lands. Anadarko plans to install a 1,750 horsepower (hp) compression engine during the initial project startup and up to 19,250 hp at full development. Compression horsepower would be electric powered. Methane and CO_2 from the exploration area would be delivered to the compressor station via gas gathering lines. Once the gas reaches the compressor station, dehydration units would remove water from the gas, and the water would be evaporated from the dehydration unit.

1.3 Purpose and Need

The Monell EOR Project has been proposed as a means by which the declining oil and gas production in the Monell Unit can be reversed in an economical and technologically sound fashion. The proposed Monell EOR Project would increase oil recovery in the Monell Unit by using CO_2 flooding. By implementing the Monell EOR Project, increased incremental production of oil would occur in the Monell Unit that would not be possible using natural or waterflooding methods. The incremental production of oil would extend the economic life of the Monell Unit and benefit both state and local economies.

The development of federal oil and gas leases by private industry is an integral part of the national policies regarding energy development. The project would fulfill the federal government's policy to foster and encourage energy development, as expressed in the Mining and Minerals Policy Act of 1970, Federal Land Policy and Management Act of 1976 (FLPMA), the Federal Onshore Oil and Gas Leasing Reform Act of 1987, and the Energy Policy Act of 2005.

Alternatives to the proposed project were evaluated such as the drilling of fewer wells, directional drilling, or horizontal drilling. However, these alternatives were eliminated from further detailed analysis, as discussed in Section 2.2.3.

1.4 Conformance with Land Use Plans

The proposed project would be located within the BLM's Rock Springs Field Office area. The most recent Resource Management Plan (RMP) for this area was completed in 1997, i.e., Record of Decision and Green River RMP (BLM 1997a). Guidance on resource development also is provided in the Sweetwater County Land Use Plan (THK Associates, Inc. 1997). The Proposed Action is in conformance with all of the management decisions in the Green River RMP.

1.5 NEPA Relationship to Statutes, Regulations, and/or Other Plans

The Proposed Action would comply with all applicable federal, state, and local laws, plans, and permits required for this type of activity. A list of potential authorizations can be found in **Table 1-2**. Leasing for federal oil and gas resources fall are under the authority of laws and guidance of the Mining and Minerals Policy Act of 1970, FLPMA, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987. The BLM is responsible for managing both surface and mineral resources on BLM managed surface lands. The BLM would develop Conditions of Approval for the drilling and associated activities from this environmental assessment (EA). Drilling of federal minerals is subject to BLM Onshore Oil and Gas Orders (43 Code of Federal Regulations [CFR] 3164). Federal review of the drilling project is done through the Notice of Staking (NOS) option of the APD process, as described in Order #1 and 43 CFR 3160. Order #1 requires that the applicant comply with the following requirements:

- Operations must result in the diligent development and efficient recovery of resources.
- All activities must comply with applicable federal laws and regulations and with state and local laws and regulations applicable to federal leases.
- All activities must contain adequate safeguards to protect the environment.
- Underground sources of fresh water must be protected from fluid injection operations.
- All activities must protect public health and safety.

Table 1-2
Potential Federal, State, and Local Permits, Approvals, and Authorizing Actions

Issuing Agency/Program/Permit Name	Permits/Approvals/Authorizing Actions	Applicable Project Component
Federal Permits, Approvals, and Authorizing Actions		
U.S. Department of the Interior (BLM)		
Onshore Oil and Gas Orders	Permitting of operations (drilling, completion, abandonment), drilling operations, site security, measurement of oil, flaring of gas, produced water disposal	Wells, associated facilities, roads
Right-of-way Grant, Temporary Use Permits	Right-of-way grants for access roads on BLM managed land; temporary use permits for facilities and pipelines	Access roads, associated facilities, and pipelines
U.S. Army Corps of Engineers (USACE)		
Permit for Dredged or Fill Material (404 Permit)	Placement of fill or dredged material in waters of the U.S. or adjacent wetlands	All Proposed Action and alternative surface-disturbing activities affecting waters of the U.S. or wetlands
Section 401 Certification for Stream Crossings	Permit for stream crossings	Access roads, pipelines
U.S. Fish and Wildlife Service (USFWS)		
Endangered Species Act	Informal or formal consultation for threatened and endangered species	All project components
U.S. Environmental Protection Agency (USEPA)		
Resource Conservation and Recovery Act (RCRA)	Permits for treatment, storage, or disposal of hazardous waste	All project components
Clean Water Act	Spill Prevention, Control, and Countermeasure (SPCC)	Transfer and storage of petroleum and petroleum fuels
State Permits, Approvals, and Authorizing Actions		
Wyoming Department of Environmental Quality (WDEQ)		
Wyoming Air Quality Standards and Regulations	Permits for emissions from new or modified sources; prevention of significant deterioration (if applicable); control of hazardous air pollutants, hydrogen sulfide, and volatile organic compounds	All stationary fuel-burning sources, tanks, separators, dehydrators, and compressors
Storm Water Permits	Storm water construction permits	Construction of drilling locations and access roads
Solid Waste	Disposal of wastes	Wells and related facilities

Table 1-2 (Continued)

Issuing Agency/Program/Permit Name	Permits/Approvals/Authorizing Actions	Applicable Project Component
Wyoming Department of Transportation		
Underground Injection Control	Injection of fluid into the subsurface	Wells and related facilities
Transport Permits	Permit for oversize, overlength, and overweight loads	Transportation of equipment and materials on state highways
Wyoming Oil and Gas Conservation Commission		
Oil and Gas Rules and Regulations	Drilling operations, safety regulations, pit permits, product measurement, and authorization of flaring	Wells and related facilities
Underground Injection Control	Class II injection/disposal wells	Underground injection/disposal wells
Wyoming Board of Land Commissioners		
Authorize activities on state land	Approval of oil and gas leases, ROWs, temporary use permits, and developments on state land	Facilities on state lands
Local Permits, Approvals, and Authorizing Actions		
Sweetwater County		
Road Use Authorization	Weight and length loads on county roads	Transportation of equipment and materials on county roads
Conditional Use Permits, Zoning	New structures	Associated facilities

Use of existing access roads and construction of new roads would be authorized in conjunction with well locations by sundry notice (43 CFR 2800). The APD also would conform to existing lease stipulations. Access over state and county roads would be authorized under local requirements.

1.6 Decision to be Made

The BLM Rock Springs Field Manager must decide on the terms and conditions (Conditions of Approval for the Surface Use Plan of Operations [SUPO]) under which Anadarko would economically develop oil and gas resources using tertiary recovery methods while protecting natural resources. Terms and conditions must be identified prior to the final approval of the APD for each well. The APD approvals are granted for a period not to exceed 1 year. A decision also must be made on whether or not to approve sundry notice for BLM public land to access or construct support facilities for the project.

1.7 Scoping and Development of Issues

A scoping notice was mailed to approximately 62 government agencies, companies, organizations, and individuals, with a 30-day comment period ending on August 8, 2005 (Appendix B). Seven comment letters were received by the BLM; four from government agencies; one from a private corporation; and two from non-government organizations. A more detailed discussion of comment letters is included in Section 5.1 of this EA. Key issues raised by the BLM interdisciplinary team and the public include:

<u>Project Description Issues</u>

- Consider the use of close-loop “pitless drilling” systems which would decrease the size of the drilling pad and eliminate the need for a reserve pit.

- Consider technologies that would reduce the size of the well pad surface.

<u>Resource Issues</u>

- Potential increased traffic and associated impacts to existing county, state, and BLM roads;
- Potential impacts to air quality resources from emissions associated with additional drilling and oil production activities;
- Potential effects of surface and subsurface disturbance on paleontological resources in the Wasatch Formation;
- Potential effects of surface disturbance on soils that are considered to be erodible and highly alkaline;

- Potential effects of surface disturbance on the channel stability in Bitter Creek;
- Potential effects of staging, refueling, and storage areas on the Bitter Creek floodplain.
- Potential impacts to quality and quantity of surface water and groundwater resources including wetland resources from construction and oil production activities;
- Potential effects of surface disturbance on riparian vegetation;
- Control of non-native invasive weeds that may develop in disturbed areas;
- Potential impacts to prehistoric and historic resources;
- Potential impacts to wildlife habitat used by big game and raptor species;
- Potential effects of roads and development on wildlife populations and their habitat;
- Potential impacts to aquatic resources in Bitter Creek;
- Potential impacts to wild horses and livestock grazing;
- Potential impacts to visual resources;
- Potential impacts to federally listed threatened, endangered, candidate, and BLM-sensitive species; and
- Potential cumulative effects of drilling and oil production activities in combination with other past, present, and foreseeable future actions on lands adjacent to the Monell EOR project area.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1 Alternative Development Process

The development of alternatives to the Proposed Action is an important part of the NEPA process. In accordance with 40 CFR 1502.14(a), the BLM is required to define issues and evaluate all reasonable alternatives. The BLM evaluated two alternatives in this EA: the Proposed Action (Section 2.2.1) and No Action (Section 2.2.2.1). The Proposed Action involves exploratory drilling and subsequent development of oil and gas reserves on federal lands within the Monell EOR project area.

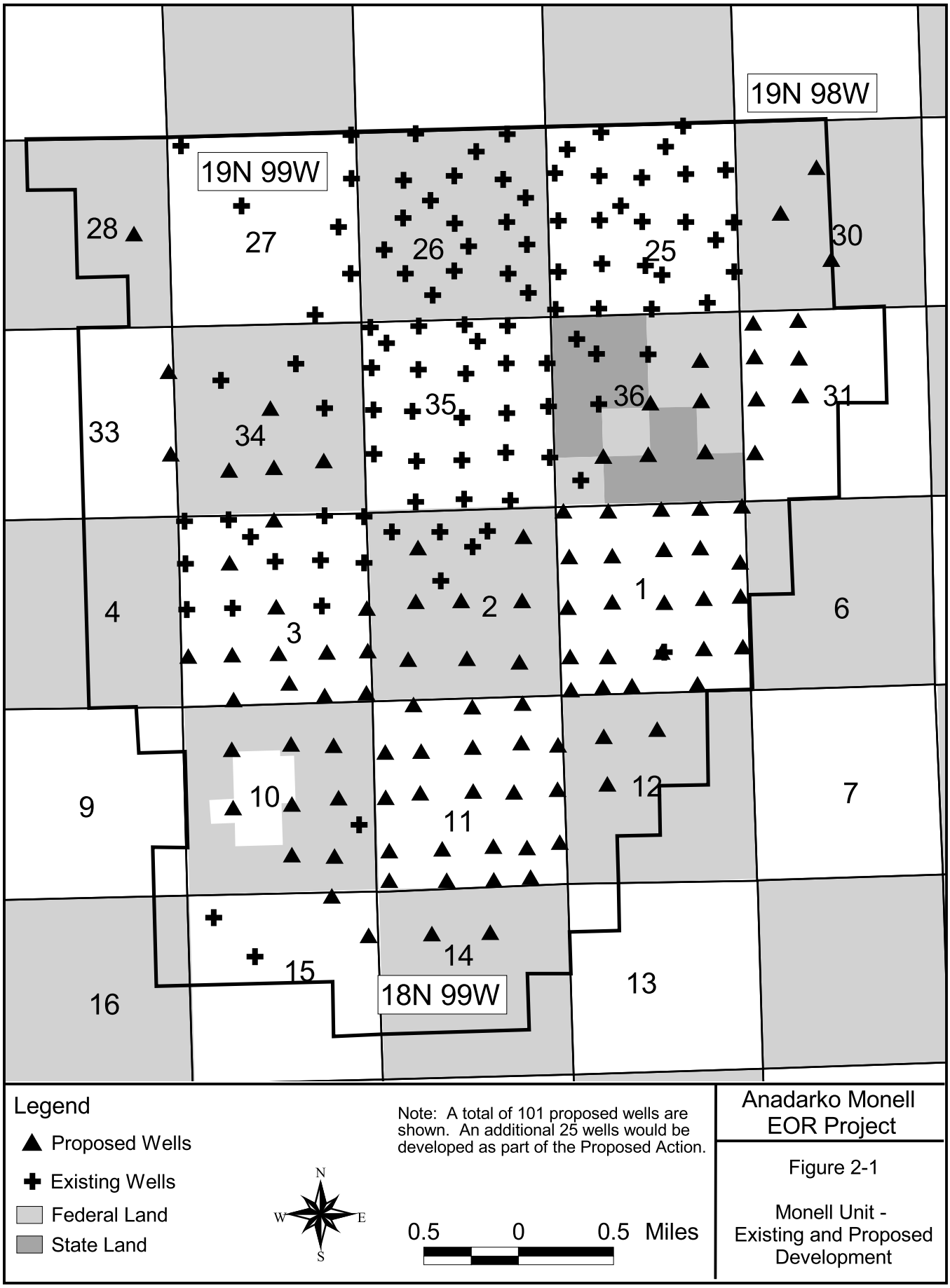
2.2 Description of Alternatives

2.2.1 Proposed Action

2.2.1.1 Introduction

Anadarko proposes to develop an EOR CO_2 project located within the administrative boundary of the BLM's Rock Springs Field Office. Anadarko proposes to drill a maximum of 126 wells, including 46 wells on BLM public lands, as part of the Proposed Action on 40-acre spacing generally located in Township 18 North (T18N), T19N, Range 98 West (R98W), and R99W, 6th PM, Sweetwater County, Wyoming. The locations of 101 proposed wells have been identified, as shown in **Figure 2-1**. An additional 25 wells (locations not determined at this time) may be drilled based on results of initial drilling. The legal description for the Proposed Action is T19N, R99W, Sections (Sec.) 25, 26, 27, 34, 35, 36, and eastern portions of Sec. 28 and 33; T19N, R98W, western portions of Sec. 30 and 31; T18N, R99W, Sec. 1, 2, 3, 10, 11, and portions of Sec. 4, 9, 12, 13, 14, 15, and 16; T18N, R98W, northwest corner of Sec. 6. Guidance for development of environmentally sound construction, maintenance, and reclamation activities for the Monell EOR project was provided by the Oil and Gas Gold Book (BLM and USFS 2005).

The surface ownership in the project area is a checkerboard pattern, with a total of 51 percent private land (5,130 acres), 46 percent of federal land (4,630 acres), and 3 percent state land (360 acres). Generally, the mineral ownership matches the surface ownership pattern. Private owners include Anadarko Land Company (ALC), Union Pacific Railroad, Sweetwater County School District, Bar X Sheep Company, Blair Hay Land and Livestock Company, PH Livestock Company, and Fuels Acquisition Company. ALC leases its surface land to Rock Springs Grazing Association for grazing purposes only. Access is allowed for hunting and recreational purposes on ALC lands, although hunting can be controlled by the grazing lessee. Access to other private


19N 98W
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18N 99W
Legend
Proposed Wells
Existing Wells
Federal Land
State Land
Note: A total of 101 proposed wells are shown. An additional 25 wells would be developed as part of the Proposed Action.
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Anadarko Monell EOR Project
Figure 2-1
Monell Unit - Existing and Proposed Development

lands is determined by the landowners. The overall estimated disturbance on federal land would be approximately 385 acres initially and 89 acres after reclamation. These estimates would represent approximately 8.3 percent and 1.9 percent, respectively, of the public land located within the project area.

Ancillary facilities would include access roads, oil, gas, and water gathering lines; a power source with a 3-mile overhead transmission line, 230-kilovolt (kV) line from Pacific Power & Light (PP&L) line to the Monell Substation; a central gathering/treating/metering facility (Main Gathering Battery); recycle compressor station within Main Gathering Battery; three test facilities; a Booster compressor station; and an underground electrical distribution system. Existing aboveground power lines within the Monell Unit would be dismantled. Permitting and the NEPA analysis for the 3-mile PP&L transmission line were previously approved by the BLM. Construction is scheduled to be completed in December 2005.

Access into the field would be provided by I-80, Sweetwater CR No. 4-24 and CR 4-26, and existing lease roads. Development of the 126 wells would require both new construction and upgrade of approximately 32 miles of new and existing access roads and approximately 95 miles of gathering lines (facility corridors). An estimated 12 miles of new roads would be built on federal land and 20 miles of road/facilities corridors would be built on private land.

Each producing well would require a power source and gas, oil, and water gathering lines to transport product to a centralized facility to be located on private land. Water lines also would be required to transport produced water to a central disposal facility. A trunk line or oil, gas, and water gathering system would be constructed utilizing high-density polyethylene (HDPE) starting with 3.5-inch-diameter line at the wellhead and graduating up to 12-inch-diameter line at the compressor inlet. A network of water lines would be constructed (up to 8-inch-diameter HDPE) to collect produced fluids. All produced water would be reinjected, and no surface water discharge would be required. Water would be conveyed to a water transfer station and then on to a water injection facility located within the Monell Unit. Gathering lines would be installed adjacent to access roads when feasible.

The estimated disturbance that would occur on federal land is listed in **Table 2-1**. Disturbance would occur during initial construction and drilling phase and after reclamation (i.e., life of project). Assumptions used in estimating the potential disturbance areas for the various project components are provided as footnotes to the table.

Drilling is expected to last for approximately 3 to 6 years, with a projected LOP of 20 to 25 years. It is anticipated that it would take approximately 8 days to drill, log, and case each well utilizing a conventional rotary drilling rig and associated rig equipment. Six additional days would be

required to run a bond log, perforate, fracture, and set a pump with a completion rig. As the project develops, road and infrastructure construction would occur concurrently with well drilling and testing. Although some level of activity would be continual, peak drilling and construction would be scheduled to begin in the spring of 2006 and continue for 3 to 6 years.

2.2.1.2 Preconstruction Planning and Site Layout

Well pads and associated access roads and gathering lines would be designed and located to minimize disturbance to areas with important wildlife habitat and/or recreational value, including wetlands and riparian areas. Important wildlife habitat is defined as areas used by breeding raptors or greater sage-grouse and seasonal big game species.

Table 2-1
Types and Approximate Acreage of Surface Disturbance on Federal Land, Proposed Action

	Estimated Life-of-Project (LOP) Disturbance Area (acres)				Estimated Initial Disturbance Area (acres)			
Type of Disturbance	**Federal**	**Private**	**State**	**Total**	**Federal**	**Private**	**State**	**Total**
Number of Wells	46	77	3	126	46	77	3	126
Well Pads[1]	46	77	3	126	92	154	6	252
Roads[2]	41.82	70	2.73	114.55	83.64	140	5.46	229.1
Treating Facilities and Substation[5]	0.0	15.0	0.0	15.0	0.0	15.0	0.0	15.0
Pipelines[3,4]	0	0	0	0	209.1	350	13.64	572.74
Injection Headers	0.75	3.75	0.0	4.5	0.75	3.75	0.0	4.5
Total	**88.57**	**165.75**	**5.73**	**260.05**	**385.49**	**662.75**	**25.1**	**1,073.34**

[1]Assumes initial disturbance of approximately 2 acres for each well pad and LOP disturbance of 1 acre per well pad.
[2]Assumes an average of 0.25 mile of new roads with parallel gas gathering and water discharge lines (60-foot average disturbance width) for each well. All disturbance except for the estimated 30-foot-wide road travel way and adjacent ditches would be reclaimed for the LOP.
[3]Assumes an average of 0.75 mile of new gathering and injection lines per well of which approximately 0.50 mile would be constructed within existing pipeline corridors.
[4]Assumes an average disturbance width of 50 feet.
[5]The treating facilities (about 8.0 acres of disturbance) would be located on private land and 5.0 acres for an Electrical Substation to be located on private land.

To allow project activities to proceed in restricted areas and/or during periods of restriction (e.g., mild winters, historical raptor nests or potential greater sage-grouse breeding/nesting sites, etc.), approval from the BLM in consultation with other agency personnel (e.g., Wyoming Game and Fish Department [WGFD], USFWS, the USACE, and the State Historic Preservation Office [SHPO]) would be required. This approval would be acquired prior to the initiation of specific

project activities (i.e., well pad construction, drilling, completion, and facility installation) on areas requiring federal authorization when sensitive resource constraints are involved.

Anadarko would follow the procedures outlined below to gain approval for the proposed activity on public lands within the project area. Development activities proposed on private and State of Wyoming surface would be approved by the Wyoming Oil and Gas Conservation Commission (WOGCC). The WOGCC permitting procedures require filing an APD with the WOGCC and obtaining a ROW from the surface owner.

- Prior to the start of construction activities on federal lands, Anadarko would submit a NOS, APD, sundry, or ROW application to the BLM with a map showing the specific location of the proposed activity. Anadarko, BLM, and affected surface lessees or owners would conduct an on-site evaluation during which site specific requirements would be identified and discussed. Following the on-site evaluation, Anadarko would file the application, which would include site-specific construction plans where necessary to describe the proposed development.

- The proposed facility would be staked by Anadarko and inspected by representatives of the BLM to ensure consistency with plans in the APD/Sundry Notice/ROW Application.

- Should discrepancies in the application be identified, Anadarko would revise the application as necessary. The BLM would then grant an authorization with the appropriate Conditions of Approval. The applicant then has 1 year within which to commence the proposed activity.

- Prior to approval, Anadarko must have cleared the proposed construction area for cultural values, special status plants and animals, greater sage-grouse, etc. If any of these resources are identified in the project study area, appropriate mitigation would be applied.

2.2.1.3 Construction and Drilling Phase

Road Construction

Proper authorizations would be obtained for all roads. Procedures for designing, constructing, and upgrading roads on federal lands would follow guidelines specified in the BLM Manual 9113: Roads (BLM 1985). Road authorization and use would be secured by the applicant through ROWs or sundry notice. The average travel surface width for gravel-surfaced resource roads would be 16 feet, with turnouts as necessary (100 feet long with 50-foot tapers spaced at 1,000-foot intervals). For the analysis of project impacts in this EA, all roads are considered resource roads. Because roads and gathering lines would be constructed within a single corridor,

a corridor width of approximately 100 feet would be used during construction. No new roads would be required to cross Bitter Creek, since an existing road can be used for access.

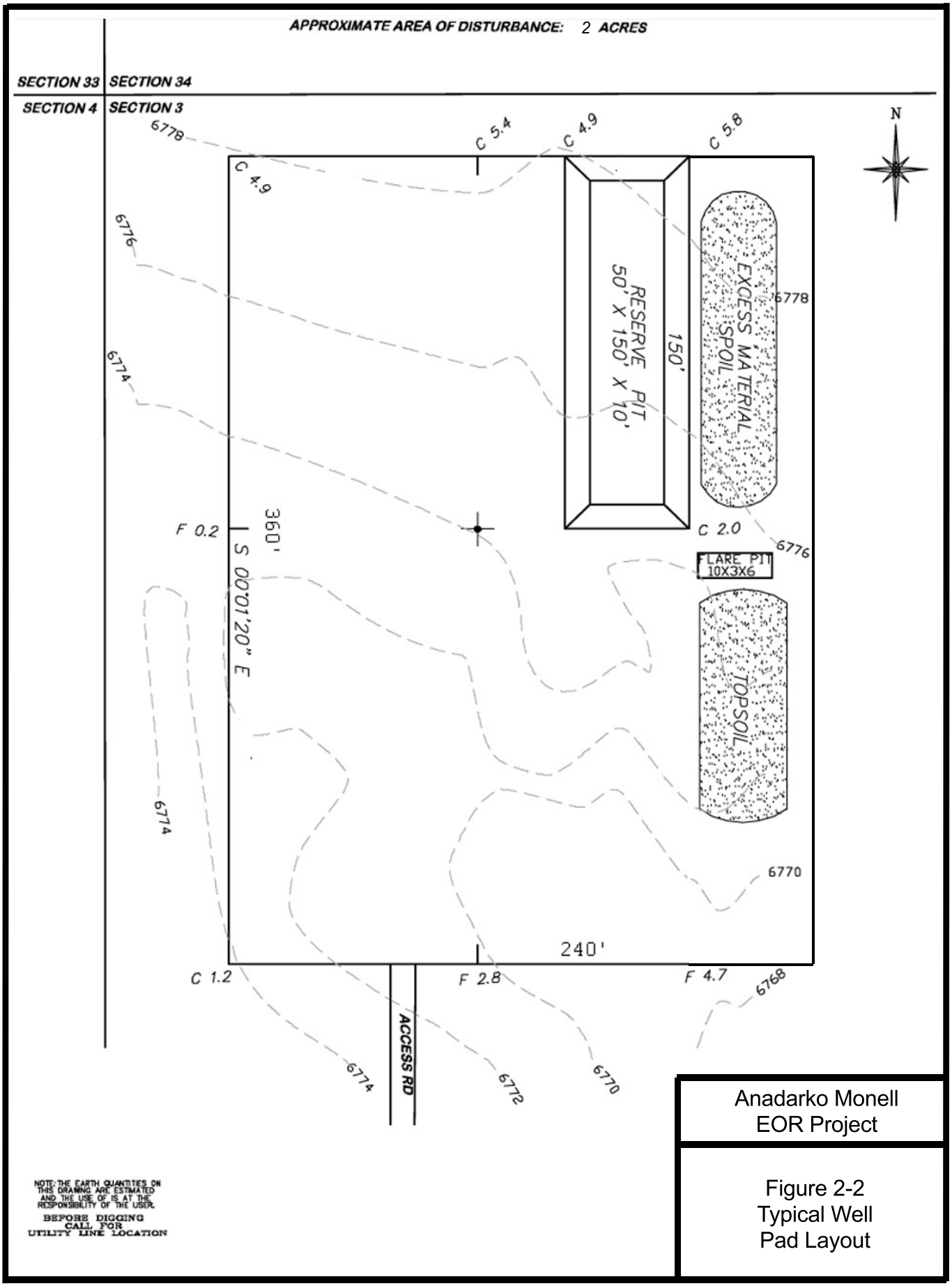
Well pad and access road construction would require a maximum of four workers for a period of approximately 5 days per location. These workers would include both heavy equipment operators engaged in road and well pad construction and truck drivers hauling heavy equipment to and from locations. Construction workers would likely be hired locally and contracted by Anadarko or its agents.

Primary access to the project area would be via CR 4-26 and CR 4-24, which traverse the area. All roads on federal land would be surfaced with appropriate materials according to BLM guidelines. Available topsoil (up to 12 inches) would be stripped from all road corridors prior to commencement of construction activities, stockpiled, and then redistributed and reseeded on backslope areas of the borrow ditch after completion of road construction activities. Borrow ditches would be reseeded in the first appropriate season after initial disturbance. If a well is determined to be unproductive, the entire road corridor would be recontoured and reclaimed within 1 year using stockpiled topsoil and appropriate seeding techniques. Any large rocks that occurred on the corridor prior to construction would be scattered over the disturbed area after reseeding. Total surface disturbance for roads is estimated to be about 229 acres (84 acres on public land) during the initial phase and 115 acres (42 acres on public land) after reclamation (LOP) (**Table 2-1**).

Well Pad Design and Construction

Major components of each well pad would include a level area for placement/support of the drilling rig and other equipment and an earthen reserve pit to contain drilling fluids. (**Figure 2-2**). Reserve pits are an acceptable method to deal with drilling muds when operated under the standard conditions of approval. Other methods such as closed-loop pitless mud systems are available, but they are more expensive and may not necessarily reduce the disturbance footprint. The entire well pad would be cleared of vegetation, and up to 12 inches of topsoil would be removed from all areas of cut, fill, and/or subsoil storage. After topsoil is removed, the pad would be graded using standard earth-moving equipment (e.g., dozers, scrapers) to prepare a level-working surface. Each well location would be designed so that the amount of cut-and-fill material would roughly balance, where feasible, thereby minimizing the need to stockpile excess subsoil adjacent to the well location until site reclamation.

The reserve pit would be excavated using a dozer or other appropriate equipment. Materials excavated from the reserve pit would be stockpiled adjacent to the pit and used to backfill the pit



Anadarko Monell
EOR Project

Figure 2-2
Typical Well
Pad Layout

during reclamation. Reserve pits would be lined with impermeable liners when required on BLM sections, and would be fenced to protect livestock and wildlife until the pit is reclaimed. Reserve pit fluids would be allowed to dry by evaporation for approximately 1 year prior to reserve pit closure and drill site reclamation. When the pit is backfilled, cuttings and drilling muds would be covered to a depth of at least 3 feet.

The level area of the well pad required for initial drilling and completion operations would be approximately 360 feet x 240 feet, including a reserve pit approximately 100 feet x 50 feet and 10 feet deep, which would represent an average surface disturbance of approximately 2 acres per well.

Erosion control would be implemented, as necessary, at each well location through prompt revegetation of disturbed areas and by constructing surface water drainage controls such as berms, diversion ditches, sediment ponds, and silt fences in accordance with the approved reclamation and Storm Water Pollution Prevention Plans (SWPPPs). All diversion ditches and other surface water and erosion control structures at each location would be shown on maps provided with each APD.

2.2.1.4 Drilling Operations

Following construction of the well pad and access road for a given well, a rotary drilling rig would be transported via truck to the well pad and erected on-site. Typically, one rig would be used for drilling. If available, two rigs could occasionally be operating at the same time. Each drilling operation would require transport of approximately 25 truckloads of drilling-related equipment and materials to facilitate the drilling operation. This includes transportation of the drill rig, drill pipe, drilling fluid products, and related support equipment, but does not include the truck traffic required for re-supplying the operation (e.g., fuel, drilling fluid additives, etc.). Additional traffic would be variable, depending on the phases of the drilling operation, but should not exceed six or seven vehicles per day per drill site throughout the drilling activity.

Approximately 8 days would be required to drill, log, and case each well using a conventional rotary drill rig and associated rig equipment. Wells would be drilled to sandstones in the Almond Formation at depths of approximately 4,000 to 5,500 feet. Cuttings and all drilling fluids would be contained in the reserve pit, and drilling fluids would be recovered and re-used whenever practical.

In the event that undesirable materials (e.g., hydrocarbon liquids) are inadvertently discharged to a reserve pit, they would be removed immediately and disposed of in accordance with appropriate and applicable requirements depending on the materials that are discharged. If hydrocarbons are

present in the pit (as evidenced by sheen on the water surface) and not immediately removed, the pit would be netted or screened to protect waterfowl.

Approximately 3,500 to 5,000 barrels (bbl) of water would be required to drill each well. Assuming no re-use, the total volume of water use for drilling 126 wells would range from approximately 56.84 to 81.20 acre-feet (**Table 2-2**). Water use per year would range from approximately 9.47 to 27.07 acre-feet, depending on the volume per well and drilling duration (3 to 6 years). Dust control would require an additional 2,000 barrels per year (0.26 acre-feet per year) for up to 6 years. This water would be obtained from the water supply wells in T18N, R99W, Sec. 1, 2, and 10, which are designated as WSW1, WSW2, WSW3, and WSW35. Information on the well depths and geologic formation is provided in Section 3.4.2. The first-time application of well water on BLM public land would be evaluated for potential water quality concerns such as dissolved solids and oil and grease.

Table 2-2
Drilling Water Use Estimates

Barrels/Well	Gallons/Well[1]	Total Gallons (126 Wells)	Total ac-ft[2]	ac-ft/yr (3-Yr Drilling)	ac-ft/yr (6-Yr Drilling)
3,500	147,000	18,522,000	56.84	18.95	9.47
5,000	210,000	26,460,000	81.20	27.07	13.53

[1]Assumes 42 gallons per barrel.
[2]Assumes 325,851 gallons/acre-foot.

No abnormal temperatures, high pressures, or hydrogen sulfide are anticipated to be encountered during drilling.

A typical drilling rig would require five workers per 12-hour shift (or tour), with one crew on shift and one crew off. These crews would reside at their own homes or other living quarters in nearby towns (e.g., Rock Springs). A number of additional personnel may be required to be on location during various stages of the drilling operation, including a geologist, a mud logger, and other service personnel. In some cases, these individuals would be required to remain on location 24 hours a day during drilling operations, and trailers would be provided on-site for their use. The trailers would provide restroom facilities for the workers.

If any spills of reportable quantities for oil, gas, or other fluids occur, Anadarko would immediately contact the BLM and any other regulatory agencies as necessary, and cleanup efforts would be initiated. These actions would occur at any stage of drilling, completion, operation, or abandonment of facilities.

During drilling and subsequent operations, all equipment and vehicles would be confined to access roads, well locations, and other areas specified in approved APDs, except in emergency situations.

Freshwater aquifers and potentially mineable coal seams would be protected by running steel casing into the open borehole and cementing the casing into place. Cementing would also isolate all other formations in the hole and would effectively eliminate the possibility of contamination between hydrocarbon zones and/or water aquifers and other mineral resources. Individual well casing design would be approved by the BLM during the APD process.

2.2.1.5 Completion and Production Testing

In accordance with 43 CFR 3164, a Well Completion Report would be filed with the BLM no later than 30 days after well completion. Following wellbore casing and cementing, potentially productive oil sands of the Almond Formation would be perforated and tested. During preparation for production testing, the rig used to drill the well would be replaced with a smaller service rig that would operate only during daylight hours. Smaller diameter (2-7/8-inch or 2-3/8-inch) tubing would be placed in the cased hole and pumping equipment set below the perforated intervals. Produced fluids would be pumped from the completed zone using sucker rod pumping units, progressive cavity pumps, or submersible pumps. Each pump would initially require approximately a 40-hp prime mover powered by electricity.

Wells may be fracture stimulated to enhance productivity. Fracturing is designed to improve gas or fluid movement from the reservoir to the wellbore. Fracturing is accomplished by pumping freshwater or other water-based fluids down the tubing and through the casing perforations under sufficiently high pressure to physically fracture the reservoir rock. Sand grains or other similar proppants (particles designed to hold fractures open) are carried in suspension in the fracturing fluids into the fractures. After fracturing is complete, the wellhead is opened at the surface to allow the fracturing fluids to flow back into the wellbore and to the surface to be discharged into the reserve pit. In successfully fractured formations, the proppant provides open channels for gas and liquid to be produced to the wellbore. Excess frac fluid would be evaporated or removed from the site for disposal at an authorized location. Wells may be fractured without proppant.

Completion of the water alternating gas injectors would consist of running a cement bond log to determine adequacy of cement then perforating the interval to be injected. Double-lined tubing would be run into the well and a packer would be set at 60 to 80 feet above the perforated interval. The wellhead would be installed and the location cleaned.

After reclamation of disturbed areas no longer needed after drilling, each production and injection well location typically would occupy an area of approximately 1 acre (**Figure 2-3**).

Within 365 days after termination of drilling and completion activities, the liquid contents of the reserve pit, if any, would be removed and disposed of at an approved waste disposal facility. If adverse weather conditions prevent removal of the fluids from the reserve pit within 365 days, an extension may be granted by the BLM. Disposal and removal of reserve pit contents would be done in a manner that satisfies applicable state and federal regulations and stipulations. The reserve pit would be reclaimed by filling it with the spoil removed during initial pit construction, spreading previously stored topsoil, and reseeding according to BLM or surface owner specifications.

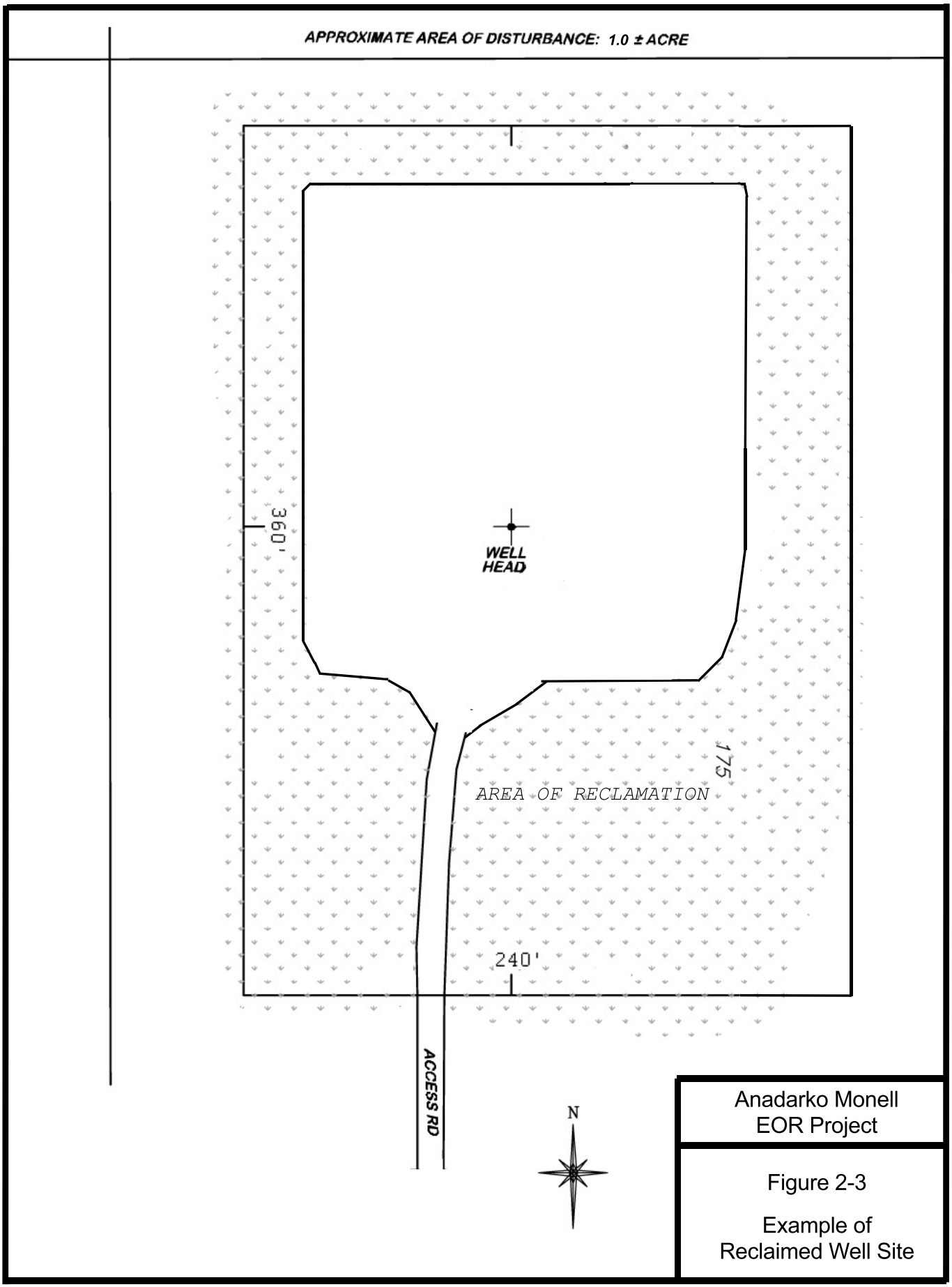
Production would, on average, require two workers for life of the project for every 60 wells. Existing Monell Unit personnel will be utilized. Telemetry would be utilized in an effort to minimize the time spent at the well site.

2.2.1.6 Production Pipelines

Production collection lines for in-field fluid collection (gathering system) would be installed to bring oil/water/gas/CO_2 from individual well sites to the CGF and the interconnect pipeline. Production collection lines would generally be located adjacent to roads, where feasible, and all necessary authorizing actions for the lines would be addressed prior to installation. A total of approximately 132 miles of oil, gas, CO_2, and water collection lines would be installed within the 50-foot-wide facilities corridor.

Sufficient topsoil to facilitate reclamation would be removed from collection line ROWs and stockpiled before construction. Suitable topsoil material removed in conjunction with clearing and stripping would be conserved in stockpiles within the ROW. Topsoil would be stripped to a minimum depth of 6 inches.

A trench approximately 5 feet deep would be excavated with a trencher or backhoe. Up to 12-inch-diameter steel with HDPE liner or Fiberspar pipe would be buried at depths of 3 to 4.5 feet, except at major road and railroad crossings, where the depth would be at least 6 feet. Spoil and topsoil would be windrowed separately. If pipelines are required to cross Bitter Creek, these lines would be bored. Automatic shutoff valves would be used at fluid pipeline crossings on Bitter Creek. Intermittent pipeline crossings would be located in areas that would not affect channel stability or stream flows.


APPROXIMATE AREA OF DISTURBANCE: 1.0 ± ACRE
360'
WELL HEAD
175'
AREA OF RECLAMATION
240'
ACCESS RD
N
Anadarko Monell
EOR Project
Figure 2-3
Example of
Reclaimed Well Site

2.2.1.7 Gas Compression

If the project proves successful, a CO_2 recompression facility would be constructed within the Main Battery area, located in the NW1/4 NW1/4 of Sec. 35, T19N, R99W, on private lands. Anadarko installed a 1,750 hp compressor engine during the initial portion of the project, with maximum of 19,250 hp at full development. Compression horsepower would be electric utility powered. Methane and CO_2 from the production wells would be delivered to the compressor station via gas gathering lines. Once the gas reaches the compressor station, dehydration units would remove residual water from the gas, and this water would be condensed and collected from the dehydration unit. A third party has proposed a Natural Gas Liquids (NGL) recovery plant to be located in T19N, R99W, Sec. 35, with a maximum area of 3 acres. The NGL plant would not result in new disturbance on BLM public land. For this reason, the disturbance area is not included in **Table 2-1**.

2.2.1.8 Oil Production

Rod-type pumping units or submersible pumps would be used to artificially lift fluid from the wells. Water produced during initial production operations would be disposed of in the existing water disposal wells. Injection wellheads and pumping unit motors may be enclosed by small shelters to protect the equipment from the elements.

All wells would be operated in a safe manner according to standard industry operating procedures. Routine maintenance of the producing wells would be necessary to maximize performance and to detect operational difficulties. Each well site would be monitored daily to ensure operations are proceeding safely and efficiently. Routine on-site equipment maintenance would also be performed as necessary. All roads and well sites would be regularly inspected and maintained (e.g., regraded, resurfaced, and watered) to minimize dust and erosion and to ensure safe operations.

Workovers are implemented on an as-needed basis and are undertaken to increase or maintain production from the current downhole producing zone; to recomplete in a new zone; to lower operating costs by reducing water and/or sand production; or to return the well to its production objective by pulling and replacing leaking tubing or pulling and repairing lift equipment. Workovers normally take 1 to 4 days and would be scheduled to minimize potential adverse effects to sensitive environmental resources.

2.2.1.9 Estimated Employment Requirements and Vehicle Use

Existing Anadarko employees would be utilized for EOR field development and operation over the LOP. Additional workers would be used for surveying, engineering, maintenance, inspection, and other specialty services. Construction workers would be hired from the local work force when available.

The estimated number of persons employed in various phases of the pre-drilling, construction, drilling, completion/testing, and producing well services including pipeline construction are shown in **Table 2-3**. It should be noted that many of the personnel employed on different phases of the well development are not full-time employees, but short-term skilled or craft workers. In most cases, the length of time for each activity is indicated in addition to the expected time on-site for the different activities involved in field development.

Table 2-3
Work Force Categories and Numbers

Worker Classification	Proposed Action
Supervisors	6
Welders/Helper	8
Surveyors	6
Laborers	90
Large Equipment Operators	7
Drill Rig Crews	30
Machine operators	6
Total	**153**

Bus transportation is expected to be provided by the general contractor from Rock Springs. Local resident workers from other parts of the area would be expected to supply their own transportation to the work site; they would not be expected to report to Rock Springs. The Proposed Action would require 30 and 40 vehicle round trips per day, respectively. The average vehicle occupancy would be two persons per vehicle. The remaining workers would require one bus trip a day from Rock Springs.

A summary of vehicle use for well completion and operation is provided in **Table 2-4**.

Table 2-4
Vehicle Use for Well Completions and Operations

Well Completion Trucks	Weight (pounds)	Number of Wheels	Vehicle Miles Traveled (VMT)	Number of Trips per Well
Rig crew	8,000	4	14	7
Water haulers	80,000	18	14	5
Frac Crews	80,000	18	14	6
Perforators/logger	40,000	6	14	1
Operations	**Weight (pounds)**	**Number of Wheels**	**Vehicle Miles Traveled (VMT)**	**Number of Trips per Well**
Lease Operators	5,000	4	40	3
E&I Technicians	5,000	4	20	1

2.2.1.10 Water Supply and Disposal

Water for drilling and dust control would come from existing water wells (see Section 2.2.1.4 for quantity and location). Water used to drill one well would be re-used to drill subsequent wells where practical. Produced water would be injected in existing disposal wells. Produced water would be transported from well locations to the water injection wells via buried water pipelines. Water for hydrostatic testing also may be used from the same water wells. The estimated volume, if used, would be 0.07 acre-feet per year. Hydrostatic test water would be discharged through a structure at the end of each test section to dissipate energy and reduce erosion.

2.2.1.11 Ancillary Facilities

Anadarko would construct ancillary facilities as necessary to meet production needs. Such facilities may include, but not be limited to: 1) produced water disposal equipment; 2) treating and processing facilities (separator building – 50 feet x 75 feet with 15-foot eaves); 3) underground electrical power lines; 4) control and test facilities (building size – approximately 20 feet x 20 feet); 5) CO_2 injection header stations; 6) pipeline pigging facilities (building size – approximately 50 feet x 75 feet); 7) field storage buildings; 8) cathodic protection facilities; 9) 230-kV overhead power transmission line owned by Pacific Power from Sec. 23 of T19N, R99W to Sec. 35 of T18N, R99W; and 10) 230-kV to 34.5-kV substation owned by Anadarko in T18N, R99W, Sec. 35. The number and location of such ancillary facilities is unknown at this time, but most would be installed within the boundaries of existing disturbances.

The underground electric distribution lines would be trenched to a depth of approximately 36 inches. The minimum depth at road crossings would be 36 inches at the shallowest point, with

the line placed in a rigid conduit and encased in red cement. The lines would be conveyed into ground-level transformers at appropriate locations for energy supply. The underground lines would be marked at 200-foot intervals with voltage markers.

2.2.1.12 Site Restoration

Reclamation would be conducted on all disturbed public lands in compliance with standards of performance identified in Appendix 5-1 of the Green River RMP (BLM 1997a). The short-term goals of the reclamation program are to stabilize disturbed areas on BLM public land as soon as possible after disturbance to protect sites and adjacent undisturbed areas from degradation and protect existing native vegetation. The long-term goal is to return the land to conditions approximating those that existed prior to disturbance.

A reclamation plan would be included in the Surface Use Plan of Operations by describing both interim and final reclamation. Reclamation would occur during two phases of the proposed project. Initially, well pads and facilities corridors would be partially reclaimed after well testing and production/ancillary facilities are installed. This initial reclamation would reduce the amount of disturbed area to only that necessary for production operations. Final reclamation at the end of the LOP would involve reclamation of all remaining disturbed areas including unproductive well sites and ROWs to these sites.

2.2.1.13 Initial Reclamation

After installation of production equipment, the well pad needed for a producing well would be reduced from approximately 2 acres to approximately 1 acre. Drilling and other fluids contained in reserve pits would be evaporated and covered in place as authorized by the BLM and/or WOGCC. The unused portion of the pad would be recontoured and reseeded within 1 year. Reclamation specifications, including methods and seed mixes, would be developed by Anadarko in consultation with the BLM or the private landowner. Reseeding also would be performed on all portions of roads, gathering line ROWs and well pads that do not need to remain disturbed during production. The entire pad and resource road for all unproductive locations would be reclaimed according to BLM or private landowner specifications within 1 year of abandonment after testing. Wells would be plugged and abandoned as authorized by the BLM or WOGCC.

2.2.1.14 Final Reclamation

At the end of the project's life (from 20 to 25 years), Anadarko would obtain necessary authorizations from the appropriate regulatory agencies or private landowners to complete reclamation. Wells would be permanently or temporarily plugged or shut-in until decisions are

reached regarding future production options. Pipelines would be purged of all combustible products and retired in place or removed, based on authorizing agency or landowner specifications. All aboveground facilities would be removed, and all unsalvageable materials would be disposed of at authorized sites. Roads would be reclaimed or left in place, based on authorizing agency or landowner preference. Reclamation procedures would be based on site-specific requirements and techniques commonly employed at the time the area is reclaimed. Compacted areas would be thoroughly ripped to a depth of 12 to 18 inches before topsoil is replaced. A seed mix approved by the BLM would be broadcast or drill seeded. Specific seed mixes will be determined by the Authorized Officer prior to reclamation.

2.2.1.15 Applicant-committed Resource Protection Measures

Anadarko will closely coordinate with the BLM, state, and/or private landowner to minimize surface disturbance of all activities associated with this project and will be in compliance with the specific regulations relating to these activities. This coordination will ensure all potential impacted resources are properly identified, evaluated, and protected as necessary. Measures designed to reduce disturbance or impacts are described below.

- Anadarko has committed to bury all electric utility lines for this project and remove overhead lines in order to enhance visual resource values within the Monell Unit.

- Anadarko has committed to the installation of remote telemetry on all wells. The remote telemetry equipment in the form of electricity generating solar panels and data transmitters present a low visual impact. The telemetry provides remote monitoring that reduces the need for daily inspections of well locations and provides real-time data concerning potential upset conditions enabling the operator to respond proactively to prevent environmental degradation (e.g., malfunctioning valve that may lead to a spill).

- Anadarko also has committed, as practically as possible, to placing pipelines in previously disturbed areas along roads for pipelines even though the measure would increase the amount of pipelines to be constructed. Locating pipelines in previously disturbed areas would greatly reduce the amount of overall disturbance.

2.2.2 Other Alternatives

The BLM has considered one other alternative that was carried forward for detailed analysis in this EA and it is No Action, as described below.

2.2.2.1 No Action Alternative

The No Action Alternative is required under the President's Council on Environmental Quality (CEQ), 40 CFR 1502.14(d), and applicable BLM implementing regulations. CEQ regulations require that a No Action Alternative must be considered in all EAs. The No Action Alternative provides a benchmark, enabling decision-makers to compare the magnitude of environmental effects of the action alternatives. Under the No Action Alternative, the BLM would reject the drilling and development proposal as submitted by Anadarko in the Proposed Action. Rejection of the current proposal would not, however, be a denial of all oil and natural gas development in the area. Transport of oil and natural gas products would be allowed from those wells within the project area that are currently productive. Additional gas development could occur on State and private lands within the project area under APD's approved by the WOGCC.

Therefore, for the purpose of analysis in this EA, the No Action Alternative means that the Proposed Action would not be implemented and that existing land uses would continue within the Monell Unit EOR Project area.

2.2.3 Alternatives Considered but Eliminated from Detailed Analysis

Several alternatives were considered in the alternatives evaluation, with variations on well pad spacing, number of well pads, and drilling techniques. These alternatives included the following: 1) fewer wells; 2) directional drilling from fewer wells; and 3) horizontal drilling from fewer wells. The rationale for eliminating these alternatives was based on the whether the technique had technical limitations or it did not meet the purpose and need, as discussed below. An important aspect of developing a successful CO_2 flood project is that the reservoir sweep efficiency and the ultimate amount of recoverable reserves are directly related to the subsurface location of the wells and the number of wells. This factor is an important part of the approach that must be part of any alternative drilling technique. Limitations involving this design factor are discussed for directional and horizontal drilling.

2.2.3.1 Fewer Wells

To determine an effective well spacing, Anadarko conducted reservoir simulation studies and economic analyses to determine the most effective well spacing that would maximize recovery of the resource. Fewer wells cost less, but they take longer to displace oil from injection to production wells and recover oil resulting in lower economic return on investment. Drilling more wells would incur higher costs, but also would cause faster oil recovery because of the denser well spacing, and closer distance between injection and production wells. Anadarko's simulations and economic analyses indicated that the fewest number of wells to provide the maximum

resource recovery would be based on 40-acre spacing. Therefore, this alternative was eliminated because it would not meet the purpose and need (i.e., increased incremental production of oil in a technological effective manner).

2.2.3.2 Directional Drilling from Fewer Well Locations

Directional drilling enables access to a subsurface location that is different from the surface location. Anadarko examined the feasibility of utilizing directional drilling to reduce the number of drill sites required to develop the EOR unit by vertical well bores. Wells would be directionally drilled from common pads to obtain the required 40-acre well spacing (1,320 feet between wells). The conclusion of the analysis was that directional drilling would not be an appropriate alternative for CO_2 flooding because of the additional costs and technical risks (including loss of sweep efficiency).

The use of directionally drilled wells require additional costs for two reasons. First, the increased drilling costs for directional drilling tools and services can represent from 20 to 25 percent of the total drilling and completion well cost. Second, the increased production well maintenance costs (20 to 25 percent over the life of the well) would result from increased rod pumping maintenance for deviated wellbores.

The technical risks from the use of directionally drilled wells from a single drilling site are mostly the result of having severe bends in the wells, which would cause increased risks of getting casing, tubulars, and downhole equipment through the bends and avoid getting stuck and/or losing the hole. Since vertical bores through the reservoir have been determined to be the most effective well configuration (Section 2.3.4), a directionally drilled well would have a double bend increasing the likelihood of the problems described above. Therefore, this alternative was eliminated because of technical limitations.

2.2.3.3 Horizontal Drilling from Fewer Well Sites

Horizontal drilling is a form of directional drilling in which the portion of the well bore in the reservoir is essentially horizontal, thus opening more of the formation to production in contrast to vertical wells. Anadarko examined the feasibility of drilling horizontal wells from common drill pads. Horizontal wells could reduce the number of wells needed by increasing the amount of formation that would be available in individual wells than for vertical wells and also accessing subsurface locations different from surface locations. Detailed analysis indicated increased costs and technical risks, described above for directional drilling, associated with drilling horizontal wells into the thin sandstone reservoir (Almond UA-5). It was concluded that it would not be possible to obtain optimum reservoir sweep efficiency for injected CO_2 to mobilize enough incremental oil.

Field experience and reservoir characteristics provide input into reservoir production simulations to determine whether horizontal or vertical wells would result in the most efficient recovery. In the case of the Almond UA-5 reservoir, recent research has shown it to be less uniform than originally thought (De Jarnett et al. 2005). The production simulations indicate that the reservoir complexity causes variability of porosity and permeability within the reservoir, which increases the likelihood that sweep efficiencies would be less with horizontal wells than vertical wells. The decreased sweep efficiencies would result in lower recovery of the resource. Additionally, it is not certain that sweep improvement techniques such as water alternating gas or chemical additives would be as effective in horizontal wells. Therefore, this alternative was eliminated because it would not meet the purpose and need and this approach has technical limitations.

3.0 AFFECTED ENVIRONMENT

This chapter describes the environmental baseline conditions in the area potentially affected by Anadarko's proposed Monell EOR Project. The BLM NEPA Handbook (H 1790-1) requires that all EAs address certain Critical Elements of the Human Environment. These critical elements are presented in **Table 3.0-1** along with the location in Chapters 3.0 and 4.0 where the element is discussed. If the element does not occur within the project area or would not be affected, this is indicated below, and the element is not discussed further in the EA.

Table 3.0-1
List of Critical Elements

Resource	EA Section
Air Quality	3.1 and 4.1
Areas of Critical Environmental Concern	None present, would not be affected
Drinking Water/Groundwater Quality	3.4 and 4.4
Cultural Resources	3.13 and 4.13
Environmental Justice	3.11 and 4.11
Floodplains	3.4 and 4.4
Hazardous and Solid Wastes	3.14 and 4.14
Invasive Non-native and Noxious Weeds	3.5 and 4.5
Migratory Birds	3.6.1.4 and 4.6
Native American Concerns	3.12 and 4.12
Prime and Unique Farmlands	None present, would not be affected
Threatened, Endangered, and Sensitive Species	3.5.4, 3.6.2, 3.7.2, 4.5, 4.6, and 4.7
Wetlands and Riparian Zones	3.5.1 and 4.5
Wild and Scenic Rivers	None present, would not be affected
Wilderness	None present, would not be affected

The study areas for the Proposed Action and cumulative impact analysis area (CIAA) are described in each resource discussion. The boundaries of the study areas, especially the CIAA, may vary for each resource depending on the spatial estimate of indirect impact area or mobility of the resource (e.g., big game).

3.1 Air Quality

3.1.1 Climate of Southwest Wyoming

The proposed project study area is located in southwestern Wyoming. The relatively dry southwest portion is a high plateau nearly surrounded by mountain ranges. This area in Wyoming ranges in elevation from 7,000 feet to more than 7,600 feet above mean sea level (amsl). Because of its elevation, this area has a relatively cool climate. Summer nights are invariably cool, although daytime readings may be quite high at times. Above 6,000 feet elevation, the temperature rarely exceeds 100°F.

The National Weather Service (NWS) recorded meteorological measurements at Rock Springs, Wyoming, from 1971 to 2000. For the proposed project location, the mean minimum temperature in July ranges from 50°F to 60°F. In the wintertime, it is characteristic to have rapid and frequent changes between mild and cold spells. Rock Springs is typically cool with an annual mean temperature of 42.8°F. Mean monthly winter temperatures range from 13°F to 29°F and summer mean monthly temperatures range from 59°F to 69°F. Recorded extreme temperatures at the Rock Springs Airport are -37°F in January 1963 and 98°F in July 2002. The frost-free season generally averages 110 to 120 days.

In the southwestern part of the state as shown by the climate record at Rock Springs (**Table 3.1-1**), average maximum July temperatures are in the low 80s°F and the average maximum January temperature is about 29°F. Average overnight low temperatures in July are approximately 46°F and in January near 11°F.

Over most of the southwest portion of Wyoming annual precipitation varies from 7 to 10 inches. Rock Springs Airport is located approximately 45 miles northwest of the project area at an elevation of 6,750 feet (Western Regional Climate Center 2004). The annual mean precipitation at Rock Springs is 9.46 inches.

During the summer, showers are frequent but amount to only a few hundredths of an inch. Occasionally, very heavy rain associated with thunderstorms will cover a few square miles. Several local storms each year produce 1 to 2 inches of rain and occasionally 3 to 5 inches in a 24-hour period. Rapid run-off from heavy rain during thunderstorms causes flash flooding on the headwater streams and when these storms coincide with the melting of the snow pack, the flooding is intensified. February is the driest month on average with an annual mean precipitation of 0.52 inch, and May is the wettest month with an annual mean of 1.36 inches.

Table 3.1-1
Rock Springs Climate for the Period 1948 – 2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Maximum Temperature (°F)	29.2	33.5	41.7	52.9	63.7	74.4	83.1	80.8	70.5	57.3	40.2	31	54.8
Average Minimum Temperature (°F)	11.4	14.3	21	28.8	37.5	46	53.1	51.4	42	31.9	20.3	12.9	30.9
Average Total Precipitation (inches)	0.5	0.5	0.7	1.0	1.2	0.9	0.7	0.6	0.8	0.8	0.6	0.5	8.8
Average Total Snow Fall (inches)	6.9	5.7	6.8	5.8	2	0.1	0	0	0.7	4	5.6	6.1	43.6
Average Snow Depth (inches)	3	2	1	0	0	0	0	0	0	0	1	2	1

Snow falls frequently from November through May and is light to moderate at lower elevations. About five times a year on average, stations at lower elevations will have snowfall exceeding 5 inches. Snowfalls of 10 to 15 inches or more occur infrequently outside of the mountains. Wind will frequently accompany or follow a snowstorm and pile the snow into drifts several feet deep. High winds, low temperatures, and snow cause blizzard or near blizzard conditions. These conditions sometimes last 1 to 2 days, and it is uncommon for a severe blizzard to last over 3 days. Total annual snowfall varies considerably. Over the drier southwest portion, snowfall amounts vary from 45 to 55 inches. The annual average snowfall at Rock Springs is 43.6 inches, with December through March being the snowiest months on average.

The nearest comprehensive wind measurements are recorded at the Rock Springs Airport, approximately 45 miles northwest of the project area. Winds blow predominately from the west to southwest 53 percent of the time, with an average wind speed of nearly 12 miles per hour (5.33 meters per second).

Wind frequency and strength greatly affects the transport and dispersion of air pollutants. The potential for atmospheric dispersion is relatively high for the project study area due to the high

frequency of strong winds. However, calm periods and nighttime cooling may enhance air stability, thereby, inhibiting air pollutant transport and dilution.

3.1.2 Air Quality

Air quality in the study area is considered to be relatively good because of a limited number of large industrial emission sources and predominately favorable atmospheric dispersion conditions. Industrial sources in the southwest quadrant of Wyoming include five large trona plants, several gas processing plants, two coal-fired power plants, numerous oil and gas wells and production facilities and associated natural gas compressor stations (WDEQ 2003).

Within the proposed project study area, the WDEQ–Air Quality Division (AQD) has the primary responsibility for implementing the Federal Clean Air Act (CAA) and the permitting of air emission sources. Therefore, emission sources proposed under this action are subject to state permitting requirements including the application of Best Available Control Technology (BACT).

National and Wyoming Ambient Air Quality Standards (NAAQS and WAAQS) have been promulgated for the purpose of protecting human health and welfare with an adequate margin of safety. Pollutants for which standards have been set include sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), and particulate matter less than 10 (PM_{10}) or 2.5 ($PM_{2.5}$) microns in aerodynamic diameter. While no pollutant monitoring data are available for the proposed project study area, background values recorded in the region are well within the NAAQS and WAAQS. Measured regional background concentrations are presented in **Table 3.1-2** with the applicable ambient air quality standards. Under the Prevention of Significant Deterioration (PSD) provisions, incremental increases of specific pollutant concentrations are limited above a legally defined baseline level. Many national parks and wilderness areas are designated as PSD Class I. The PSD program protects air quality within Class I areas by allowing virtually no incremental increases in pollutant concentrations. Areas of the state not designated as PSD Class I are classified as Class II. For Class II areas, greater incremental increases in ambient pollutant concentrations are allowed. The PSD increments for both Class I and II areas are presented in **Table 3.1-2**.

The project area and surrounding region is federally designated as a PSD Class II area. The two nearest PSD Class I areas are Bridger and Fitzpatrick Wilderness areas located approximately 100 miles north of the project study area. Contiguous with Bridger Wilderness are Popo Agie Wilderness and the Wind River Roadless Area, both designated as PSD Class II. Savage Run, a state designated PSD Class I area, is located approximately 150 miles east of the project study area.

Table 3.1-2
Air Pollutant Background Concentrations, National and State Ambient Air Quality Standards and PSD Increments

Pollutant and Averaging Time	Measured Background Concentration ($\mu g/m^3$)	National and Wyoming Ambient Air Quality Standard ($\mu g/m^3$)	PSD Class I Increment ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
Carbon Dioxide (CO)				
1-hour	2,299[1]	40,000	n/a	n/a
8-hour	1,148[1]	10,000	n/a	n/a
Nitrogen Dioxide (NO_2)				
Annual	3.4[2]	100	2.5	25
Ozone (O_3)				
1-hour	169[2]	235	n/a	n/a
8-hour	147[2]	157	n/a	n/a
Particulate Matter (PM_{10})				
24-hour	47[3]	150	8	30
Annual	16[3]	50	4	17
Particulate Matter ($PM_{2.5}$)				
24-hour	15[3]	65	n/a	n/a
Annual	5[3]	15	n/a	n/a
Sulfur Dioxide (SO_2)				
3-hour	29[4]	1,300	25	512
24-hour (National)	18[4]	365	5	91
24-hour (Wyoming)	18[4]	260	5	91
Annual (National)	5[4]	80	2	20
Annual (Wyoming)	5[4]	60	2	20

[1]Data collected at Rifle and Mack, Colorado in conjunction with proposed oil shale development during the early 1980s (CDPHE-AQCD 1996).
[2]Data collected at Green River Basin Visibility Study site, Green River, Wyoming (ARS 2002).
[3]Data collected at the Emerson Building, Cheyenne, Wyoming, during 2002 (WDEQ-AQD 2003).
[4]Data collected at the Craig Power Plant site and at Colorado Oil Shale areas from 1980 to 1984 (CDPHE-AQCD 1996).

Note: Measured background ozone concentration value represents the top tenth percentile maximum 1-hour value. Other short-term background concentrations are second-maximum values.

- Wyoming Ambient Air Quality Standards from: Wyoming Air Quality Standards and Regulations, Chapter 2.0 – Ambient Standards.
- National Ambient Air Quality Standards from: 40 CFR part 50 National Primary and Secondary Air Quality Standards.
- PSD Increments from: 40 CFR part 51.166 Prevention of Significant Deterioration of Air Quality.

The WDEQ/AQD has been authorized by the USEPA to enforce national ambient air quality standards set forth in the CAA, as amended (42 U.S. Code [U.S.C.] §7401 et seq.) through Article 2 of the Wyoming Environmental Quality Act (W.S. 35-11-201 et seq.) and the Wyoming State Implementation Plan. The WAAQS and NAAQS set upper limits for specific air pollutant concentrations at all locations where the public has access, expressed in micrograms per cubic

meter (μg/m^3) (**Table 3.1-2**). Wyoming Air Quality Standards and Regulations (WAQS&R) define ambient air as "that portion of the atmosphere, external to buildings, to which the general public has access" (WDEQ/LOD 2000). Lands within an approved mine permit boundary are not usually accessible to the general public and are not subject to the state air quality standards. Rather, they are governed by federal Mine Safety and Health Administration respirable dust standards and regulations designed to protect worker safety (30 CFR 70, 72, 74, and 75 et seq.).

Ambient air concentration data collected at monitoring sites in the region provide an indication of existing air quality. Criteria pollutant monitoring has been performed in the region for PM_{10} at sites both displaced from and predominantly upwind of the Monell EOR project area. Both displaced and local upwind sites are considered “background” monitoring sites in this analysis, although local upwind monitoring sites may be impacted by local industrial operations under certain meteorological conditions. By considering local upwind sites as background sites, a conservative range of PM_{10} concentrations is reported to reflect existing air quality in the region. These conservative monitoring results indicate that PM_{10} concentrations in the project study area are below applicable WAAQS and NAAQS.

Ambient standards for $PM_{2.5}$ have been defined in the WAQS&R; however, these standards would not be enforced at the state level until USEPA has completed an ongoing review and has determined to retain and enforce these regulations. Regional monitoring-based background values for other criteria pollutants (CO, NO_2, O_3, and SO_2) have been collected at monitoring sites in Sweetwater County, Wyoming, and in northwest Colorado and are well below applicable WAAQS and NAAQS (see **Table 3.1-2**).

Particulate monitors located at Black Butte Coal Mine indicate regional compliance with applicable WAAQS and NAAQS. Based on calculated and measured emissions, the dominant air pollutants emitted in the general area are PM_{10}, SO_2, and nitrogen oxide (NO_X). The largest contributors to PM_{10} emissions are the three mining operations in the area--the Black Butte Coal Mine, Jim Bridger Coal Mine and Leucite Hills Coal Mine, and the Jim Bridger Power Plant. Local traffic on unpaved roads also contributes to total PM_{10} concentrations, as does wind erosion of exposed surfaces. It should be noted that some measured exceedances in the 24-hour concentrations of PM_{10} did occur from 2000 through 2003 in the vicinity of the Black Butte Coal Mine. Ambient concentrations of gaseous criteria pollutants (CO, NO_2, and SO_2) occur primarily from mobile sources (vehicles) and from the Jim Bridger Power Plant.

Table 3.1-2 also presents the maximum increase of PM_{10} (PSD Increment) allowed by the federal CAA under the PSD regulations and adopted in Chapter 6 of the WAQS&R. These regulations are designed to prevent significant deterioration of existing air quality in pristine regions within the NAAQS. Under these regulations, the ambient levels of pollutants would be allowed to rise by

specified increments. Prior to obtaining a permit to construct through the WDEQ/AQD, an emissions source must demonstrate that ambient concentrations from the proposed source plus selected regional sources are less than applicable Class I and II increments.

The New Source Review process would include an evaluation of potential impacts to Air Quality-Related Values (AQRV) such as visibility, aquatic ecosystems, flora, fauna, etc., performed under the direction of federal land managers.

Chapter 6 of the WAQS&R requires WDEQ/AQD to review all plans for construction of any new or modified emissions sources prior to the issuance of construction permits. In order to obtain a construction permit, an emissions source must demonstrate compliance with emissions standards, NAAQS, WAAQS, PSD increments, and other applicable air quality regulatory requirements. If required by WDEQ/AQD, the demonstration must include air pollutant emissions from other nearby existing emissions sources to ensure that overall air quality is quantified as part of the permitting process.

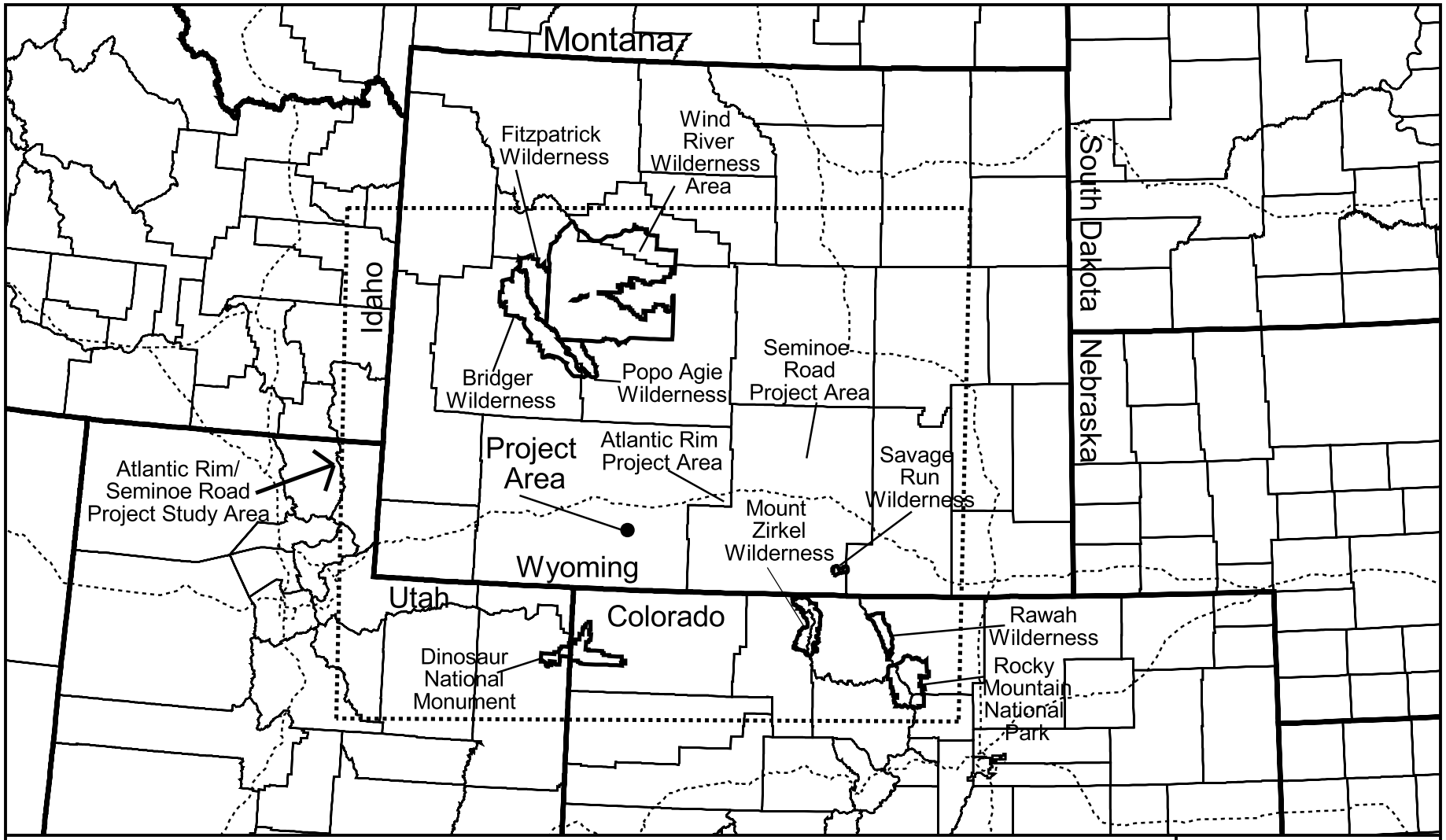
The CIAA for air quality includes southwest Wyoming, northeast Utah, southeast Idaho, and northwest Colorado (**Figure 3.1-1**).

3.2 Geology and Soils

3.2.1 Geology

3.2.1.1 Physiography and Topography

The project area is located in the eastern Greater Green River Basin, which is part of the Wyoming Basin physiographic province (Howard and Williams 1972). The Greater Green River Basin covers much of southwestern Wyoming and extends into northeastern Utah and northwestern Colorado. Elevations in the project area range from 6,600 to over 7,000 feet amsl. The area lies between the east flank of the Rock Springs Uplift and the west side of the Washakie Basin, one of several smaller sub-basins within the Greater Green River Basin. The topography consists of rolling plains and mesas bounded by prominent escarpments, referred to locally as rims. Where the plateaus are crossed by drainages, the topography is deeply incised. The project area is located between Table Rock on the southeast and the east slope of the Rock Springs Uplift.



Legend

Highways

Anadarko Monell EOR Project

Figure 3.1-1

CIAA for Air Quality

3.2.1.2 Stratigraphy

The bedrock in the project area consists of portions of the Fort Union and Wasatch Formations. The formations are Tertiary in age and largely consist of sandstones, claystone, shale, and coal (Love and Christensen 1985). The Almond Formation sandstones that produce oil and gas in the Monell Unit are upper Cretaceous in age. **Figure 3.2-1** depicts the stratigraphic and structural relationship in the area.

There is a fairly thick sequence of sedimentary rocks that underlie the project area. The Washakie Basin may contain approximately 20,000 to over 30,000 feet of sedimentary rock (Kent 1972). The total stratigraphic section in the project area from the surface to Precambrian basement may be up to 23,000 feet thick and consist of sedimentary rocks representing Cambrian to Tertiary. The Ordovician through Devonian Systems are not present in this area (Love et al. 1993). The Precambrian basement may consist of metamorphic rocks that may be billions of years old (Simms et al. 2001).

3.2.1.3 Geological Structure

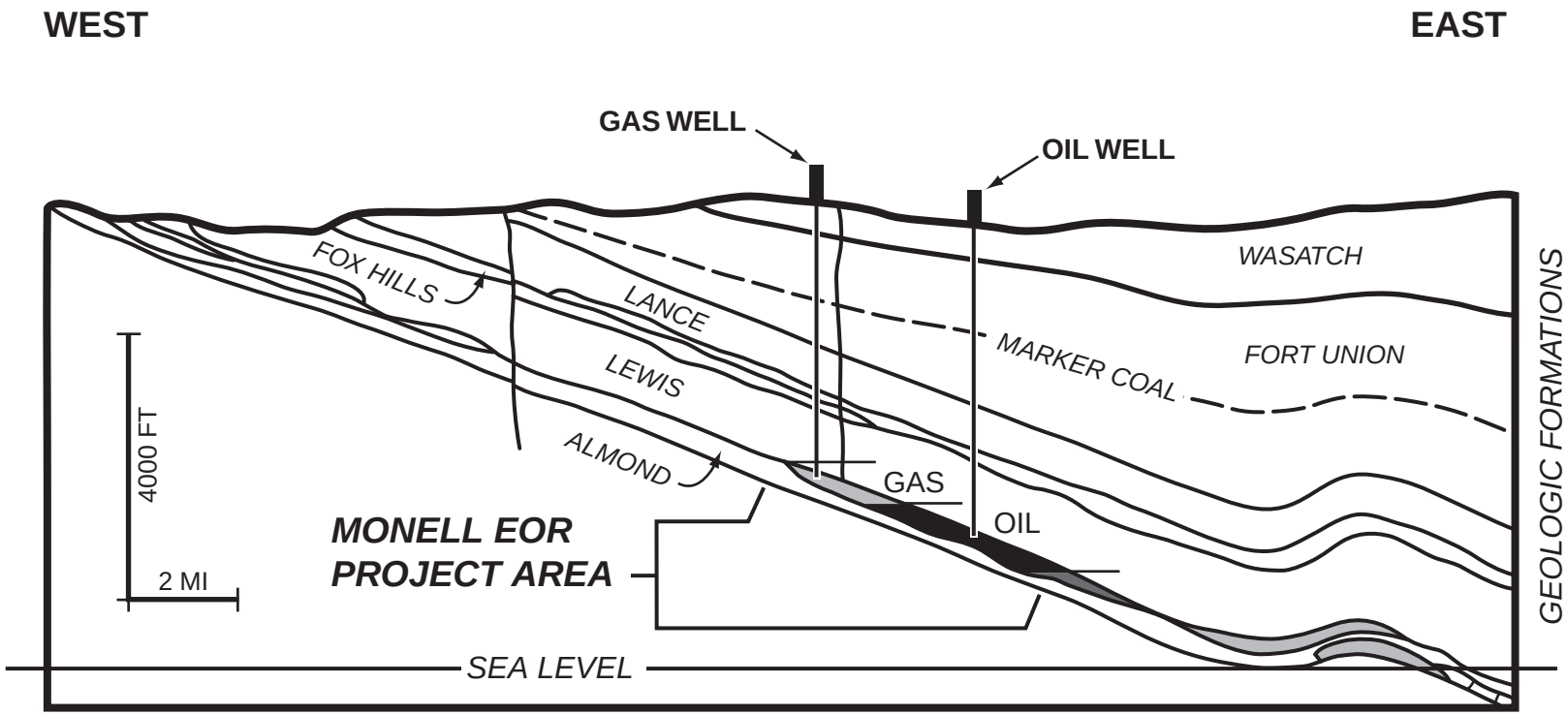
The Rock Springs Upift is a very large asymmetric anticlinal structure, with gentle southeast dips ranging from 5° to 9° (BLM 2003a). The proposed project is located on the east-dipping flank of the Rock Springs uplift. The sedimentary rocks continue to dip to the east to the structural axis of the Washakie Basin, generally 20 to 25 miles east of the project area (DeBruin 2003).

There are no apparent surface faults in the project area (Love and Christiansen 1985). Ryder et al. (1989) reported deep faults in the area mapped from seismic information; however, these faults are located outside of the project area and do not reach the surface.

3.2.1.4 Geological Hazards

Potential geologic hazards include landslides and earthquakes. Landslides involve the mass movement of earth materials down slopes and can include debris flows, soil creep, and slumping of large blocks of material. There are no identified landslides in the project area (Wyoming Geological Survey 2005).

Earthquakes occur when blocks of the earth's crust move along areas of weakness or faults releasing energy. There are no identified active faults in the project area (U.S. Geological Survey [USGS] 2005). An active fault is a fault that has demonstrated movement within the last 11,000 years. The project is located in an area of moderate risk from ground shaking, if a maximum credible earthquake (i.e., causing maximum ground motion) was to occur in the region (Frankel et al. 1997).



Source: Richers et al. (1986)

Anadarko Monell
EOR Project

Figure 3.2-1
Geological Cross-Section
of the Monell EOR
Project Area

3.2.2 Soils

Soils within the project area were identified and described based on review of a Sweetwater County Conservation District soils survey map, general Wyoming soils map, and information collected during a mid-August 2005 field survey (NRCS 2005; University of Wyoming 2005).

The upland areas located northeast and southeast of Patrick Draw and south of Bitter Creek include strongly alkaline coarse loamy to loamy soils approximately 14 inches deep to sandstone or soft shale bedrock. These are very shallow, well-drained, calcareous soils derived from sandstone, shale, and limestone, which are associated with variably steep slopes (3 to 30 percent), consist of washed parent material, and have moderate wind and water erosion hazards. This soil type supports sagebrush shrubland, salt desert shrubland/greasewood, mixed grass prairie, and foothills grassland vegetation.

The sand dune lands, located in the northeastern portion of the project area east of Patrick Draw, include strongly alkaline fine sand to coarse loamy soils about 60 inches deep, and are excessively drained. These soils occur as nearly level to undulating alluvial bottomlands and fans with scattered dune lands. These are deep, calcareous soils derived from sandstone which are associated with gently sloping surfaces (1-6 percent). In unstabilized dune communities, the hazard for wind erosion is severe. However, in most of this area, the sand is stabilized by vegetation, and the potential for water erosion is slight and wind erosion is moderate.

Deep, coarse loamy to very fine sandy loam, alkaline soils occur along Patrick Draw and Bitter Creek and their associated unnamed tributaries. These are moderately deep (about 60 inches) soils which occur on nearly level to gently sloping (0-4 percent) alluvial fans and bottomlands. These areas are characterized by sparse to moderately dense vegetative cover, moderate water erosion rates, and soil chemistry constraints for vegetative growth (e.g., high salinity, alkalinity, and shrink-swell potential). These areas are susceptible to accelerated wind and water erosion if disturbed without the implementation of erosion control measures. The extent of hydric soils (i.e., characteristically saturated during the growing season, or areas that are frequently ponded or flooded) within the project area are localized to wetland/riparian areas along Bitter Creek and unnamed tributaries.

Calcareous soils coincide with outcrops of limestone or sandstone, or soils formed in weathered limestone throughout the project area. These soils are commonly shallow with surface rock on limestone outcrops. On deeper soils, a caliche layer (i.e., hardened calcium carbonate) forms a shallow depth that limits root penetration and moisture infiltration.

An important component of soils in Wyoming's semiarid rangelands, especially in the Wyoming big sagebrush cover type, are biological soil crusts, or cryptogamic soils that occupy ground area not covered with vascular plants. Cryptogamic soils were observed at scattered locations along the ROWs during field surveys in the spring of 2004. Biological soil crusts are predominantly composed of cyanobacteria, green and brown algae, mosses and lichens. They are important in maintaining soil stability, controlling erosion, fixing nitrogen, providing nutrients to vascular plants, increasing precipitation infiltration rates, and providing suitable seed beds (BLM 2003). They are adapted to growing in severe climates; however, they take many years to develop (20 to 100) and can be easily disturbed or destroyed by surface disturbance associated with compaction, trampling, off-road vehicle (ORV) use, etc.

Surface soil samples were collected at four locations within the project area and submitted to a soils analytical laboratory to obtain information regarding the physical and chemical properties of these soils. This information was used to provide a preliminary indication of the suitability of these surface soils for future reclamation. Physical and chemical properties that were used as criteria to determine the suitability of these surface soils for reclamation included sodium adsorption rate, electrical conductivity, pH, soil texture, and coarse fragment percentage. Based on review of this information, three of the four soils were considered suitable for reclamation. One of the four soils was considered unsuitable for reclamation due to a high sodium adsorption ratio (40.5), high electrical conductivity (19.3 deciSiemens per meter), and high clay content (44 percent). This soil type covers approximately 934 acres and is located in the southern portion of the project area immediately east of Bitter Creek, which is characterized by a prevalence of greasewood and sparse herbaceous layer interspersed with bare ground.

The CIAA for soils is the four 6th-level watersheds that drain the Monell EOR project area. Additional information on these watersheds is provided in Section 3.4.

3.3 Mineral and Paleontological Resources

3.3.1 Mineral Resources

3.3.1.1 Leasable Minerals

<u>Fluid Minerals</u>

The major fluid minerals in the area are oil, natural gas, and coal bed methane. Geothermal energy is also considered a fluid mineral resource, but there are no identified geothermal resources in the project area.

Oil and Natural Gas. The Monell Unit is located in an area with abundant oil and natural gas resources. The Greater Green River Basin is estimated to contain undiscovered resources of 84 trillion cubic feet of natural gas and 131 million bbls of oil (USGS 2002). The proposed project is located in the vicinity of several oil and gas fields which are listed in **Table 3.3-1**.

Table 3.3-1
Oil and Gas Fields in the Vicinity of the Monell EOR Project

Field Name/Location	Date Discovered/ Status	Producing Formation(s)	Oil - Cumulative Production[1,2]	Gas – Cumulative Production[1,2] (thousand cubic feet)
Antelope T17N, R100-101W	1970/Active	Almond Mesaverde	27,587	37,436,205
Arch Unit T19N, R98W	1959/Active	Almond	19,041,235[3]	92,174,291[3]
Brady North T17N, R100W	1978/Active	Dakota Entrada, Nugget Weber	8,626,362	21,414,697
Deadman Wash T20, R101W	1973/Active	Frontier Muddy Dakota	4,282	26,740,810
Delaney Rim T18N, R97W	1976/Active	Lewis Almond	1,321,566	9,803,770
Desert Springs T20 & 21 N R98W	1958/Active	Fox Hills Lance Lewis Almond	1,527,502	344,230,619
Desert Springs West	1959/Active	Lewis Almond	1,655,424	20,044,501
Golden Wall T18n, R101W	1977/Abandoned	Dakota	130	2,906
Hallville T19N, R100W	1962/Abandoned	Almond	40,907	2,237
Neff T18N, R98W	1968/Abandoned	Almond	255	32,795
Higgins T17N; R98-99W	1969/Active	Almond, Lewis, Nugget, Weber	59,963	89,336,346
Masterson T20N, R101W	1970	Blair Mowry Muddy Dakota	1,652	1,598,348
Patrick Draw (includes Monell Unit) T18 & 19N R98 & 99W	1959/Active	Fox Hills Lance Lewis Almond Ericson	60,705,343	510,535,036

Table 3.3-1 (Continued)

Field Name/Location	Date Discovered/ Status	Producing Formation(s)	Oil - Cumulative Production[1,2]	Gas – Cumulative Production[1,2] (thousand cubic feet)
Point of Rocks T19 & 20N, R101W	1963/Active	Blair Frontier	117,394	6,224,954
Red Hill T19N, R100W	1962/Abandoned	Almond Ericson	0	14,913
Sand Butte T17N; R99W	1960/Active	Mesaverde	0	3,426,392
Shiprock T19N, R101W	1977/Active	Frontier	0	1,557,605
Stage Stop T18N; R99W	1966/Active	Almond, Lance, Lewis, Wasatch, Fort Union	924,564	12,499,685
Table Rock T18N; R97-98W T19N; R97-98W	1946/Active	Wasatch, Ft. Union, Fox Hills Lewis, Mesaverde, Frontier, Dakota, Morgan, Nugget, Weber, Madison	6,300,038	679,007,794
Table Rock Southwest T18N, R98W	1955/Active	Almond, Lewis, Mesaverde	39,179	2,838,502

[1]Production to end of June 2005.
[2]Bitter Creek Gas Development has been approved, but there is no production reported at this time.
[3]Production to end of December 2005.

Source: WOGCC 2005; Wyoming Geological Association 1992.

Coal Bed Methane. The total undiscovered coal bed methane resources of the Greater Green River Basin are estimated be about 1.5 trillion cubic feet of gas (USGS 2002). The project area is within an area of potential for production of coal bed methane from upper Cretaceous and Tertiary rocks. Anadarko has two coal bed methane projects in the area that are listed in **Table 3.3-2**. Although the Copper Ridge Unit has reported production since July 2003, it is still classified as exploratory by the WOGCC.

Solid Leasable Minerals. Solid leasable minerals include coal, trona, and oil shale. Coal and trona are produced in substantial quantities in the Green River Basin. Coal is mined from the Fort Union Formation at the Black Butte Coal Mine, about 4.0 miles west of the project area. Most of the mineable coal has been removed since mining began in 1980 (BLM 2005). There are no trona

leases in the project area, but trona is mined in areas west and northwest of Rock Springs. The potential oil shale bearing Green River Formation is present to the south of the project area (Love and Christensen 1985), but there are oil shale no strata in the project area.

Table 3.3-2
Coal Bed Methane Units in the Vicinity of the Proposed Project

Unit Name Location	Date First Production/Status	Coal	Gas Cumulative Production (thousand cubic feet)
Copper Ridge T16-17N; R100-101W	July 2003/ Exploratory	Undetermined	243,352[1]
North Copper Ridge T17-18N, R100-101W	Not available/ Exploratory	Undetermined	1,027[2]

[1]Production to May 2005.
[2]Production to October 2004.

Source: WOGCC 2005.

3.3.1.2 Locatable Minerals

No locatable minerals or mining claims are present in the project area (BLM 1997a).

3.3.1.3 Mineral Materials

There is moderate potential for mineral materials (sand and gravel), but there are no active sand and gravel pits in the project area (BLM 1997a).

CIAA for minerals covers T17N to T20N, R98W to R101W, and the west halves of T18N and T19N, R97W. Also included in the CIAA is T21N, R93W. The oil and gas fields listed in **Table 3.3-1** are in the CIAA.

3.3.2 Paleontological Resources

The paleontological resources on public lands are recognized by the BLM as a fragile and nonrenewable scientific record of the history of life on earth, and therefore, they represent an important and critical component of America's natural heritage. Once damaged, destroyed, or improperly collected, their scientific and educational value may be greatly reduced or lost forever. In addition to their scientific, educational, and recreational values, paleontological resources can

be used to inform land managers about interrelationships between the biological and geological components of ecosystems over long periods of time.

Management of paleontological resources is directed by the Antiquities Act of 1906. The BLM has authority to manage paleontological resources under a number of authorities including, but not limited to, the Archaeological Resource Protection Act of 1979 (16 U.S.C. 470ee), which prohibits the unauthorized removal of fossils that are in an archaeological context, and Federal Cave Resources Act of 1988 (16 U.S.C. 4306), which prohibits the removal of paleontological resources when they are taken without authorization from a designated significant cave. The BLM utilizes other more general laws and authorities to protect paleontological resources. These laws include Theft of Government Property (18 U.S.C. 641), Damage to Government Property (18 U.S.C. 1361), and FLPMA (43 U.S.C. 1733).

In addition, BLM Manual 8720, *General Procedural Guidance for Paleontological Resource Management*, is intended to provide a consistent and comprehensive approach to the management of paleontological resources including identification, evaluation, protection, and use (BLM 1998).

Scientifically significant paleontological resources, including vertebrate, invertebrate, plant, and trace fossils, are known to occur in many of the geologic formations within the project area. These fossils are documented in the scientific literature, in museum records, and are known by paleontologists and land managers familiar with the area.

The paleontologic potential of the project study area was evaluated using the Probable Fossil Yield Classification (PFYC) developed by the U.S. Forest Service (USFS) and used by the BLM. The classifications include:

- Class 1 Igneous and metamorphic geologic units (excluding tuffs) that are not likely to contain recognizable fossil remains.

- Class 2 Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant nonvertebrate fossils.

- Class 3 Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.

- Class 4 Class 4 geologic units are Class 5 units that have lowered risks of human-caused adverse impacts or lowered risk of natural degradation. Proposed ground-disturbing activities

would require assessment to determine whether significant paleontological resources occur in the area of a Proposed Action and whether the action would impact the resources.

- Class 5 Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils or scientifically significant nonvertebrate fossils and that are at high risk of natural degradation or human-caused adverse impacts.

Paleontological resources within sedimentary deposits exposed at the surface record the history of animal and plant life in Wyoming during the early part of the Cenozoic Era (Paleocene and Eocene Epochs). Three geologic deposits are exposed at the surface within the project area: 1) unnamed deposits of Quaternary (Holocene) age; 2) Wasatch Formation of early Eocene age; and 3) Fort Union Formation of Paleocene age. With the exception of the Holocene deposits that are too young to contain fossils, all sedimentary rock units in the project area have the potential to contain scientifically important paleontological resources (BLM 2003a).

3.3.2.1 Wasatch Formation

The high paleontological potential of the Wasatch Formation in southern Wyoming is well known. Along the east flank of the Rock Springs Uplift both the Niland Tongue and main body contain accumulations of fossil vertebrates (fish, turtles, crocodiles, birds, and mammals), invertebrates (snails and clams), and traces and tracks of these organisms and fossil plants. Vertebrate remains include isolated bones and teeth and rarely articulated skeletal parts. The fossil mammals include primates, insectivores, marsupials, condylarths, (archaic hoofed animals), artiodactyls, perissodactyls, carnivores, creodonts, bats, rodents, arctocyonids, and tillodonts.

Review of institutional records (University of California, University of Colorado, and University of Wyoming) reveal that more than 250 fossil vertebrate localities have been identified in the Wasatch Formation along the east flank of the uplift. Six fossil vertebrate localities occur in the Niland Tongue. At least two dozen fossil localities are known from the main body of the formation exposed along the east side of Patrick Draw Road. To date, more than 13,000 cataloged specimens in the University of California Museum of Paleontology, the University of Colorado Museum, the U.S. National Museum, and the University of Wyoming have come from sediments of the Wasatch Formation as exposed along the Patrick Draw Road (BLM 2003a). The BLM considers the Wasatch Formation a Class 5 formation.

3.3.2.2 Fort Union Formation

The high potential of the Fort Union Formation exposed along the eastern flank of the Rock Springs Uplift to produce scientifically important fossils of vertebrates, invertebrates, and plants is

well documented (BLM 2003a). Fossil vertebrate remains are known from more than 50 fossil localities presently identified in the formation. Mammal fossils from these localities include at least 70 species representing multituberculates, marsupials, proteutherians, insectivores, primates, carnivores, condylarths, pantodonts, and taeniodonts of middle to late Paleocene age. The uppermost rocks of the formation contain fossil mammals that mark the transition of the Eocene epoch and document the appearance of modern mammalian families in North America as well as the disappearance of archaic forms.

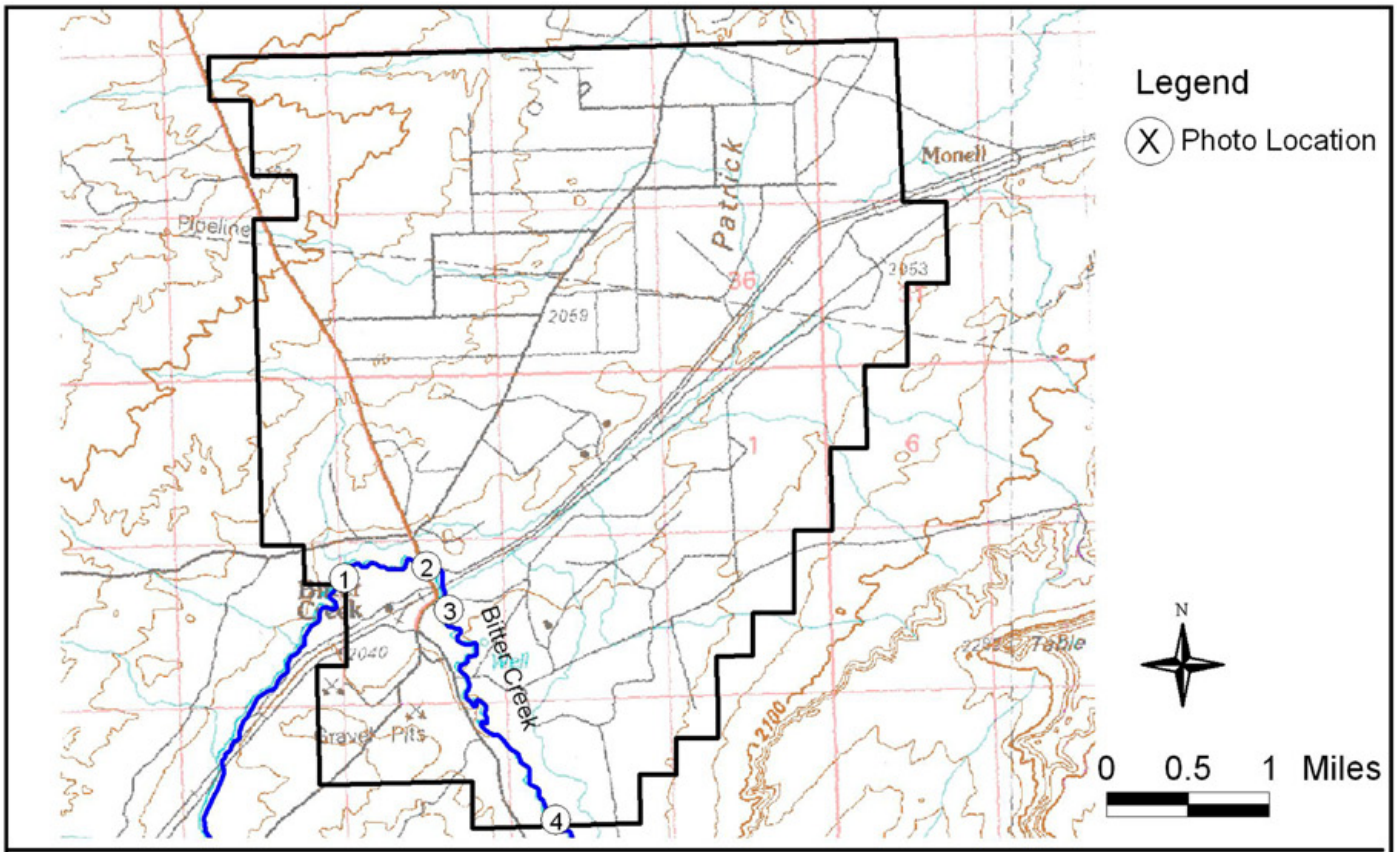
To date, more than 1,500 vertebrate specimens have been collected from the Fort Union Formation along the east flank of the uplift. The localities and specimens are of high scientific importance for several reasons: 1) they yield small mammals, reptiles, and amphibians, many of which are new species and are the subject of ongoing study; 2) they include a late Paleocene age locality with the greatest diversity of fossil mammals known from that age; and 3) they include localities that are closely tied with plant fossils allowing the study of mammalian evolution as it ties with climatic evolution (BLM 2003a). The BLM considers the Fort Union Formation a Class 3 formation.

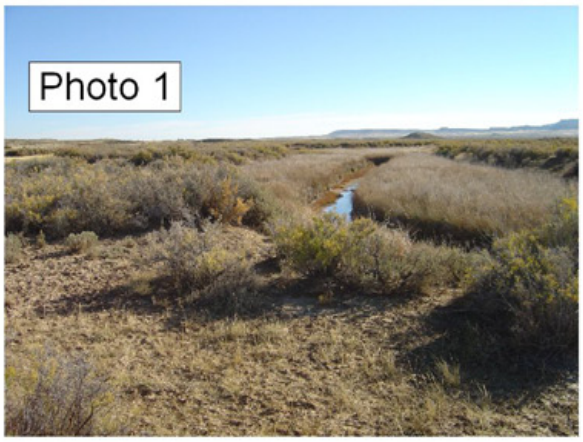
3.4 Water Resources

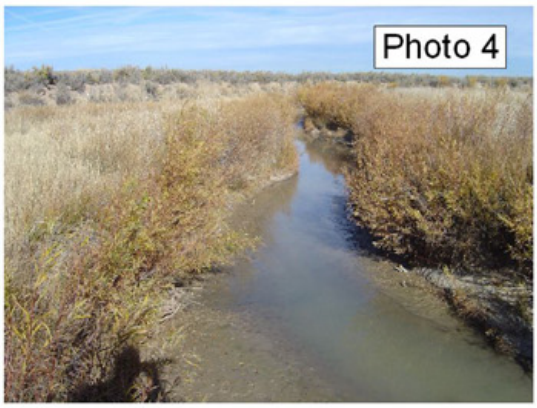
3.4.1 Surface Water

The project area lies within the Bitter Creek drainage (USGS Basin #14040105). Bitter Creek is the main surface water feature in the drainage. In the project area, numerous unnamed and one named tributary stream (i.e., Patrick Draw) provide water on an intermittent basis. The Bitter Creek watershed discharges into the Green River near the town of Green River, Wyoming, which is located approximately 40 miles downstream of the project study area.

Within the project area (T18N, R99W, Sec. 3, 10, 14, and 15), Bitter Creek mainly exhibits perennial flow. In total, approximately 3.1 miles of Bitter Creek are located within the project study area. Representative sections of the stream are shown in **Figure 3.4-1**. Bitter Creek contains a mixture of intermittent, ephemeral, and perennial sections both upstream and downstream of the project area. Peak flow occurs mainly in the spring and early summer as a result of snowmelt and rainfall. Based on a site reconnaissance conducted in June 2005, the wetted stream channel varies from approximately 2 to 8 feet. The wider stream sections are the result of beaver dam construction. The streambank widths vary from approximately 5 to 40 feet. The wider widths reflect the presence of erodible soils and steep-cut banks. Streamflow monitoring was conducted at one gauging station (#09216545) on Bitter Creek near the town of Bitter Creek, Wyoming (T18N, R99W, Sec. 10). Based on data collected from 1975 through 1981, the mean annual







Anadarko Monell EOR Project

Figure 3.4-1

Bitter Creek Drainage

average streamflow ranged from 1.5 cubic feet per second (cfs) in 1976 to 11.2 cfs in 1980 (USGS 2004). The highest instantaneous peak discharge recorded at this station was 346 cfs in 1980.

The Bitter Creek floodplain is approximately 0.5 to 0.75 mile wide. Most of the floodplain is considered a saline upland area with vegetation dominated by greasewood or sagebrush. Riparian vegetation consisting of willow occurs mainly in areas with beaver dam development.

The WDEQ (2001) classifies surface waters according to quality and ability to support aquatic life. Bitter Creek is a Class 2C stream, while Patrick Draw and numerous other unnamed intermittent tributaries are considered 4B waters. These classifications are defined as follows:

- **Class 2C** waters are those known to support or have the potential to support only nongame fish populations or spawning and nursery areas at least seasonally including their perennial tributaries and adjacent wetlands. Class 2C waters include all permanent and seasonal nongame fisheries and are considered "warm water." Uses consist of nongame fisheries, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture, and scenic value.

- **Class 4B** waters are intermittent and ephemeral stream channels that have been determined to lack the hydrological potential to normally support and sustain aquatic life pursuant to the provisions of Section 33(b) of the WDEQ regulations. In general, these streams are characterized by only infrequent wetland occurrences or impoundments within or adjacent to the stream channel over its entire length.

Water quality in Bitter Creek has been monitored at a USGS station (#09216545) near Bitter Creek, Wyoming, from 1975 through 1981 (USGS 2004). Sampling results showed pH from 7.8 to 9.3 (average of 8.6), total dissolved solids (TDS) from 280 to 4,500 milligrams/liter (mg/L) (average of 1,755 mg/L), and total suspended solids (TSS) from 22 to 21,900 mg/L (average of 1,846 mg/L). These results indicate relatively low water quality due primarily to high dissolved solids, suspended sediment, and turbidity. A primary water quality concern in the area is salinity. Erosive and saline soils naturally occur within the general area due to the presence of material from sedimentary rocks of the Tertiary Green River and Wasatch Formation. Bitter Creek was listed on the 2000 WDEQ/Water Quality Division (WQD) 303(d) list of water bodies with water quality impairments because of elevated levels of fecal coliform/e-coli bacteria and dissolved chlorides detected by the WDEQ/WQD and the USGS. The Sweetwater County Conservation District has initiated a planning effort to develop a watershed plan, with a final plan schedule of March 2005 (BLM 2005).

Based on available water quality data, surface waters in the study area are not suitable for domestic purposes. Surface water uses could include agriculture, industrial, wildlife, and livestock watering.

The CIAA for surface water resources is the four 6th-level watersheds that drain the Monell EOR project study area (**Figure 3.4-2**). In total, these watersheds contain approximately 20 miles of Bitter Creek (intermittent and perennial segments) over 100 miles of intermittent and ephemeral tributaries to Patrick Draw and Bitter Creek.

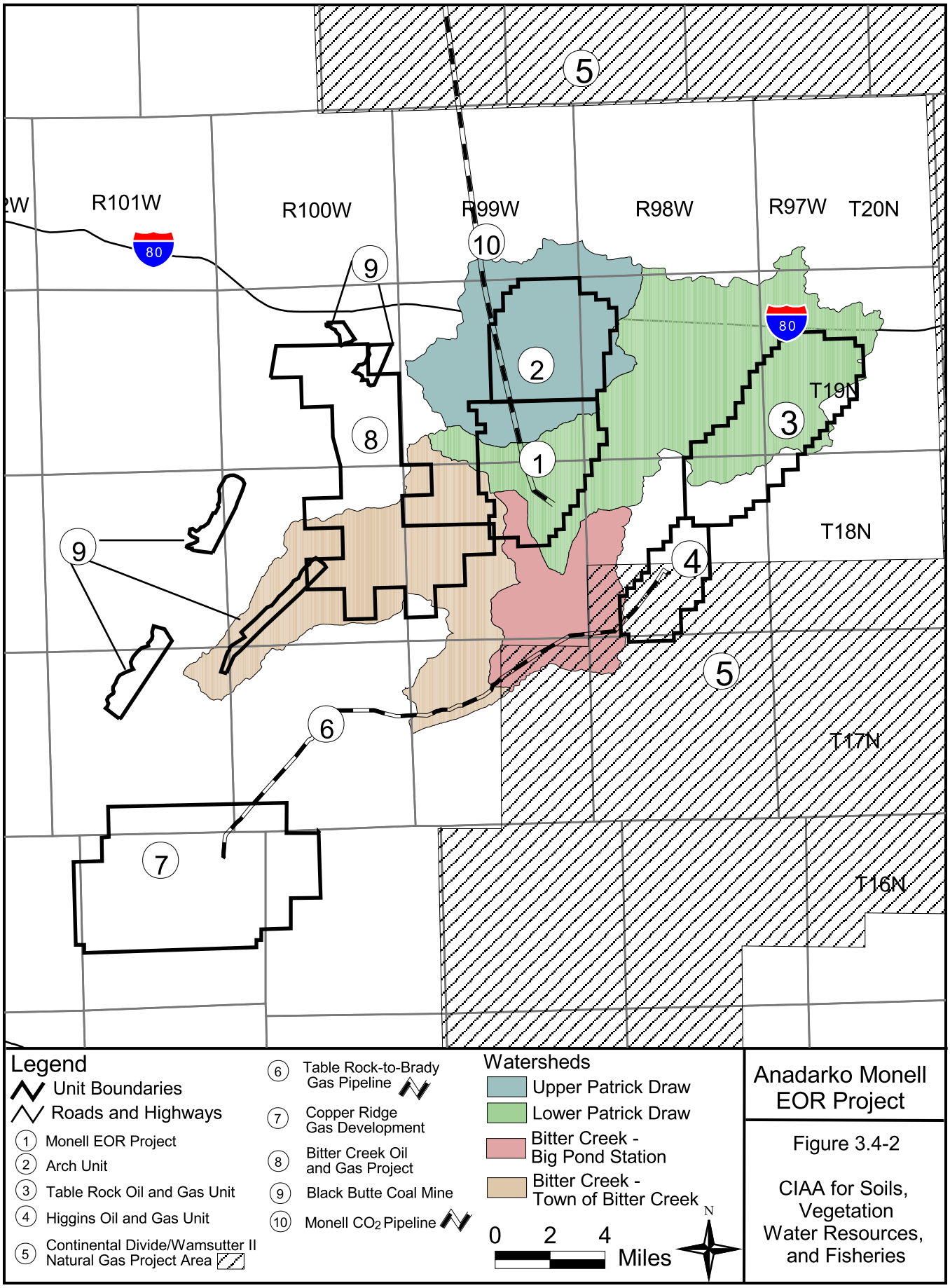
Collectively, the Monell EOR project area encompasses approximately 10,112 acres of these four watersheds, which consisted of 2,714 acres for Upper Patrick Draw; 5,973 acres for Lower Patrick Draw; 871 acres for Bitter Creek/Big Pond Station; and 554 acres for Bitter Creek/Town of Bitter Creek.

3.4.2 Groundwater

The project area is located in the western portion of the Washakie Basin and the eastern flank of the Rock Springs uplift. The Wyoming Water Development Commission (2001), Collentine et al. (1981), and Welder and McGreevy (1966) have described groundwater resources within this basin. Beneath the project area, both confined and unconfined groundwater exists in shallow and deep aquifers with geologic strata that dip in an eastern direction in the basin. The major confined aquifer zones are included within the Mesaverde Group and Wasatch Formation. In general, the underlying formations are at depths greater than 50 to 100 feet from the surface and range in thickness from less than 100 to 5,000 feet. Groundwater flow is in an eastward direction at a gradient equivalent to the stratigraphic dip (Welder and McGreevy 1966). Recharge to the water bearing strata of the Washakie Basin is mainly from infiltration of precipitation. The estimated recharge rate for the general area is 0.01 to 2.0 inches per year (Heath 1984). However, most of the precipitation leaves the area as surface runoff before it can infiltrate into the groundwater. Infiltration of precipitation and recharge from stream channels provide the majority of shallow groundwater volume.

Lesser amounts of unconfined groundwater occur locally in some alluvial valleys and where saturated rocks are near the surface. The primary source of unconfined groundwater in the study area is the Bitter Creek alluvium.

In addition to the Bitter Creek alluvium and zones within the Wasatch formation, four bedrock formations (Fort Union, Lance, Almond, and Erickson Sandstone) underlie the project study area and contain water-bearing units. The latter two are members of the Mesaverde Group, which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8
9
10
Legend
Unit Boundaries
Roads and Highways
1 Monell EOR Project
2 Arch Unit
3 Table Rock Oil and Gas Unit
4 Higgins Oil and Gas Unit
5 Continental Divide/Wamsutter II Natural Gas Project Area
6 Table Rock-to-Brady Gas Pipeline
7 Copper Ridge Gas Development
8 Bitter Creek Oil and Gas Project
9 Black Butte Coal Mine
10 Monell CO2 Pipeline
Watersheds
Upper Patrick Draw
Lower Patrick Draw
Bitter Creek - Big Pond Station
Bitter Creek - Town of Bitter Creek
0 2 4 Miles
N
Anadarko Monell EOR Project
Figure 3.4-2
CIAA for Soils, Vegetation Water Resources, and Fisheries

underlie the confining Lewis Shale. These units occur at greater depths than alluvial deposits and are found at scattered locations. These units are mainly comprised of sandstone, which ranges in size from fine to course grain material. There are no known seeps or springs within the project study area.

According to the Wyoming State Engineer's Office records, approximately 27 water wells have been drilled in the project study area. Most of these wells (23) are used for monitoring, while the remaining four wells are associated with Anadarko's Monell Development. These four wells are 3,580 to 4,040 feet deep and completed in the Almond Formation (Wyoming State Engineer's Office 2005). Yields from these wells are 451 to 475 gallons per minute (gpm). Depths of the monitoring wells are 16 to 93 feet.

Groundwaters in Wyoming are classified in order to apply standards to protect water quality. Based on the WDEQ classifications, groundwater underlying the project area are considered Class II (agricultural use), Class III (livestock), Class IV (Industrial use), Class V (commercial deposits of hydrocarbons), and Class VI (unsuitable use). Groundwater quality of the various geologic formations underlying the project area ranges from poor to good (Welder 1968). Previous sampling in the underlying formations have shown TDS concentrations ranging from less than 500 to over 50,000 mg/L (Collentine et al. 1981). Groundwater from depths less than 1,500 feet from the surface generally exhibits TDS values less than 3,000 mg/L (Welder and McGreevy 1966). Alluvial aquifers such as Bitter Creek also have relatively high TDS concentrations. Area groundwater also typically shows a high degree of mineralization and is characterized as calcium sulfate or sodium bicarbonate/sulfate.

The CIAA for groundwater resources is the underlying groundwater below the four 6th-level watersheds.

3.5 Vegetation, Wetlands, and Range Resources

3.5.1 Vegetation and Wetlands

3.5.1.1 Vegetation

The project area is characterized by a mosaic of shrublands, prairie grasslands, and riparian/wetland areas, which include several vegetation types. Ground-truthed Gap Analysis Project (GAP) resources generated by the USGS Biological Resources Division and field reconnaissance information collected on June 29, 2005, and August 15 through 19, 2005 were used to identify specific vegetation types within the project area. Seven vegetation types were identified, of which five primarily consist of native vegetation and are collectively classified as

rangeland. These vegetation types include sagebrush shrubland, salt desert shrubland/ greasewood, mixed-grass prairie, foothills grassland, and wetland. The remaining two vegetation types support limited or non-native vegetation and include urban/developed and barren areas. No cultivated cropland or pastureland occurs within the project area.

Sagebrush Shrubland

The sagebrush shrubland vegetation type comprises approximately 30.6 percent (approximately 3,095 acres) of the pre-disturbance vegetation within the project area. This type is most commonly found in valley bottoms, and on plateaus and benches. This type is widely distributed within the project area and includes a combination of mostly sparse with lesser amounts of low to moderately dense sagebrush and a variety of grass and forb species in the understory. Plant species that typically occur in this type include Basin big sagebrush (*Artemisia tridentata* spp. *tridentata*), Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*), sand sagebrush (*Artemisia filifolia*), broom snakeweed (*Gutierrezia sarothrae*), rabbitbrush (*Chrysothamnus* spp.), prickly pear (*Opuntia* spp.), spiny hopsage (*Grayia spinosa*), Indian ricegrass (*Achnatherum hymenoides*), needle-and-thread (*Hesperostipa* spp.), and western wheatgrass (*Pascopyrum smithii*).

Salt Desert Shrubland/Greasewood

The salt desert shrubland/greasewood type comprises approximately 29.3 percent (approximately 2,968 acres) of the pre-disturbance vegetation within the project area. This is indicative of dry, saline or alkaline soils and, in the project area, is generally found in drainage bottoms, and flats adjacent to Bitter Creek and Patrick Draw. This type is primarily dominated by greasewood (*Sarcobatus vermiculatus*) and saltbush (*Atriplex* spp.). Common species which may occur within this type include spiny hopsage, bud sagebrush (*Picrothamnus desertorum*), and winterfat.

Mixed-grass Prairie

The mixed-grass prairie type comprises approximately 7.4 percent (approximately 747 acres) of pre-disturbance vegetation within the project area. This type is a combination of low, medium, and high herbaceous rangeland types. Mixed-grass prairie can be divided into several types and is characterized by many common species including needle-and-thread, western wheatgrass, prickly pear, and scarlet globemallow (*Sphaeralcea coccinea*). Wyoming big sagebrush is a common shrub of this grass community within the area.

Foothills Grassland

The foothills grassland type comprises approximately 11.5 percent (approximately 1,167 acres) of pre-disturbance vegetation within the project area. This type also consists of a combination of grasses, which comprise 50 percent or more of the species composition, and a minor shrub component. Foothills grassland is comprised of numerous grassland species including squirreltail (*Sitanion hystrix*), Indian ricegrass, needle-and-thread, and western wheatgrass. Big sagebrush, black sagebrush (*Artemisia nova*), broom snakeweed, rabbitbrush, fourwing saltbush (*Atriplex canescens*), and winterfat (*Krascheninnikovia lanata*).

Riparian/Wetland

See Section 3.5.1.2, Wetlands, for a description of wetlands in the project area.

Urban/Developed

The urban/developed category is less than one percent (approximately 43 acres) of the surface area within the project area and includes lands that have been heavily disturbed by well field development including buildings and well pads. A detailed description of these facilities is provided in Section 2.2, Description of Alternatives.

Barren

The barren category comprises approximately 19.1 percent (approximately 1,936 acres) of the surface area within the project area. This cover type, as defined by WGFD, includes rock outcrops; roads; sandbars; eroded gullies; areas with less than 10 percent ground cover; and perennial snow and ice. It occurs as small, scattered areas throughout the project area or as several large blocks throughout the western portion and is associated with Patrick Draw.

The CIAA for vegetation would be the same as described in Section 3.2, Soils.

3.5.1.2 Wetlands

Based on GAP data, the riparian/wetland type comprises approximately 1.6 percent (approximately 157 acres) of pre-disturbance vegetation within the project area. According to National Wetland Inventory (NWI) map produced by the USFWS, four wetland and waters of the U.S. types potentially occur within the project area. These areas are widely scattered and include 57 distinct areas or segments.

The wetland and waters of the U.S. classes associated with Bitter Creek include palustrine emergent, unconsolidated shore, unconsolidated bottom, and aquatic bed, as indicated on the NWI map. These wetlands and waters of the U.S. are exclusively associated with Bitter Creek and its unnamed tributaries. Based on observations made during June and August 2005 field surveys, wetland areas occur only along Bitter Creek. Dominant plant species associated with these areas include Baltic rush (*Juncus balticus*), spikerush (*Eleocharis* spp.), silverweed cinquefoil (*Argentina anserina*), Canada thistle (*Cirsium arvense*), narrowleaf willow (*Salix exigua*), and other wetlands species. No farmed or otherwise modified wetlands were identified within the project area.

Approximately 8.71 acres of surface drainage features are identified as intermittent riverine systems and are located within the project area. Features, which are considered other waters of the U.S., are afforded generally the same protection as those granted to wetlands under the Clean Water Act (CWA). Areas designated as other waters of the U.S. generally do not meet the BLM's guidelines for consideration as wetlands requiring mitigation. Waters of the U.S. include flowing streams, dry channels, and other tributaries to "navigable" waterways, as well as wetlands.

Based upon field observations conducted in June and August 2005, the intermittent drainages observed within the project area do not contain wetland or riparian vegetation. Wyoming big sagebrush, rabbitbrush, greasewood, and various upland grass and forb species occur in these drainages.

USACE is the final regulatory authority for wetlands and other waters of the U.S. identified within the project boundary and will provide the final determination and approval of the wetland boundaries. Anadarko will provide applicable information and cooperation to the USACE to enable authorization of a Nationwide Permit (NWP) for construction activities.

The CIAA for wetlands would be the same as described in Section 3.2, Soils.

3.5.2 Noxious Weeds

An increasing concern on both public and private lands is the occurrence and spread of noxious weeds and invasive plant species. Typical locations for noxious weed infestations are riparian zones, livestock concentration areas, roads, highways, and disturbed soils.

Noxious and invasive species known to exist in the project area include scattered occurrences of halogeton (*Halogeton glomerata*), cheatgrass (*Bromus tectorum*), curlycup gumweed (*Grindelia squarosa*), whitetop (*Cardaria draba*), perennial pepperweed (*Lepidium latifolium*), and Canada thistle (*Cirsium arvense*). Saltcedar (*Tamarix ramosissima*) seedlings were observed along Bitter

Creek. **Table 3.5-1** illustrates the Wyoming and Sweetwater County lists of prohibited noxious weed species, some of which may occur within the project area.

Table 3.5-1
Noxious Weeds Potentially Occurring within the Project Area

Common Name	Scientific Name	Wyoming Noxious Weed List	Sweetwater County, WY Weed List
Russian knapweed	*Acroptilon repens*	X	X
Skeletonleaf bursage	*Ambrosia tomentosa*	X	X
Common burdock	*Arctium minus*	X	X
Whitetop	*Cardaria draba*	X	X
Musk thistle	*Carduus nutans*	X	X
Plumeless thistle	*Carduus* spp.	X	X
Spotted knapweed	*Centaurea biebersteinii*	X	X
Diffuse knapweed	*Centaurea diffusa*	X	X
Canada thistle	*Cirsium arvense*	X	X
Field bindweed	*Convolvulus arvensis*	X	X
Quackgrass	*Elymus repens*	X	X
Leafy spurge	*Euphorbia esula*	X	X
Lady's bedstraw	*Galium verum*		X
Foxtail barley	*Hordeum jubatum*		X
Black henbane	*Hyoscyamus niger*		X
Houndstongue, Dyer's woad	*Isatus tinctoria*	X	X
Perennial pepperweed	*Lepidium latifolium*	X	X
Oxeye daisy	*Leucanthemum vulgare*	X	X
Dalmation toadflax	*Linaria dalmatica*	X	X
Yellow toadflax	*Linaria vulgaris*	X	X
Purple loosestrife	*Lythrum salicaria*	X	X
Scotch thistle	*Onopordum acanthium*	X	X
Perennial sowthistle	*Sonchus arvensis*	X	X
Saltcedar	*Tamarix ramosissima*	X	X
Mountain thermopsis	*Thermopsis montana*		X

The CIAA for noxious weeds would be the same as described in Section 3.2, Soils.

3.5.3 Range Resources

The project area is located within the Rock Springs Grazing Allotment Number (13018). The land status in the Rock Springs Allotment consists of 1,055,477 acres of public land, 20,782 acres of state land, and 984,803 acres of private land. The Rock Springs Field Office administers grazing for the Rock Springs Allotment that consists of 110,599 Animal Unit Months (AUMs) in conjunction with the 1,055,477 acres of public land. The grazing permittee is given credit for the unfenced private and state lands grazed in common within this allotment. Overall, the stocking rate for the

Rock Springs Allotment would be approximately 10 acres/AUM. But more realistically, the stocking rate for livestock may be closer to 12 to 15 acres/AUM due to vegetation types, landform, slope, environmental conditions, and precipitation. Therefore, the entire project area potentially includes approximately 810 AUMs, using the stocking rate of 12.5 acres per AUM.

The CIAA for livestock grazing is the 2,061,062-acre Rock Springs Allotment. Approximately 92 percent of the allotment is permitted for grazing from December 1 to May 15 by cattle and sheep, while the remaining 8 percent is permitted for grazing from May 1 through October 31, spring, fall, and summer. Depending upon the year and the annual fluctuation in the livestock industry, not all of the 110,599 AUMs are authorized each year.

3.5.4 Threatened, Endangered, Candidate, and Sensitive Plant Species

The federal Endangered Species Act (ESA) (16 U.S.C. 1531-1543) and the BLM's Special Status Species Management Policy 6840 (6840 Manual Section) (Rel. 6-121) protect listed threatened and endangered plant species and their critical habitats. A list of federal and state threatened, endangered, proposed, and candidate plant species and BLM listed special status plant species that may occur within the project area was compiled from the information provided by the BLM (BLM 2005) and Wyoming Natural Diversity Database (WNDD 2005).

Three special status plant species were identified as potentially occurring within the project area (BLM 2005; WNDD 2005). The potential occurrence of these special status species were based on range, known distribution, and the presence of potentially suitable habitat within the project area (**Table 3.5-2**). As a result, one federally listed species (Blowout penstemon) was eliminated from detailed analysis (see **Table 3.5-2**).

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) had been identified by the BLM as potentially occurring in the project area in the vicinity of Bitter Creek. Ute ladies'-tresses orchid is a perennial terrestrial orchid that is endemic to moist soils near wet meadows, springs, lakes, and perennial streams. This plant generally occurs in small scattered groups in relatively open areas where vegetation is not densely overgrown. Ute ladies'-tresses orchid is best identified during the flowering stage, which occurs from mid-July to mid-September. Based on field surveys conducted in August 2005, scouring, heavy sediment deposits, and moderately dense wetland vegetation was observed along Bitter Creek. As a result, the potential for occurrence of Ute ladies'-tresses orchid in the project area would be low.

Blowout penstemon (*Penstemon haydenii*) has been identified by the BLM as potentially occurring within the project area. Blowout penstemon is a perennial terrestrial forb that is endemic to "blowouts," sparsely vegetated areas in active sand dunes created by wind erosion. This plant

generally occurs on steep, northwest-facing slopes comprised of fine sand and fine clay soils. Blowout penstemon is best identified during the flowering stage, which occurs from May to early July. As of 2004, three known populations at 14 locations occur in Carbon County, with estimated numbers of 6,900 to 7,800 plants (Heidel 2005). Based on known soil characteristics, topography, and historic data, the potential for occurrence of blowout penstemon in the project area would be low.

Table 3.5-2
Special Status Plant Species Identified for the Proposed Project Area

Common Name/ Scientific Name	Status[1]	Potential for Occurrence[2]	Eliminate from Detailed Analysis?
Ute ladies'-tresses orchid/ *Spiranthes diluvialis*	FT	Low. Potential habitat at Bitter Creek had been scoured by high runoff events and heavy sediment deposits were evident during August 2005 habitat surveys.	No
Blowout penstemon/ *Penstemon haydenii*	FE	None.	Yes. Marginal suitable habitat was identified in the project area during habitat surveys in August 2005. Historic data indicate that the only viable population for this species occurs in Carbon County, Wyoming.
Nelson's milkvetch/*Astragalus nelsonianus*	BLM	High. Suitable habitat was identified in the project area during habitat surveys in August 2005. Occurrence and historic data indicates that this species occurs just outside the project boundary.	No

[1]FT = Federal threatened, FE = Federal endangered, BLM = BLM sensitive.
[2]Based on soils, geology, vegetation communities, and known distribution records.

The Nelson's milkvetch (*Astragalus nelsonianus*) has been identified by the BLM as potentially occurring adjacent to the project area. Nelson's milkvetch is a selenium-scented perennial herb that occurs on alkaline, often seleniferous, clay flats and shale bluffs. Known occurrences are found primarily in sparsely vegetated sagebrush and cushion plant communities at elevations of 5,200 to 7,600 feet. This species has approximately 15 known occurrences in Sweetwater County, Wyoming. Based on known soil characteristics, vegetation community types within the

project area, occurrence distribution, and historic data, the potential for occurrence of Nelson's milkvetch in the project area would be high.

The CIAA for threatened, endangered, candidate, and sensitive plant species would be the same as described in Section 3.2, Soils.

3.6 Wildlife

3.6.1 Recreationally and Economically Important Species and Nongame Wildlife

As discussed in Section 3.5.1, the predominant vegetative habitat types within the project area include sagebrush shrubland, mixed-grass prairie, foothills grassland, salt desert shrubland/greasewood, and riparian/wetland. The project area is characterized by flat to low rolling terrain with intermittent terraces, steep slopes, and rocky ridges. Baseline descriptions of both resident and migratory wildlife include species that have either been documented in the project area or those that may occur in the project region based on habitat associations. Wildlife species that would occur within the majority of the proposed project area are typical of the sagebrush and saltbush-greasewood communities. Species that inhabit riparian/wetland habitat would be limited to the Bitter Creek drainage in the southwestern portion of the project area. In the following discussions, the project area refers to the Monell Unit, including existing oil and gas wells in the north central portion of the project area.

3.6.2 Big Game Species

Big game species that occur in the project region include elk, pronghorn, and mule deer. Although the project area occurs within the Petition Elk Herd Unit (Hunt Area 124), occurrence by elk within the project area would be limited to transient individuals. In general, elk in the Petition Herd Unit are found to the south of the project area in scattered bands of higher elevations on ridges such as Powder Rim, Kinney Rim, Flat Top Mountains, etc. The closest winter-yearlong range for elk is located approximately 9 miles south of the project area. Therefore, elk are not discussed further in this EA.

Pronghorn occur throughout the project area. Pronghorn inhabit grasslands and semi-desert shrublands on flat to rolling topography and browse on shrubby plants, especially sagebrush, throughout the year. During the winter, pronghorn generally utilize areas of relatively high sagebrush densities and overall low snow accumulations, on south- and west-facing slopes. Pronghorn in the project region belong to the Bitter Creek Pronghorn Antelope Herd (Hunt Area 57). The Bitter Creek Pronghorn herd unit had a 2003 postseason population estimate of 12,000 animals, approximately 48 percent of the population objective of 25,000 animals. The

5-year (1998-2002) population average was 13,000 animals (53 percent of the objective) (BLM 2005). Continued drought, increasing oil and gas production, and increased grazing are the primary conflicts affecting the Bitter Creek herd unit (BLM 2005). The entire Monell project area is designated as winter/yearlong pronghorn range. No crucial winter/yearlong pronghorn habitat occurs within the project boundary. The closest crucial yearlong pronghorn habitat is approximately 2.75 miles north of the project boundary and approximately 3 miles southwest of the project boundary.

The CIAA for pronghorn is the Bitter Creek Herd Unit, which encompasses approximately 1,844,665 acres. As discussed above, the entire project area occurs in winter/yearlong pronghorn range. Approximately 87 percent of the CIAA is winter/yearlong range. The remaining herd unit is designated as crucial winter/yearlong range (12 percent) and severe winter relief range (1 percent).

Mule deer inhabit virtually all vegetation types within the project region. Mule deer feed on a wide variety of plants including forbs, grasses, sedges, shrubs, and trees. Like the pronghorn, winter habitat for the mule deer occurs in areas of relatively high sagebrush densities and overall low snow accumulation, on south- and west-facing slopes. Mule deer within the project region belong to the South Rock Springs Mule Deer Herd (Hunt Area 100). The South Rock Springs Mule Deer Herd had a 2003 post-hunt population estimate of 7,200 animals, approximately 61 percent of the population objective of 11,750 animals. The 5-year (1998-2002) population average was 6,320 animals, approximately 54 percent of the population objective (BLM 2005). All of the Monell project area is designated as winter/yearlong mule deer habitat. The closest mule deer crucial winter range is located approximately 10 miles west of the project boundary. Due to poor overall habitat conditions for mule deer within the project region, occurrence by this species within the project area would be limited to transient individuals.

The CIAA for mule deer consists of the South Rock Springs Herd Unit and the Baggs Herd Unit, which encompasses approximately 3,580 total acres. As discussed above, the entire project area occurs in winter/yearlong mule deer range. Approximately 62 percent of the CIAA is winter/yearlong range. The remaining habitat in the herd units are designated as crucial winter/yearlong range (21 percent) and spring/summer/fall range (18 percent).

3.6.3 Wild Horses

The proposed project area is within the Salt Wells Creek Wild Horse Herd Management Area (WHHMA) that includes an area from U.S. Highway 191 south of Rock Springs, east to the Rock Springs-Rawlins BLM Resource Area boundary, and south to the Wyoming-Colorado state line. The WHHMA includes 1,193,283 acres, 61 percent of which is federal land, 3 percent of which is

State of Wyoming land, and 36 percent of which is private land. Several bands of wild horses use the Monell EOR project area. The "herd-appropriate management level" for the Salt Wells Creek herd, as determined by the BLM, is 251 to 365 wild horses. The Salt Wells Creek herd was recently gathered and is currently estimated to have approximately 251 wild horses (J. D'Ewart 2005). There is minimal fencing within the Salt Wells WHHMA, and a majority of the fences present are associated with deeded property or major transportation corridors such as I-80, Wyoming Highway 430, and the Union Pacific Railroad tracks. The CIAA for wild horses is the Salt Wells WHHMA and the Monell EOR project area representing approximately 1.5 percent of the total area within the WHHMA.

3.6.4 Upland Game Birds

Important upland game species that occur within the project region include greater sage-grouse and mourning dove. The greater sage-grouse is a BLM-sensitive species, which is discussed in Section 3.6.8.2, Special Status Species. Mourning dove occur within the project area region during the spring and summer months and are associated within shrubland and grassland communities. Mourning dove is classified by the WGFD as abundant and is likely to occur within the project boundary during the breeding season.

3.6.5 Waterfowl and Shorebirds

Waterfowl and shorebird use within the project region would be minimal based on the small amount of available open water and wetland habitat. Bitter Creek would provide the only potential habitat for waterfowl and shorebirds within the project area. However, nesting habitat for waterfowl and shorebirds would be considered marginal, based on the deep incised banks and the limited amount of wetland vegetation.

3.6.6 Nongame Species

A diversity of nongame species (e.g., mammals, raptors, passerines, amphibians, and reptiles) occupy a variety of trophic levels and habitat types within the project region. Predatory mammal species that occur within the project region include coyote, red fox, raccoon, ermine, long-tailed weasel, badger, western stopped skunk, striped skunk, and bobcat.

Representative small mammals within the project region include desert cottontail, mountain (Nuttall's) cottontail, white-tailed jackrabbit, least chipmunk, white-tailed prairie dog, Wyoming ground squirrel, thirteen-lined ground squirrel, northern pocket gopher, Ord's kangaroo rat, bushy-tailed woodrat, and deer mouse (WGFD 2004). These small mammals provide a substantial prey base for the areas predators including mammals (e.g., coyote, badger, skunk),

raptors (eagles, buteos, accipiters, owls), and reptile species. Representative birds that occur within the project region are discussed below in Section 3.6.7, Migratory Birds.

Other nongame species in the project region include common reptiles such as northern sagebrush lizard, greater short-horned lizard, intermountain wandering gartersnake, great basin gopher snake, and prairie rattlesnake. Amphibian presence within the project area would be limited to wetland habitat associated with Bitter Creek. Amphibian species that occur within the project region include tiger salamander and the Great Basin spadefoot.

The CIAA for other nongame species (small mammals, amphibians, ands reptiles) would be the same as discussed above for birds.

3.6.7 Migratory Birds

Nongame birds within the project region include a wide range of migratory bird species including neotropical migrants - birds that breed in North America and winter in the neotropical region of South America. These birds are considered integral to natural communities and act as environmental indicators, based on their sensitivity to environmental changes caused by human activities. Representative bird species that occur in the project region include Say's phoebe, western kingbird, horned lark, barn swallow, black-billed magpie, American crow, western meadowlark, sage sparrow, sage thrasher, and a number of raptor species (see below) (WGFD 2004). Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) (16 USC 703-711) and Executive Order (EO) 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 Federal Register [FR] 3853).

Raptor species that could potentially occur as residents or migrants within the project region include eagles (bald and golden eagles), buteos (e.g., red-tailed hawk, Swainson's hawk, ferruginous hawk), falcons (e.g., peregrine falcon, prairie falcon, American kestrel), accipiters (e.g., Cooper's hawk and sharp-shinned hawk), owls (e.g., great-horned owl, burrowing owl, long-eared owl, short-eared owl), northern harrier, and turkey vulture. One intact golden eagle nest was located within the Monell Unit boundary, but outside of the project area. In addition, raptor nest data from the BLM Rock Springs Field Office show records of three raptor nests occurring within 1-mile from the Monell Unit boundary.

A draft Memorandum of Understanding among the USFS, BLM, and USFWS was prepared pursuant to EO 13186 in order to promote conservation of migratory birds and minimize the potential adverse effects of take to these birds. The MBTA serves to protect migratory birds from deleterious impacts. EO 13186 was enacted to, among other things, ensure that environmental analyses of federal actions evaluate the impacts of actions, and agency plans on migratory birds.

Other elements of EO 13186 state that the federal agency should restore and enhance the habitat for migratory birds and abate the detrimental alteration of the environment and that emphasis should be placed on species of concern, priority habitats, and key risk factors.

The CIAA for birds (e.g., perching birds, raptors, and waterfowl) includes the Monell Unit, and a 2-mile buffer area around the Monell Unit (approximately 39,198 acres). Representative bird species that could occur within the project region are discussed above. Although no raptor nests have been identified within the project boundary, burrowing owls were observed within the project boundary during prairie dog habitat surveys in August 2005. Consequently, it is highly likely that burrowing owls breed within suitable habitat (e.g., prairie dog burrows) within the project boundary. In addition, 8 raptor nest sites have been documented within a 2-mile buffer area from the project boundary.

3.6.8 Threatened, Endangered, Candidate, and Sensitive Wildlife Species

Special status species are those species for which state or federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species that are protected under the ESA, or are considered as candidates for such listing by the USFWS, and those species that are designated by the BLM State Director as sensitive (BLM 2002).

In accordance with the ESA, the lead agency in coordination with the USFWS must ensure that any action they authorize, fund, or carry out would not adversely affect a federally listed threatened or endangered species. In addition, as stated in Special Status Species Management Policy 6840 (6840 Policy) (Rel. 6 121), it also is BLM policy “to conserve listed species and the ecosystems on which they depend, and to ensure that actions requiring authorization or approval by the BLM are consistent with the conservation needs of special status species and do not contribute to the need to list any special status species, either under the provisions of the ESA or other provisions” identified in the 6840 Policy.

A total of 20 terrestrial special status species including federally listed, federal candidate; and BLM sensitive species were identified as potentially occurring within the project area (BLM 2005; WNDD 2005). The potential occurrence of these special status species was based on range, known distribution, and the presence of potentially suitable habitat crossed by the proposed route. As a result of this review, 14 species were analyzed in detail (**Table 3.6-1**). Four BLM sensitive species (long-eared myotis, Townsend’s big-eared bat, long-billed curlew, and northern leopard frog) were eliminated from detailed analysis (see **Table 3.6-1**).

Table 3.6-1
Special Status Wildlife Species Identified for the Proposed Project

Common Name/ Scientific Name	Status[1]	Potential for Occurrence	Eliminate From Detailed Analysis
MAMMALS			
Black-footed ferret *Mustela nigripes*	FE	Low. Potentially suitable habitat (i.e., prairie dog colonies) has been identified as occurring within the project area.	No
Long-eared myotis *Myotis evotis*	BLM	None	Yes. The project does not occur within suitable roosting or foraging habitat for this species.
Spotted bat *Euderma maculatum*	BLM	Low. Foraging habitat (rocky areas near perennial water, riparian woodlands, and desert sagebrush-grassland). Potential roosting habitat also could occur within the project region.	No
Townsend's big-eared bat *Corynorhinus townsendii*	BLM	None	Yes. The project does not occur within suitable roosting or foraging habitat for this species.
White-tailed prairie dog *Cynomys leucurus*	BLM	High. Prairie dog colonies have been identified within the project area.	No
Pygmy rabbit *Brachylagus idahoensis*	BLM	Low. Suitable habitat (tall, dense sagebrush) occurs within the project area.	No
Wyoming pocket gopher *Thomomys clusius*	BLM	Moderate. Habitat (upland habitats with gravelly loose soils) occurs in the project area. This species has been documented in the project vicinity.	No
Swift fox *Vulpes velox*	BLM	Low. Habitat (open and flat prairies and arid plains) occurs in the project area.	No
BIRDS			
Bald eagle *Haliaeetus leucocephalus*	FT[2]	None	Yes. The project does not occur within suitable nesting or roosting habitat (i.e., riparian habitat) for this species.
Ferruginous hawk *Buteo regalis*	BLM	Moderate to high. Nest sites have been identified within the project vicinity.	No
Burrowing owl *Athene cunicularia*	BLM	High. Nesting habitat occurs within the project area.	No
Long-billed curlew *Numenius americanus*	BLM	None	Yes. The project does not occur within suitable nesting habitat (e.g., shortgrass prairie or grassy meadow) for this species.

Table 3.6-1 (Continued)

Common Name/ Scientific Name	Status[1]	Potential for Occurrence	Eliminate From Detailed Analysis
BIRDS (Continued)			
Mountain plover *Charadrius montanus*	BLM	Moderate. Nesting habitat occurs within the project area.	No
Greater sage-grouse *Centrocercus urophasianus*	BLM	Low. The project area contains marginal suitable breeding habitat (high canopy cover sagebrush).	No
Sage thrasher *Oreoscoptes montanus*	BLM	Moderate. Nesting habitat occurs within the project area. This species has been documented in the project vicinity.	No
Loggerhead shrike *Lanius ludovicianus*	BLM	Moderate. Nesting habitat occurs within the project area. This species has been documented in the project vicinity.	No
Brewer's sparrow *Spizella breweri*	BLM	Moderate. Nesting habitat occurs within the project area. This species has been documented in the project vicinity.	No
Sage sparrow *Amphispiza belli*	BLM	Moderate. Nesting habitat occurs within the project area. This species has been documented in the project vicinity.	No
AMPHIBIANS			
Northern leopard frog *Rana pipiens*	BLM	None	Yes. The project does not occur within suitable habitat (i.e., permanent water sources with suitable wetland vegetation) for this species.
Great basin spadefoot toad *Spea intermontana* [*Scaphiopus intermontana*]	BLM	Moderate. Habitat occurs within the project area.	No

[1]Status
FE - Federally endangered
FT - Federally threatened
FC - Federal candidate
BLM - BLM sensitive
[2]The species has been proposed for delisting by the USFWS; the final rule on the decision is pending.

The bald eagle was eliminated from detailed analysis, based on the lack of potential nesting and roosting habitat within the project area (**Table 3.6-1**). Canada lynx, whooping crane, and yellow-billed cuckoo also were eliminated due to a lack of suitable habitat within the project area.

In addition, the bald eagle was eliminated from detailed analysis, based on the lack of potential nesting and roosting habitat within the project area (**Table 3.6-1**). Canada lynx, whooping crane,

and yellow-billed cuckoo also were eliminated due to lack of suitable habitat within the project area.

The CIAA for special status species includes the Monell Unit area and a 4-mile buffer around the Monell Unit area (approximately 83,358 acres).

3.6.8.1 Mammals

Black-Footed Ferret

The black-footed ferret is federally listed as endangered. Black-footed ferrets are considered obligate associates to prairie dogs, which constitute their primary food source and provide burrows for shelter. Although the proposed project occurs within the historic range of the black-footed ferret, this species is presently restricted to reintroduced populations in Montana, South Dakota, Utah, Arizona, and Carbon County in Wyoming; however, remnant ferret populations may exist in portions of its former range (Hillman and Carpenter 1980). The nearest black-footed ferret reintroduction area is located approximately 55 miles south of the project area in the Little Snake Black-footed Ferret Management Area in Moffat County, Colorado.

The Black-footed Ferret Survey Guidelines for Compliance with the Endangered Species Act (USFWS 1989) defines potential black-footed ferret habitat as any white-tailed prairie dog colony or complex greater than 200 acres in size and meet or exceed a hole density of 20 burrows per hectare (8 burrows per acre). Based on the USFWS letter entitled *Removal of Black-footed Ferret Survey Recommendation Across Much of Wyoming*, many white-tailed prairie dog colonies or complexes are considered to be “block cleared” by the USFWS. The majority of white-tailed prairie dog colonies in the project area are not considered to be blocked cleared by the USFWS (USFWS 2004).

A total of nine active white-tailed prairie dog colonies occur within the project area. Of the nine prairie dog colonies, seven of the colonies meet the USFWS habitat criteria to potentially support black-footed ferrets. These nine colonies and their approximately sizes and burrow densities within the project area boundary are presented in **Table 3.6-2**. Although potentially suitable habitat for the black-footed ferret is defined by the size and density of active prairie dog colonies, it is assumed that all colonies that occur within the project boundary are associated with larger complexes and, therefore, meet the acreage and size criteria established by the 1989 guidelines.

Although prairie dog colonies within the project boundary could potentially support wild or introduced ferrets, the potential for species occurrence within the project area would be considered low for the following reasons: the considerable distance of the nearest black-footed

ferret reintroduction site to the project area; the last known wild population of ferrets was discovered near the town of Meeteetse in northwest Wyoming in 1981.

Table 3.6-2
White-tailed Prairie Dog Colonies that Have Been Identified within Anadarko's Proposed Enhanced Oil Recovery Project

Prairie Dog Colony ID #	Approximate Colony Size in the Project Area (acres)	Approximate Burrow Density (burrows/acre)	Meet USFWS' Ferret Habitat Criteria
PD-1	925	9	Yes
PD-2	826	13	Yes
PD-3	126	10	Yes
PD-4	2	8	Yes
PD-5	5	9	Yes
PD-6	15	11	Yes
PD-7	21	6	No
PD-8	15	6	No
PD-9	11	11	Yes

Spotted Bat

The spotted bat inhabits rocky areas near perennial water and other habitats including riparian, pinyon-juniper woodlands, juniper-shrubland and desert sagebrush-grassland. Roost sites typically include crevices or cracks in cliffs (Fitzgerald et al. 1994; WGFD 1996, 2004). As discussed above for the other two bat species, no historic roosts or potentially suitable roosting habitat has been identified within the project boundary (WGFD 2004). Consequently, occurrence by this species within the project area would be limited to foraging or migrating individuals. As a result, potential for occurrence within the project area would be low.

White-tailed Prairie Dog

White-tailed prairie dogs occur in basin-prairie and mountain foothill habitats consisting of shrubland, sagebrush-grassland, and short- and mixed-grassland that contain suitable upland soil types for constructing extensive burrow systems (WGFD 2004). As discussed above for the black-footed ferret, a total of nine white-tailed prairie dog colonies have been identified within the project area. These prairie dog colonies are presented in **Table 3.6-2**. As a result, the potential for occurrence within the project area would be high.

Pygmy Rabbit

The pygmy rabbit is typically found in areas of tall, dense sagebrush cover, usually along intermittent streams or riparian areas. Burrows are located in areas of deep, loosely compacted sandy soils (Heady et al. 2002; WGFD 2004). The pygmy rabbit has been documented within the project area and occurs within suitable habitat. Consequently, the potential for occurrence within the project area would be high.

Wyoming Pocket Gopher

The Wyoming pocket gopher is a fossorial animal, spending most of its life underground. This species is found primarily along dry ridge tops and is associated with gravelly, loose soils and greasewood vegetation (WGFD 2004). Potentially suitable habitat for this species is known to occur within the project area. Occurrence by this species has been documented in the immediate vicinity of the project area (WNDD 2005). Consequently, it is possible that this species could occur within suitable habitat in the project area. As a result, the potential for occurrence within the project area would be moderate to high.

Swift Fox

The swift fox occupies short-, mid-, and mixed grass prairies with gently rolling hills. Den sites are typically located on flat areas or along slopes or ridges that provide a good view. Young are born in late March, April, or early May (Fitzgerald et al. 1994; WGFD 1996, 2004). Suitable habitat for this species could potentially occur within the project area. The closest known observation occurred south of the Wamsutter area. Breeding individuals have been documented in Sweetwater County (WGFD 2004). Consequently, it is possible that this species could occur within potentially suitable habitat in the project area. However, the potential for occurrence within the project area would be low.

3.6.8.2 Birds

Ferruginous Hawk

The ferruginous hawk is a relatively uncommon and locally distributed occupant of grasslands, sagebrush, and desert scrub habitats in the Great Plains and Great Basin regions. In Wyoming, this species breeds in basin-prairie shrublands, short-grass prairie, and cottonwood-riparian habitats. Nest sites include cliff faces, rock outcrops, and grassy knolls, but also are known to nest in pinyon-juniper (WGFD 2004). No potentially suitable nesting habitat occurs within the project area. However, ferruginous hawk nests have been documented in the Bitter Creek project area,

immediately west of the project boundary (BLM 2005). As a result, the potential for occurrence within the project area would be moderate to high.

Burrowing Owl

The burrowing owl occurs from south-central British Columbia eastward to southern Saskatchewan and south through most of the western United States. Burrowing owls primarily nest in rodent burrows, particularly prairie dog burrows, in grasslands, shrublands, deserts, and grassy urban settings. Suitable nesting habitat for this species is known to occur within the project area. Breeding individuals have been documented in Sweetwater County (WGFD 2004). Three burrowing owl pairs were identified during the 2005 prairie dog surveys in the southern portion of the project area. As a result, the potential for occurrence by this species within the project area would be high.

Mountain Plover

The mountain plover was proposed for federal listing in 1999 but was subsequently withdrawn from federal listing in 2003 (68 FR 53083). The historic breeding range of the mountain plover included shortgrass prairies from extreme southern Canada, south through the Great Plains of the U.S. Currently, mountain plovers only nest in isolated areas throughout their range (WGFD 1996). In Wyoming, the breeding range of this species is widespread and relatively common in favored habitat; however, population levels and trends are not known (WGFD 1996). Breeding habitat for this species appears to vary geographically. However, throughout its range suitable breeding habitat is characterized primarily by shortgrass prairie grassland where grazing is intensive, or in areas of fallow fields or active prairie dog towns. In addition, breeding plovers also have been documented on well drill pads (USFWS 2002). Areas of flat bare ground appear to be the most prominent characteristic of suitable breeding habitat for plovers.

In Wyoming, mountain plovers have been documented in areas of low (less than 4 inches tall) vegetation with little to no topography, short-grass prairies, low shrubs, and on dry mudflats (Parrish et al. 1993). Data from the BLM Rock Springs Field Office indicate that this species has been observed in the Bitter Creek project area, immediately west of the project boundary (BLM 2005). As a result, it is possible that mountain plover could occur within suitable habitat during the breeding season (April 1 to July 10). Potential for occurrence within the project area would be moderate to high.

Greater Sage-Grouse

The greater sage-grouse is a sagebrush obligate species that occurs on the plains and foothills throughout much of the west. Strutting grounds or lek sites are used from late March to April and are generally located in open areas such as broad ridges, grassy areas, and disturbed sites, in proximity to sagebrush habitat. Nests are generally located under sagebrush or other large shrubs, generally within 2 miles from the lek (WGFD 2003). Nesting and brooding habitat typically consists of higher than average canopy cover of sagebrush and herbaceous plant density that provide adequate cover and forage for hens and chicks. During winter greater sage-grouse feed almost exclusively on sagebrush. Winter habitats generally consist of tall sagebrush stands that have a relatively high canopy cover and are located in areas where snow depths do not restrict access to sagebrush, such as south-facing slopes and windswept areas (WGFD 2003).

The Cherokee Trail greater sage-grouse strutting ground is located approximately 3.2 miles east of the project area in T18N, R98W, Section 15. The overall habitat quality within the project area is considered marginal because of sparse or low density sagebrush communities. Therefore, the potential for occurrence within the project area would be low.

Sage Thrasher

The sage thrasher occurs in basin-prairie and mountain-foothill shrub-dominated habitats (WGFD 2004). This species typically requires large patches of sagebrush steppe habitat for nesting. Suitable nesting habitat for this species could potentially occur within the project boundary. Although this species has not been identified as occurring within the project area, breeding individuals have been documented in the Bitter Creek project area, immediately west of the project boundary (BLM 2005). Additional observations have been recorded northwest of the project area (WNDD 2005). Consequently, it is possible that this species could occur in potentially suitable habitat within the project area. As a result, the potential for occurrence within the project area would be moderate to high.

Loggerhead Shrike

The loggerhead shrike prefers open habitat in close proximity to brushy areas containing trees or shrubs. It breeds in basin-prairie and mountain-foothills shrublands, sagebrush, grassland, pinyon-juniper woodlands, and woodland chaparral. Nests are usually hidden below the crown in the crotch or low branch of a deciduous tree or shrub (WGFD 2004). Suitable nesting habitat for this species could potentially occur within the project boundary. Breeding individuals have been documented in Sweetwater County (WGFD 2004). Several loggerhead shrike were identified

during the 2005 prairie dog surveys in the project area. As a result, the potential for occurrence by this species within the project area would be high.

Brewer's Sparrow

The Brewer's sparrow inhabits basin-prairie and mountain-foothills shrublands, especially Wyoming big sagebrush and woodland chaparral habitats (WGFD 2004). Nest sites are typically less than 2 meters high in sagebrush. Although this species has not been identified as occurring within project boundary, breeding individuals have been documented in the Bitter Creek project area, immediately west of the project boundary (BLM 2005). Additional observations have been recorded northwest of the project area (WNDD 2005). Consequently, it is possible that this species could occur in potentially suitable habitat within the project area. As a result, the potential for occurrence within the project boundary would be moderate.

Sage Sparrow

The sage sparrow inhabits semi-open habitat in basin-prairie and mountain-foothills shrublands, and are closely associated with Wyoming big sagebrush. Nests typically occur less than 1 meter high under sagebrush (WGFD 2004). Although this species has not been identified as occurring within the project boundary, breeding individuals have been documented in Sweetwater County (WNDD 2005; WGFD 2004). Consequently, it is possible that this species could occur in potentially suitable habitat within the project area. As a result, the potential for occurrence within the project area would be moderate.

3.6.8.3 Amphibians

Great Basin Spadefoot Toad

The Great Basin spadefoot toad inhabits sagebrush, semi-desert shrublands, and pinyon-juniper woodlands below 6,000 feet in elevation. Habitat ranges from the bottoms of rocky canyons to broad dry basins and stream floodplains. It uses both temporary and permanent water sources for breeding (Hammerson 1999; WGFD 2004; WNDD 2005). Potentially suitable habitat for this species is known to occur within the project area. Occurrence by this species has been documented in the immediate vicinity of the project area (WNDD 2005). Consequently, it is possible that this species could occur within suitable habitat in the project area. As a result, the potential for occurrence within the project area would be moderate.

3.7 Aquatic Resources

3.7.1 Bitter Creek

Fisheries in Bitter Creek are limited to the approximate 3.3-mile perennial segment that runs through the southern portion of the project study area. Based on surveys conducted near the town of Bitter Creek, nongame native fish species such as flannelmouth sucker (*Catostomus latipinnis*) and speckled dace (*Rhinichthys osculus*) were collected. Habitat in the project portion of the stream consists of riffles, pools, and runs, with the deepest pools occurring in areas with beaver dams. Upstream sections of Bitter Creek also support mountain sucker (*Catostomus platyrhynchus*) along with flannelmouth sucker and speckled dace (WGFD 2004).

3.7.2 Threatened, Endangered, and Sensitive Species

The Bitter Creek drainage within and adjacent to the project area supports the only known population of pure flannelmouth suckers in Wyoming that are not sympatric with introduced white suckers. The WGFD has categorized the flannelmouth sucker as a Status 1 species, which is defined as a species that is physically isolated and/or exist at extremely low densities throughout their range, and habitat conditions are declining or vulnerable (WGFD 2006). These fish are the only known Wyoming population that is genetically unaltered, and therefore, they represent an important source for future restoration efforts. The population in Bitter Creek inhabits approximately 24 miles of habitat between the Town of Bitter Creek and a point just downstream of the La Clede Gage Station. The project area segment represents approximately 14 percent of known habitat in Bitter Creek and also showed the highest catch rates for this species in recent surveys.

Recent sampling efforts have collected this species at two locations upstream of the town of Bitter Creek (Keith et al. 2003). Habitat for this species mainly consists of pools in streams and large rivers (Baxter and Simon 1970). Spawning typically occurs in May through early August. A conservation strategy has been proposed for flannelmouth sucker for the Colorado River Basin including the Green River and its tributaries (Utah Department of Natural Resources 2004).

Four federally listed fish species, Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail (*Gila elegans*), occur downstream of the project area in the Green River. The most upstream occurrence for any of these species is below Flaming Gorge near Jensen, Utah. These species were eliminated from further discussion in this EA for the following reasons: 1) project construction or operation activities would not affect water quality in occupied reaches or critical habitat; and 2) water use for drilling and project operations would come from deep groundwater sources in the Almond

Formation, which are not connected to surface flows in Bitter Creek or the Green River (see Section 3.4.2).

The CIAA for fisheries and sensitive aquatic species includes the four 6th level watersheds that occur in the Bitter Creek project study area (see **Figure 3.4-2**).

3.8 Land Use and Recreation

The following sections describe land use and recreation opportunities in the project area.

3.8.1 Land Ownership and Use

Within Sweetwater County, approximately 73 percent of the 6,708,743 acres are public lands. **Table 3.8-1** summarizes land ownership in Sweetwater County.

Table 3.8-1
Summary of Land Ownership – Sweetwater County, Wyoming

Land Ownership	Acres
Total Public Lands	4,891,652
Private Lands	1,860,085
Water Surface	35,629
Total Acreage	6,708,743
Total Square Miles	10,482

Source: Wyoming Division of Economic Analysis http://www.sweda.net/Demographics.htm.

The surface ownership pattern within and adjacent to the project is checkerboard, typically where even-numbered sections are owned by the federal government, odd-numbered sections are privately owned, by the Rock Springs Grazing Association (RSGA) or Union Pacific Land Resources (UPLR). **Table 3.8-2** summarizes the ownership of potentially affected sections by project activity. Some township section numbers are listed two or three times due to multiple activities occurring at those locations.

The project area includes approximately 10,120 acres, of which 4,630 (45.7 percent) acres are owned by the federal government and administered by the BLM, 360 (3.6 percent) acres are owned by the State of Wyoming, and 5,130 (50.7 percent) acres are privately owned.

Table 3.8-2
Land Ownership

Location (Township and Range)	Ownership (by Section of Township)		
	BLM	State	Private
Monell Unit			
T18N, R98W	6		
T18N, R99W	2,4,10,12,14,16		1,3,9,11,13,15
T19N, R98W	30		31
T19N, R99W	26,28,34,36	36	25,27,33,35

Major land uses in the project area include oil and gas development, livestock grazing, wildlife habitat, and recreation. In addition, some activities associated with the adjacent oil and gas operations also are located within the project area. There are no ROW exclusion or avoidance areas within the project area.

The project area is located within the Rock Springs Grazing Allotment. Stocking rates for livestock are approximately 12.5 acres per AUM, indicating that the entire project area potentially includes approximately 810 AUMs.

The CIAA for land use is the project area and a 4-mile buffer, an area of approximately 10,100 acres.

3.8.2 Recreation

Lands within the project area offer some big game hunting opportunities. Secondary recreational activities within the project area include camping, wild horse viewing, off-road use, rock and fossil hunting, and hiking. The area is designated as “roaded-natural,” a definition used in the Recreation Opportunity Spectrum (ROS) to characterize an area with moderately frequent human encounters and with resource modifications evident.

The project area is in an ORV Existing Area, meaning that off-highway vehicles must stay on existing roads and trails. This area also is located within the Salt Wells WHHMA. These areas offer passive recreation opportunities for viewing wild horses.

Given the checkerboard landownership pattern, the controlled nature of the property, and the availability of other more potentially appealing areas in the general area, these secondary recreational opportunities appear to receive limited use in the project area. There are no developed recreation areas within the project area.

The CIAA for recreation is the proposed project area plus a 4-mile buffer around the project area. In total, CIAA represents approximately 83,358 acres.

3.9 Visual Resources and Noise

3.9.1 Visual Resources

The project area is located within Wyoming Basin physiographic province, which is characterized by eroded elevated plains with isolated low mountains. Vegetation is dominated by Wyoming big sagebrush, saltbush, greasewood, and grasses. **Figure 3.9-1** shows characteristic views of the study area landscape. Human modifications to the natural landscape include oil and gas development (roads, railroad, well pads, wellhead facilities, and two processing plants), sparsely scattered ranch buildings, and unpaved roads. The project area is visible from the Overland Trail at a distance of 2.4 miles (**Figure 3.9-2**).

The BLM has established a visual inventory and analysis process to manage aesthetic values on public lands. The Visual Resource Management (VRM) System describes procedures for evaluating existing scenic quality and assigning visual resource inventory categories based on a combination of scenic values, visual sensitivity, and viewing distances from important viewpoints.

Through the RMP process, the visual inventory information is evaluated along with other management considerations to assign VRM classifications to all BLM public lands. The project study area is located within two VRM classifications, Classes IV and V. The percent coverage for the project area is approximately 99 percent for Class V and 1 percent for Class IV. The VRM class surrounding the Class V area is Class IV. Definitions of these two classes include:

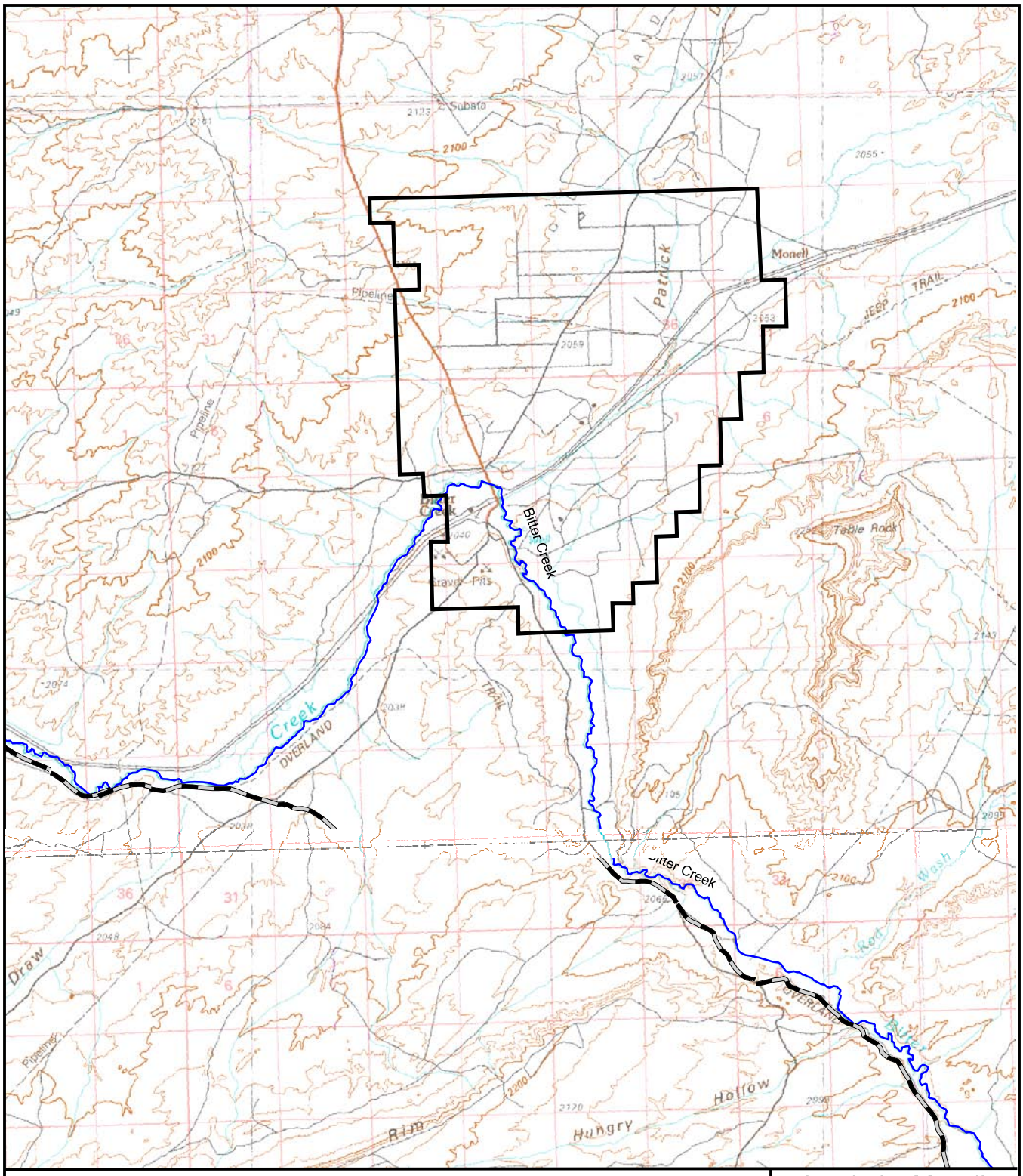
- Class IV – This is the least restrictive visual management class. The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

- Class V (Rehabilitation) – This class applies to areas where the naturalistic character has been disturbed to a point where rehabilitation is needed to bring back character with the surrounding landscape.

Anadarko Monell
EOR Project

Figure 3.9-1

Typical Views of
Study Area Landscape



Legend

Overland Trail

N

0 1 2 Miles

Anadarko Monell EOR Project

Figure 3.9-2

Overland Trail

The Green River RMP (BLM 1997a) stipulates that "All surface disturbance actions, regardless of the visual resource management class, are required to be mitigated to reduce visual impacts." This should be achieved by designing and locating the project facilities in a manner that most closely meets the minimum degree of contrast acceptable for the particular VRM class.

The CIAA for visual resources is an approximate 5-mile extension from the boundary of the Monell EOR project area, which represents approximately 111,000 acres. This distance is considered the additional area that could be viewed from the proposed Monell EOR project area.

3.9.2 Noise

Background noise levels can be affected by atmospheric conditions, wind levels, topography, vegetation, time of day, wildlife activity, and human activity. Existing noise sources in this rural setting are predominantly natural background levels from wind and wildlife in combination with occasional human activity associated with nearby well fields, the Union Pacific Railroad, or traffic to the Patrick Draw Gasoline Plant. The BLM has estimated that an average noise level in Wyoming rural areas is between 30 and 40 A-weighted decibels (BLM 1997b). Vehicle traffic in rural areas near highways has been measured at levels between 40 to 56 decibels on the A-weighted scale (dBA) (BLM and USFS 2003).

Noise-sensitive receptors in the study area mainly involve wildlife. Few residences are located within or near the project area. The closest residence is located at Points of Rocks, which is approximately 13 miles from the north boundary of the Proposed Action project area. The CIAA for noise extends an additional 1 mile around the perimeter of the Monell EOR project area. This CIAA would account for potential noise effects on sensitive receptors (wildlife) in adjacent areas.

3.10 Socioeconomics

Area socioeconomic conditions include the local economy (primarily mining and processing, and other natural resource development); population; employment and income; housing; community facilities, law enforcement, and emergency management; and local, state, and federal government fiscal conditions.

The CIAA for socioeconomics is Sweetwater County, Wyoming.

3.10.1 Population

Population in Sweetwater County reached its peak at over 41,000, in the 1980s and 1990s, declining slightly in recent years to less than 38,000. The population peak was associated with

expanded oil and gas activities, and the population then declined after oil and gas activity declined. As oil and gas activities have increased in recent years, the population has begun to increase again. **Table 3.10-1** summarizes the population characteristics of Sweetwater County, Wyoming, as well as the cities of Rock Springs and Green River, over time.

Table 3.10-1
Population Characteristics for Sweetwater County and Select Cities

Jurisdiction	1970	1980	1990	2000	July 2004 Estimate*
Rock Springs	11,700	No data	19,100	18,708	NA
Green River	4,200	No data	12,700	11,808	NA
Sweetwater County	18,400	41,723	38,823	37,613	37,758

* WES 2005

Source: Wyoming Department of Administration & Information http://www.sweda.net/Demographics.htm.

3.10.2 Economic Conditions

The major source of employment in Sweetwater County is mineral and energy resource extraction and processing. **Table 3.10-2** summarizes the income characteristics for Sweetwater County and the State of Wyoming.

Table 3.10-2
Income Characteristics for Sweetwater County and the State of Wyoming

Parameter	Sweetwater County	Wyoming
Households, 2000	14,105	193,608
Persons per household, 2000	2.62	2.48
Median household income, 1999[1]	$46,537	$37,892
Per capita money income, 1999	$19,575	$19,134
Persons below poverty, 1999	2,871	54,777
Persons below poverty, percent, 1999	7.80%	11.40%
Median Family Income	$54,173	$45,685
Per Capita Income	$19,575	$19,134
Mean Hourly Wage (total all industries/all occupations)[2]	$16.74	$14.62

[1]A household includes the immediate family and any other individuals residing with the family.
[2]Occupational Employment Statistics, November 2002.

Source: Bureau of Economic Analysis, Bureau of Labor Statistics, National Agricultural Statistics Service, National Center for Health Statistics, U.S. Census Bureau http://www.fedstats.gov/qf/states/56/56037.html.

From 1990 to 2000, there has been a decrease in employment in the mining sector, while the service, retail, and manufacturing sectors have seen an increase in employment. **Table 3.10-3** summarizes the employment characteristics by sector for Sweetwater County during that period.

Table 3.10-3
Employment Characteristics by Sector for Sweetwater County

Employment Sector	1990	1992	1994	1996	1998	2000
Farm employment	220	199	195	197	198	201
Nonfarm employment	22,620	23,937	24,914	24,188	24,553	24,048
Private employment	18,595	19,729	20,794	20,078	20,352	19,760
Agricultural services, forestry, fishing & other	81	82	123	123	157	187
Mining	4,990	5,450	5,347	4,071	3,993	3,736
Construction	1,534	1,700	2,106	1,604	1,973	1,497
Manufacturing	746	742	728	1,505	1,507	1,648
Transportation and public utilities	1,981	1,931	2,006	1,937	1,852	1,781
Wholesale trade	649	677	644	649	683	614
Retail trade	3,732	3,943	4,184	4,328	4,479	4,420
Finance, insurance, and real estate	1,125	1,002	1,026	1,206	1,215	1,130
Services	3,757	4,202	4,630	4,655	4,493	4,747
Government and government enterprises	4,025	4,208	4,120	4,110	4,201	4,288
Federal, civilian	262	262	269	271	260	266
Military	227	262	239	225	235	215
State and local	3,536	3,684	3,612	3,614	3,706	3,807
State government	278	276	286	273	264	269
Local government	3,258	3,408	3,326	3,341	3,442	3,538

Source: Bureau of Economic Analysis. 2002. Regional Economic Information System, www.sonoran.org/eps.

From 1990 to 2000, there has been a slight decrease in income from the construction and transportation and public utilities sectors, while the mining, manufacturing, and service sectors have seen a large increase in income. Non-labor income also increased significantly during this period. **Table 3.10-4** summarizes the income characteristics by sector for Sweetwater County in 1990 and 2000.

The labor force has declined since 1994, from near 22,000 to less than 20,000. Unemployment has varied between 4.6 and 6.3 percent during that time. In 2002, unemployment was 4.7 percent. **Table 3.10-5** summarizes the labor force characteristics in Sweetwater County, Wyoming, from 1994 through 2002.

Table 3.10-4
Income Characteristics by Sector for Sweetwater County

New Income by Type (All figures in millions of 2000 dollars)	1990	Percent of Total	2000	Percent of Total	New Income 1990 to 2000	Percent of Change in Share 1990 to 2000
Total Personal Income*	980		1,156		176	
Farm and Agricultural Services	2	0.2	2	0.2	0	NA
Farm	1	0.1	0	0	-1	NA
Agricultural Services	0.8	0.1	1.5	0.1	1	0
Mining	77.8	7.9	332.9	28.8	255	145
Manufacturing (including forest products)	38	3.9	121	10.4	82	47
Services and Professional	250	25.5	336	29.1	86	49
Transportation and Public Utilities	112	11.5	105	9.1	-8	NA
Wholesale Trade	25	2.5	23	2.0	-2	NA
Retail Trade	63	6.5	70	6.1	7	4
Finance, Insurance, and Real Estate	14	1.4	28	2.4	14	8
Services (Health, Legal, Business, Other)	35	3.6	110	9.5	75	42
Construction	66	6.7	59	5.1	-6	NA
Government	138	14.1	145	12.6	7	4
Non-Labor Income	238	24.2	340	29.5	103	59
Dividends, Interest, and Rent	148	15.1	225	19.5	77	44
Transfer Payments	89	9.1	115	10.0	26	15

*The sum of the above categories do not add to total due to adjustments made for place of residence and personal contributions for social insurance made by the U.S. Department of Commerce.

Source: Bureau of Economic Analysis. 2002. Regional Economic Information System, www.sonoran.org/eps.

Table 3.10-5
Labor Force Characteristics for Sweetwater County, Wyoming

Parameter	Year								
	1994	1995	1996	1997	1998	1999	2000	2001	2002
Labor Force	21,883	21,705	21,126	20,569	21,009	20,625	20,295	20,592	19,790
Employment	20,683	20,566	19,796	19,349	19,874	19,333	19,318	19,646	18,851
Unemployment	1,200	1,139	1,330	1,220	1,135	1,292	977	946	939
Unemployment Rate	5.5	5.2	6.3	5.9	5.4	6.3	4.8	4.6	4.7

Source: Wyoming Department of Employment http://doe.state.wy.us/lmi/laus/9002aa.htm.

Construction and mineral extraction occupations in this area typically pay more than the average for all occupations. **Table 3.10-6** summarizes the hourly wage characteristics for the construction and extraction occupations as compared to all occupations in southwestern Wyoming.

Table 3.10-6
Wage Characteristics for Southwestern Wyoming

2001 Average Hourly Wage for All Occupations for Southwest Wyoming (Includes Lincoln, Sublette, Sweetwater, Teton, and Uinta counties)	
Hourly	**Annual**
$15.14	$31,491.20
2001 Average Hourly Wage for Construction and Extraction Occupations Southwest Wyoming (Includes Lincoln, Sublette, Sweetwater, Teton, and Uinta counties)	
Hourly	**Annual**
$16.77	$34,881.60

Source: Wyoming Department of Employment http://doe.state.wy.us/lmi/01oespub/table9.htm.

Table 3.10-7 shows historical data for wages in the state of Wyoming for selected sectors.

3.10.3 Housing

The nature of oil and gas development construction activities (relatively short-term tasks performed by contracted labor) results in a demand for temporary housing resources such as

Table 3.10-7
Average Wage for Selected Sectors for the State of Wyoming

Sector	**Year**								
	1995	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Natural Resources and Mining	30,845	31,897	32,916	34,338	33,966	36,386	36,752	39,878	39,759
Construction	13,725	13,826	14,336	15,281	15,673	18,047	17,905	18,072	18,352
Manufacturing	22,665	23,013	24,155	25,274	25,754	26,869	27,336	28,512	29,104

Earnings by Age, Gender, and Industry 1994 – 2003. http://doe.state.wy.us/lmi/wfdemog/toc3.htm.

motel rooms, mobile home parks, and recreational vehicle parks. There also is the potential for new permanent employees involved with ongoing operations and maintenance of the project facilities to seek longer-term housing resources.

As of 2004, Rock Springs has 20 motels with over 1,100 rooms and 30 mobile home parks with over 1,900 pads.

Historically, population pressures associated with oil and gas activities have created demand for housing in Sweetwater County and the cities of Rock Springs and Green River, specifically. During "bust" cycles, there is less demand for housing, creating vacancies. **Table 3.10-8** shows vacancy rates for Sweetwater County and the cities of Rock Springs and Green River for 1990 and 2000.

Table 3.10-8
Vacancy Rates for Sweetwater County, Rock Springs and Green River

Measure	Sweetwater County	Rock Springs	Green River
Housing units, 2000	15,921	8,359	4,426
Vacant units, 2000	1,816	1,011	249
Vacancy rate, 2000	11.4%	12.1%	5.6%
Housing units, 1990	15,444	8,056	402
Vacant units, 1990	1,828	929	
Vacancy rate, 1990	11.8%	11.5%	8.9%

There were almost 16,000 housing units in Sweetwater County in 2000, of which 1,816 were vacant. Median house value of owner-occupied housing was over $104,000 in 2000, with a 75 percent home ownership rate. The characteristics of housing in Sweetwater County, as compared to the State of Wyoming are summarized in **Table 3.10-9**.

Table 3.10-9
Housing Characteristics for Sweetwater County and the State of Wyoming

Measurement	Sweetwater County	State of Wyoming
Housing units, 2002	16,053	227,941
Housing units, 2000	15,921	
Occupied Housing units, 2000	14,105	
Vacant Housing units, 2000	1,816	
Housing units, net change, April 1, 2000, to July 1, 2002	132	4,087
Housing units, percent change, April 1 2000, to July 1, 2002	0.80%	1.80%
Homeownership rate, 2000	75.10%	70.00%
Median value of owner-occupied housing units, 2000	$104,200	$96,600
Households, 2000	14,105	193,608
Persons per household, 2000	2.62	2.48

Source: Bureau of Economic Analysis, Bureau of Labor Statistics, National Agricultural Statistics Service, National Center for Health Statistics, U.S. Census Bureau http://www.fedstats.gov/qf/states/56/56037.html.

3.10.4 Community Facilities, Law Enforcement, and Emergency Management

Population in the cities of Rock Springs and Green River, as well as Sweetwater County as a whole, is below historic levels found in the 1980s and 1990s. For this reason, county and municipal infrastructure is, in general, adequate to serve a larger population than currently exists. The growth in population has not translated into a proportional increase in new students enrolled at local schools, as mostly single males or married males who choose not to move their families to the region are attracted by jobs in the oil and gas sector (Barron 2005). It has been suggested that the increase in the single male segment of the population associated with employment in the oil and gas sector has led to an increase in methamphetamine trafficking and use in Wyoming (Erickson 2004).

Law enforcement in the area is provided by the Sweetwater County Emergency Management Agency (SCEMA), which operates under Federal Emergency Management Agency (FEMA) and USEPA guidelines. SCEMA is the agency designated by the Sweetwater County Commissioners to analyze potential hazards, assess emergency response capabilities, and mitigate the effects of emergencies or disasters. SCEMA coordinates with response agencies, industry, elected officials and volunteer agencies.

The project area is served by emergency response organizations located in Rock Springs. Routine injuries are treated at Memorial Hospital of Sweetwater County. Cases requiring specialized treatment are transported to Salt Lake City by services dispatched from Salt Lake City, Utah, or Craig or Grand Junction in Colorado.

3.10.5 Local Government Facilities and Services

The State of Wyoming does not levy a personal or corporate income tax. Wyoming does not impose a tax on intangible assets such as bank accounts, stocks, or bonds either. In addition, Wyoming does not assess any tax on retirement income earned and received from another state. There is no current legislation in the works to create any state income tax. **Table 3.10-10** summarizes most local, county, and state taxes in the area.

Property taxes collected by Sweetwater County totaled over $78 million in 2003 and over $103 million in 2004 (Sanchez 2005). Lodging taxes for fiscal 2005 totaled approximately $441,609, while sales tax revenues for that same period totaled approximately $50.4 million (Wyoming Department of Revenue 2005).

Table 3.10-10
Summary of Local, County, and State Taxes

Type of Taxes	Rock Springs	Green River	Sweetwater County	State of Wyoming	Total
Real Property	8 mill	8 mill	11.980 mill	None	
Personal Property	None	None	None	None	
Inventory	Exempt if held for resale				
Sales	None	None	1.5%	4%	5.5%
Lodging (Bed)	None	None	2%	None	2%
Corporate Income	None	None	None	None	None
Personal Income	None	None	None	None	None
School	27.5 Mills	30.811 mills			

State: Industrial Property: Assessed 11.5 percent of market value.
Commercial: Assessed 9.5 percent of market value.
Residential: Assessed 9.5 percent of market value (Sweetwater Economic Development Association 2004).

Oil and gas companies pay ad valorem taxes on production and facilities. Natural gas is assessed on the previous year's production. The 2003 assessed valuation based on 2002 natural gas production was approximately $350.1 million, down from the previous year's valuation of $577.6 million. Additionally, there are countywide mill levies in the project area totaling 12.351 mills. Property taxes for 2003 in Sweetwater County were approximately $78.2 million, down 16.1 percent from the previous year (Wyoming Taxpayers Association 2003).

3.11 Environmental Justice

As required by EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," the proposed project is evaluated for any disproportionately high and adverse human health or environmental effects on minority communities and low-income communities within the context of NEPA documents.

The environmental justice study area for both the Proposed Action and the CIAA is Sweetwater County.

3.11.1 Minority Populations

The project location is in Census Tract 971600. Racial composition information is only available at this level. The total population of this census tract is 1,703 people. Of these 1,703, 92.84 percent classify themselves White (non Hispanic or Latino); 1.7 percent as Black or African American (non-Hispanic or Latino); 0.053 percent as Asian (non-Hispanic or Latino); and 0.23 percent as

American Indian or Alaska Native (non-Hispanic or Latino). Those identifying themselves as Hispanic or Latino totaled 4.93 percent (U.S. Census Bureau 2000).

3.11.2 Low-Income Populations

The project location is in Census Tract 971600, Block Group 2. Median Household Income in this area is $50,000. Approximately 4.9 percent of households in this area fall below the poverty level (U.S. Census Bureau 2000).

3.12 Transportation

The regional transportation system serving the project area includes an established system of interstate and state highways and county roads. Local traffic on federal land also is served by improved and unimproved BLM and oil and gas field roads.

Access to the project site is provided by I-80, Wyoming State Highway 430 (SH 430), and Sweetwater CR 4-26 (Brady Field Road), CR 4-24 (Patrick Draw Road), and CR 4-19 (Bitter Creek Road).

Table 3.12-1 displays traffic data, where available, for the highway access routes to the project area.

3.12.1 Federal and State Highways

Current traffic volumes on Wyoming federal and state highways are listed in **Table 3.12-1**. The WDOT assigns levels of service (LOS) standards to highways in the state system, based on speed, travel time, traffic interruptions, etc., that characterize operational conditions. “A” represents the highest level of service, while “F” represents the lowest. Highways in the project area are currently at an “A” LOS, indicating traffic could increase substantially before LOS standards would be exceeded. The interchange at Bitter Creek and I-80 is a “diamond” interchange, which should provide adequate egress from the interstate. The interchange at Patrick Draw and I-80 is a “jughandle,” with a 15 miles per hour (mph) exit speed, which could make exiting from I-80 more difficult for tractor-trailer combinations.

SH 430 is a two-lane paved highway with narrow shoulders and steep side slopes. The highway is in relatively good condition and receives a low amount of traffic; however, it is an older highway with a design that is not up to current standards (Montouro 2004).

Table 3.12-1
Highway Access to the Project Site

Route	2002 ADT	2001 ADT	2000 ADT	Level of Service
I-80 @ Patrick Draw (CR 4-24) Intersection	Proceeding West: 11,630 (5,980 trucks) Proceeding East: 11,850 (5,900 trucks)	11,500 (5,870 trucks)	10,900 (6,400 trucks)	A
I-80 @ Bitter Creek (CR 4-19) Intersection	Proceeding West: 11,850 (5,900 trucks) Proceeding East: 11,850 (6,350 trucks)	11,510 (5,870 trucks)	10,900 (6,300 trucks)	A
SH 430 @ MP 2.224 (Rock Springs urban limits) and proceeding 6 miles east Intersection	240 (30 trucks)	No data	No data	A
SH 430 @ MP 8.226 (Jct. Co. Rd. So.) and proceeding for 18 miles west	120 (20 trucks)	No data	No data	A
SH 430 @ MP 8.226 (Jct. Co. Rd. 30 West) and proceeding for 29 miles east-southeast	90 (20 trucks)	No data	No data	A

Source: Wyoming Department of Transportation (WDOT) 2002.

The CIAA for transportation is the proposed project area plus a surrounding 4-mile buffer with an area of approximately 83,358 acres.

3.13 Cultural Resources/Native American Consultation

3.13.1 Cultural Resources

Cultural resources on all federal land are protected by a series of federal laws enacted to protect these resources from damage or loss due to federally funded or permitted activities. The public's recognition that these non-renewable resources are important and should be protected began very early in this century with the 1906 Antiquities Act and continues to the present. New directions and emphases that have come to the forefront over the past 10 years include the Native American Graves Protection and Repatriation Act (NAGPRA), EO 13007, the consideration of historic and traditional landscapes, and the increased awareness of and consultation for traditional cultural properties. Three of the most important laws are the National Historic Preservation Act (NHPA) of 1966, as amended; the American Indian Religious Freedom Act (AIRFA) of 1978; and

the Archaeological Resources Protection Act (ARPA) of 1979. EO 11593 also provides necessary guidance on protection and enhancement of cultural resources.

Under authority of the mandated policies described above, the proposed project development areas were examined to locate any cultural resources within the potential area of effect of the proposed undertaking. Section 106 of the NHPA requires federal agencies to assess the effects of federal undertakings on historical and archaeological sites. This is accomplished by inventorying the area of effect, evaluating site importance and eligibility to the National Register of Historic Places (NRHP), assessing the effect of the undertaking on significant sites, and consulting with appropriate historic preservation agencies.

Two Class III cultural resource inventories were conducted for the Proposed Action. The first inventory occurred in the summer of 2004 and covered the northern half of the Proposed Action area. In the summer of 2005, the southern half of the Proposed Action area was inventoried for cultural resources. The results of each Class III inventory are described separately in the following text.

3.13.1.1 Northern Portion of Proposed Action Area

A Class III cultural resources block inventory of the northern portion of the Proposed Action area was conducted by Western Archaeological Services (WAS) from August 2004 to November 2004 to determine whether any cultural resources would be affected by ground-disturbing activities associated with the proposed construction of extraction wells and associated pipelines, access roads, and compressor stations (Gardner 2005). The objective of the Class III inventory was to provide a complete record of cultural resources located in the project area and to aid Anadarko in avoiding cultural resources when possible. The inventory encompassed a total of 1,560 acres.

Prior to the Class III block inventory, a Class I file search was conducted by WAS on August 13, 2004, through the Wyoming SHPO, Cultural Records Division. An updated file search was received on April 13, 2005. The objective of the Class I inventory was to identify any known cultural resources and previously conducted inventories in the northern portion of the Proposed Action area. Records at WAS also were reviewed. Government Land Office (GLO) maps on the SHPO web site were reviewed given the presence of previously documented historic resources in the vicinity of the project area.

The Class I files search located two previously recorded sites in the project area: 48SW12180 and 48SW14056. Site 48SW12180 is a prehistoric open camp and was recommended as eligible for the NRHP based on the potential for intact buried cultural material (Stainbrook 2005). Site 48SW14056 is a prehistoric open camp of unknown eligibility.

During the Class III block inventory, WAS located and recorded 2 previously recorded sites, 25 newly recorded sites, and 10 isolated finds (**Table 3.13-1**). The two previously recorded sites are prehistoric open camps (48SW12180 and 48SW14056). Site 48SW12180 was previously recommended as eligible for the NRHP. Based on the artifact assemblage and deposition, WAS concurs with the previous evaluation as eligible for the NRHP. Avoidance is recommended for this site. Site 48SW14056 was identified during the course of a seismic project and the eligibility was not determined. During the current block inventory, no testing was conducted at the site; therefore the site remains unevaluated. Anadarko intends to avoid all cultural sites; however, if further development and construction threaten to impact site 48SW14056, testing may be required to determine eligibility.

Table 3.13-1
Cultural Sites Identified Within the Northern Portion of the Proposed Action Area

Site Number	Site Type	Previously Recorded (Y/N?)	NRHP Eligibility
48SW12180	Prehistoric Open Camp	Y	Eligible
48SW14056	Prehistoric Open Camp	Y	Unevaluated
48SW15945	Prehistoric Open Camp	N	Unevaluated
48SW15946	Prehistoric Open Camp	N	Unevaluated
48SW15947	Prehistoric Open Camp	N	Unevaluated
48SW15948	Prehistoric Open Camp	N	Unevaluated
48SW15949	Prehistoric Open Camp	N	Unevaluated
48SW15950	Prehistoric Open Camp	N	Not eligible
48SW15951	Prehistoric Open Camp	N	Not eligible
48SW15952	Prehistoric Open Camp	N	Unevaluated
48SW15953	Prehistoric Lithic Scatter	N	Unevaluated
48SW15954	Prehistoric Lithic Scatter	N	Not eligible
48SW15955	Prehistoric Open Camp	N	Unevaluated
48SW15956	Prehistoric Open Camp	N	Unevaluated
48SW15957	Prehistoric Lithic Scatter	N	Unevaluated
48SW15958	Prehistoric Lithic Scatter	N	Unevaluated
48SW15959	Prehistoric Lithic Scatter	N	Not eligible
48SW15960	Prehistoric Lithic Scatter	N	Unevaluated
48SW15961	Prehistoric Lithic Scatter	N	Not eligible
48SW15962	Prehistoric Lithic Scatter	N	Unevaluated
48SW15963	Prehistoric Open Camp	N	Unevaluated
48SW15964	Historic Debris with Lithic Scatter component	N	Not eligible
48SW15965	Historic Debris	N	Not eligible
48SW15966	Unknown Rock Cairn	N	Unevaluated
48SW15967	Prehistoric Open Camp	N	Not eligible
48SW15968	Prehistoric Lithic Scatter	N	Unevaluated
48SW15969	Prehistoric Open Camp	N	Unevaluated

Source: Gardner 2005.

The 25 newly recorded sites include 11 prehistoric open camps (48SW15945, -15946, -15947, -15948, -15949, -15950, -15951, -15952, -15955, -15956, and -15967), 11 prehistoric lithic scatters (48SW15953, -15954, -15957, -15958, -15959, -15960, -15961, -15962, -15963, -15968, and -15969), 2 historic sites (48SW15966 [historic cairn] and 48SW15965 [historic debris) and 1 mulitcomponent site containing both a prehistoric lithic scatter and historic debris (48SW15964) (**Table 3.13-1**). Seventeen of the newly recorded sites (48SW15945, -15946, -15947, -15948, -15949, -15952, -5953, -15955, -15956, -15957, -15958, -15960, -15962, -15963, -15966, -15968, and -15969) are unevaluated for the NRHP. Anadarko intends to avoid all cultural sites. However, if further development and construction threaten to impact these 17 sites, testing may be required prior to construction to determine NRHP-eligibility (Gardner 2005). The remaining eight newly recorded sites (48SW15950, -15951, -15954, -15959, -15961, -15964, -15965, and -15967) are recommended as not eligible for the NRHP. No further work is recommended at these sites.

3.13.1.2 Southern Portion of the Proposed Action Area

A Class III cultural resources block inventory of the southern portion of the Proposed Action area was conducted by WAS from July 2005 to August 2005 to determine whether any cultural resources would be affected by ground-disturbing activities associated with the proposed construction of extraction wells and associated pipelines, access roads, and compressor stations (Ficenec 2005). Prior to the Class III block inventory, a Class I files search was conducted by WAS on June 13, 2005, and on July 9, 2005, through the Wyoming SHPO.

The Class I files search identified a total of 15 previously recorded sites within the project area: three prehistoric open camps (48SW3444, 48SW14061, and 48SW14062), one prehistoric lithic scatter (48SW5681), four prehistoric lithic and fire-cracked rock (FCR) scatters (48SW5682, -14060, -14063, and -14425), two prehistoric lithic and ceramic scatters (48SW14071 and 48SW13747), one historic bridge (48SW6413), one historic trash scatter (48SW11395), the historic Rifes Road to Bitter Creek (48SW12070), Bitter Creek Railroad Station (48SW3947), and the Washakie Basin Lithic Landscape (48SW15978) (**Table 3.13-2**). The Washakie Basin Lithic Landscape, Rifes Road to Bitter Creek, Bitter Creek Railroad Station, historic bridge, historic trash scatter, the prehistoric lithic scatter (48SW5681), one prehistoric lithic and FCR scatter (48SW14425), and one prehistoric open camp (48SW3444) are recommended as not eligible for the NRHP (Ficenec 2005). Site 48SW5682 (prehistoric lithic and FCR scatter) is eligible for the NRHP. The remaining two prehistoric open camps (48SW14061 and 48SW14062), two prehistoric lithic and FCR scatters (48SW14060 and 48SW14063), and the prehistoric lithic and ceramic scatters (48SW14071 and 48SW13747) are unevaluated.

Table 3.13-2
Cultural Sites Identified Within the Southern Portion of the Proposed Action Area

Site Number[1]	Site Type	Previously Recorded (Y/N?)	NRHP Eligibility
48SW3444	Prehistoric open camp	Y	Not eligible
48SW5681	Prehistoric lithic scatter	Y	Not eligible
48SW5682	Prehistoric lithic and FCR scatter	Y	Eligible
48SW14060	Prehistoric lithic and FCR scatter	Y	Unevaluated
Site 18	Prehistoric open camp	N	Unevaluated
Site 19	Prehistoric lithic scatter	N	Unevaluated
48SW15978	Washakie Basin Lithic Landscape	Y	Not eligible
48SW3947	Bitter Creek Railroad Station	Y	Not eligible
48SW6413	Historic bridge on the Union Pacific Railroad	Y	Not eligible
48SW11395	Historic trash scatter	Y	Not eligible
48SW12070	Historic Rifes Road to Bitter Creek	Y	Not eligible
48SW14071	Prehistoric lithic/pottery scatter	Y	Unevaluated
Site 1	Historic/early modern trash scatters	N	Not eligible
Site 2	Historic/early modern trash scatters	N	Not eligible
Site 3	Prehistoric lithic and FCR scatter	N	Not eligible
Site 4	Prehistoric lithic and FCR scatter	N	Not eligible
Site 30	Diversion ditch	N	Unevaluated
Site 20	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 21	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 22	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 23	Prehistoric lithic scatter	N	Unevaluated
48SW14063	Prehistoric lithic and FCR scatter	Y	Unevaluated
48SW14425	Prehistoric lithic and FCR scatter	Y	Not eligible
Site 5	Historic trash scatter	N	Not eligible
Site 6	Prehistoric lithic and FCR scatter	N	Not eligible
Site 7	Prehistoric lithic and FCR scatter	N	Not eligible
Site 8	Prehistoric lithic and FCR scatter	N	Not eligible
Site 9	Prehistoric open camp	N	Eligible
Site 10	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 11	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 12	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 13	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 14	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 15	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 16	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 17	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 24	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 25	Prehistoric lithic and FCR scatter	N	Unevaluated
48SW13747	Prehistoric lithic/ceramic scatter	Y	Unevaluated
48SW14061	Prehistoric open camp	Y	Unevaluated
48SW14062	Prehistoric open camp	Y	Unevaluated

Table 3.13-2 (Continued)

Site Number1	Site Type	Previously Recorded (Y/N?)	NRHP Eligibility
Site 26	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 27	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 28	Prehistoric lithic and FCR scatter	N	Unevaluated
Site 29	Prehistoric lithic and FCR scatter	N	Eligible

[1]At this time, the newly recorded sites only have field numbers.

Source: Ficenec 2005.

During the Class III block inventory, WAS located the 15 previously recorded sites, 30 newly recorded sites, and 44 isolated finds (**Table 3.13-2**). Eight of the 16 previously recorded sites and all of the isolated finds located during the Class III inventory are recommended as not eligible for the NRHP (48SW3444, -5681, -15978, -3947, -6413, -11395, -12070, and -14425); no further work is recommended for these sites. Six of the sites are unevaluated (48SW14060, -14071, -14063, -13747, -14061, and -14062). During the current block inventory, no testing was conducted at these sites; therefore the sites remain unevaluated. Anadarko intends to avoid all cultural sites; however, if further development and construction threaten to impact these six unevaluated sites, testing may be required to determine eligibility. Site 48SW5682 (prehistoric open camp) is recommended as eligible for the NRHP. Avoidance is recommended for this site.

The 30 newly recorded sites located during the block inventory include 22 prehistoric lithic and FCR scatters, 2 prehistoric open camps, 2 prehistoric lithic scatters, 3 historic trash scatters, and 1 small historic diversion ditch (**Table 3.13-2**). Of the 22 prehistoric lithic and FCR scatters, 5 are recommended as not eligible for the NRHP, 16 are unevaluated, and 1 is recommended as eligible for the NRHP. The three historic trash scatters are recommended as not eligible for the NRHP. The historic ditch, two lithic scatters, and one of the prehistoric open camps are unevaluated; the remaining prehistoric open camp is recommended eligible for the NRHP. During the block inventory, no testing was conducted at the unevaluated sites; therefore, the sites remain unevaluated. Anadarko intends to avoid all cultural sites; however, if development and construction threaten to impact the unevaluated sites, testing may be required to determine eligibility.

The GLO maps indicate that the Overland Trail (48SW1226) is located south of the project area. Due to the presence of the Trail, a location map was obtained from the BLM Rock Spring Field Office. The location map indicates that the Trail is located approximately 2.4 miles to the south of the Monell Unit boundary (see **Figure 3.9-2**).

3.13.1.3 Site Summary

During the Class III inventory of the Proposed Action area, 72 archaeological sites and 54 isolated finds were identified. Twenty-four of the 73 sites and all of the isolated finds are recommended as not eligible for the NRHP. No further work is recommended for these cultural resources. Four of the sites are recommended as eligible for the NRHP and avoidance is recommended for these sites. The remaining 44 sites are unevaluated. If these 44 sites are situated in residual/colluvial deposits that can be evaluated with one or two shovel probes; WAS will evaluate the sites for NRHP-eligibility. However, if the sites are located in eolian deposits or require more than minimal testing, the sites will remain unevaluated until Anadarko determines the location of the wells proposed for new development.

3.13.2 Native American Consultation

As a federal agent, the BLM is mandated to consult with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on federal lands. This consultation includes the identification of places (i.e., physical locations) of traditional cultural importance to Native American tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Additionally, some of these locations may be considered sacred to particular Native American individuals or tribes. Under the auspices of the AIRFA, EO 13007, the NAGPRA, and the NHPA, as amended, the BLM must take into account the effects on these types of locations.

The proposed Monell Unit development is currently in the planning stages; therefore, government-to-government consultation with Native American groups either living in or with historical ties to the project area has not been initiated. Once the well site locations have been verified, the need for consultation would be determined by the type of cultural resources identified during the Class III inventories and their location relative to the proposed well sites. If a cultural resource site of traditional cultural importance to the tribes is located within the vicinity of a well, associated facility, or new access road, letters would be sent to the identified Native American groups informing them of the proposed undertaking and soliciting their concerns/comments regarding the site.

3.14 Health and Safety

Hazardous materials, which are defined in various ways under a number of regulatory programs, can represent potential risks to both human health and to the environment when not managed properly. The term hazardous materials includes the following materials that may be utilized or disposed of in conjunction with a variety of industrial and commercial activities:

- Substances covered under the Occupational Safety and Health Administration (OSHA) Hazard Communication (Hazcom) Standard (29 CFR 1910.1200). Materials and substances covered under the Hazcom Standard may be used in a variety of industrial and commercial activities and may also be subject to the regulations listed here.

- Hazardous materials as defined under the U.S. Department of Transportation (USDOT) regulations in 29 CFR, 170-177.

- Hazardous substances as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR Table 302.4. CERCLA regulations also govern the cleanup of contaminated sites. Sites evaluated under CERCLA that pose serious threats to human health and the environment are placed on the National Priorities List and are commonly referred to as Superfund sites.

- Hazardous wastes as defined in the Resource Conservation and Recovery Act (RCRA).

- Hazardous substances and extremely hazardous substances as well as petroleum products such as gasoline, diesel, or propane, that are subject to reporting requirements (Threshold Planning Quantities) under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act (SARA).

- Petroleum products defined as “oil” in the Oil Pollution Act of 1990 (OPA 90). The materials defined under OPA 90 include fuels, lubricants, hydraulic oil, and transmission fluids.

In conjunction with the definitions noted above, the following lists provide information regarding management requirements during transportation, storage, and use of particular hazardous chemicals, substances, or materials:

- SARA Title III List of Lists (USEPA 1996) or the Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the CAA.

- USDOT listing of hazardous materials in 49 CFR 172.101.

RCRA governs the handling and disposal of solid wastes (USEPA 1998). Solid wastes comprise a broad range of materials that include garbage, refuse, sludge, non-hazardous industrial waste, municipal wastes, and hazardous waste. Solid waste as defined includes solids, liquids, and contained gaseous materials. Hazardous wastes are those materials that exhibit certain characteristics (as defined by laboratory analysis), are generated from specific industrial processes, or chemical compounds, that if abandoned could pose a threat to human health and the environment. Wastes intrinsic to oil and gas production are exempt from regulation under RCRA, but must be disposed or recycled in and environmentally acceptable manner according to rules and regulations of the WOGCC and WDEQ.

A variety of hazardous materials would be used during drilling and production operations of the project. Hazardous materials that could be used include, but are not limited to fuels, treatment chemicals, drilling mud additives, and fracturing and completion fluids. The major wastes expected to be generated are RCRA exempt oil field wastes such as formation water, drilling fluids, and completion fluids.

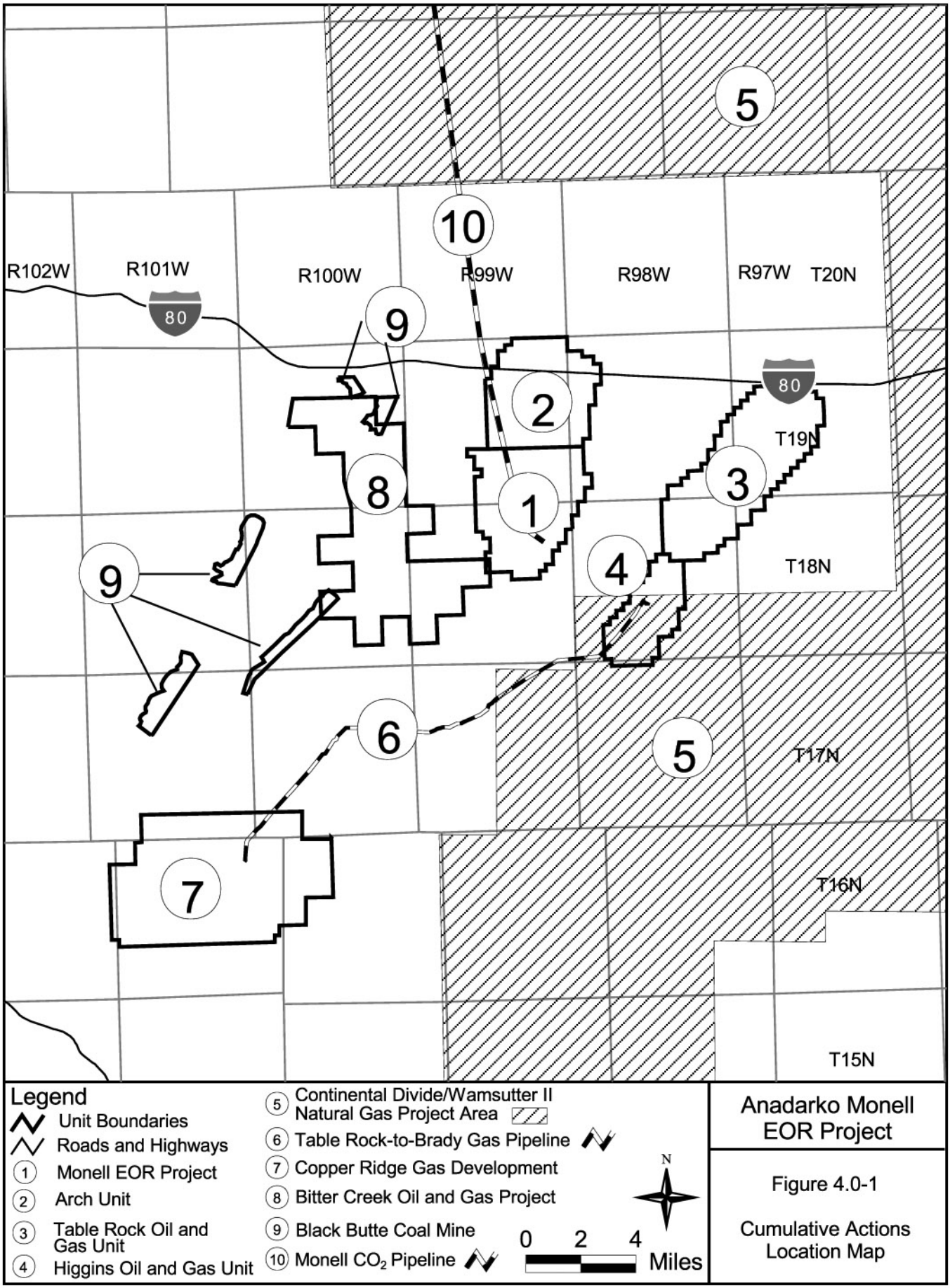
Review of USEPA compliance databases (USEPA 2005) indicates that there are no sites within or near the project area that have ongoing compliance issues or contamination problems. The databases showed no generators or generation sites of hazardous waste in the project area. The Patrick Draw Gas Plant operated by Duke Energy Field Services, Inc. in Sec. 25, T19N, R99W is listed for air quality permits in the USEPA databases, but no there are no compliance issues associated with the plant.

4.0 ENVIRONMENTAL CONSEQUENCES

Chapter 4.0 of this EA provides an analysis of the potential environmental impacts that could result from the implementation of the Proposed Action and the No Action alternatives. Narrative descriptions of potential impacts under these two alternatives are discussed for each environmental resource in Sections 4.1 through 4.14. An environmental impact is defined as a change in the quality or quantity of a given resource as a result of modification in the existing environment resulting from project-related activities. Beneficial or adverse impacts may be a primary result (direct) or secondary result (indirect) of an action, and may be permanent and long-term or temporary and short-term. This EA assumes that all applicant-committed measures described in Section 2.2.1.15 would be successfully implemented. Additional mitigation was recommended for environmental resources with impact concerns, based on guidance provided in Appendices 2 and 5-1 in the Green River RMP (BLM 1997a) and Best Management Practices (BMPs) for developing fluid mineral resources (BLM 2004a). Integration of BMPs also will be integrated into the APD process (BLM 2004b).

This chapter also discusses cumulative impacts to each resource. Cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative actions can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). Where impacts are not fully mitigated or compensated, cumulative impacts can result. The boundaries of individual CIAAs for this EA are discussed separately for each resource in Chapter 3.

Principal past actions that were considered in the evaluation of the cumulative impacts are those that have affected similar resources and for which the effect is still residual in the environment. Past or ongoing actions in the vicinity of the Monell EOR project area that have affected resources with residual effects include Anadarko's existing Monell Oil and Gas Development and CO_2 Pipeline, Anadarko's Copper Ridge Shallow Natural Gas Development, Anadarko's Table Rock-to-Brady Gas Pipeline Project, Anadarko's Table Rock and Higgins Oil and Gas Units, Bitter Creek Shallow Oil and Gas Development, Black Butte Coal Mine, and Continental Divide/Wamsutter II Natural Gas Project (**Figure 4.0-1**). Surface disturbance associated with these past actions is listed in **Tables 4.0-1** and **4.0-2**.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Legend
Unit Boundaries
Roads and Highways
1 Monell EOR Project
2 Arch Unit
3 Table Rock Oil and Gas Unit
4 Higgins Oil and Gas Unit
5 Continental Divide/Wamsutter II Natural Gas Project Area
6 Table Rock-to-Brady Gas Pipeline
7 Copper Ridge Gas Development
8 Bitter Creek Oil and Gas Project
9 Black Butte Coal Mine
10 Monell CO_2 Pipeline
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Anadarko Monell EOR Project
Figure 4.0-1
Cumulative Actions Location Map

Table 4.0-1
Estimated Surface Disturbance for the Monell Unit as of 2004

Type of Disturbance	Estimated Life-of-Project (LOP) Disturbance Area (acres)				Estimated Initial Disturbance Area (acres)			
	Federal	Private	State	Total	Federal	Private	State	Total
Number of Wells	15	61	3	79	15	61	3	79
Well Pads[1]	15	61	3	79	30	122	6	158
Roads[2]	13.7	55.4	2.7	71.8	27.3	110.9	5.5	143.6
Treating Facilities and Substation[3]	0.0	13.0	0.0	13.0	0.0	13.0	0.0	13.0
Pipelines[4,5]	0.0	0.0	0.0	0.0	68.2	277.2	13.6	359.0
Injection Header	0.7	3.7	0.0	4.4	0.7	3.7	0.0	4.4
Total	**29.4**	**133.1**	**5.7**	**168.2**	**126.2**	**526.7**	**25.1**	**678.0**

[1]Assumes initial disturbance of approximately 2 acres for each well pad and LOP disturbance of 1 acre per well pad.
[2]Assumes an average of 0.25 mile of new roads with parallel gas gathering and water discharge lines (60-foot average disturbance width) for each well. All disturbance except for the estimated 30-foot-wide road travel way and adjacent ditches would be reclaimed for the LOP.
[3]The treating facilities (about 8 acres of disturbance) would be located on private land and 5 acres for an electrical substation to be located on private land.
[4]Assumes an average of 0.75 mile of new gathering and injection lines per well of which approximately 0.5 mile would be constructed within existing pipeline corridors.
[5]Assumes an average disturbance width of 50 feet.

Table 4.0-2
Surface Disturbance (Acres) Associated With All Past and Present Actions in the CIAA

Project	Initial Disturbance	Long-Term Disturbance
Monell Existing Oil and Gas Development	678	168
Monell CO_2 Pipeline	223	128
Copper Ridge Gas Development	99	73
Table Rock Unit	478	239
Higgins Unit	84	42
Table Rock-to-Brady Gas Pipeline	285	144
Bitter Creek Gas Development	325	152
Black Butte Coal Mine	11,765	7,531
Continental Divide/Wamsutter II[1]	22,400	5,893[2]

[1]A relatively small portion (0 to 20 percent) of this project would be relevant to the CIAA for various resources.
[2]Disturbance based on approval of 71 percent of originally proposed wells (2,130) from Draft EIS.

Reasonably foreseeable development (RFD) actions under consideration by the BLM include the proposed expansion of the Black Butte Coal Mine (an additional 1,399 acres) and potential oil and gas development in the Arch Unit. Descriptions of these RFDs include:

- Arch Unit – Potential oil and gas development would depend upon the results and evaluation of performance in the Monell Unit. It is assumed that up to approximately 100 or more wells could be developed.

- Black Butte Coal Mine Expansion – A coal lease application (Pit 14 Lease) has been filed to mine approximately 1,399 acres. Approximately 33 percent of the area is federal surface land. An additional 828 acres also would be disturbed as part of the expansion of the current Black Butte Coal Mine. Ongoing reclamation would restore areas where mining is completed.

4.1 Air Quality

Air pollutant emissions would be generated in the Monell project area during well pad construction activities and oil production. The primary pollutants emitted would be PM_{10}, $PM_{2.5}$, NO_x, CO, volatile organic compounds (VOC), and SO_2. Emissions of these air pollutants would occur temporarily during well pad and road construction and during oil production operations occurring over the LOP.

Air quality impacts from the emission of these pollutants are limited by regulations, standards, and implementation plans established under the Federal CAA and are administered within Wyoming by the WDEQ/AQD. Under FLPMA and the CAA, the BLM cannot conduct or authorize any activity which does not conform to all applicable local, state, tribal, or federal air quality laws, statutes, regulations, standards, or implementation plans. Potential project impacts would be considered significant if it is demonstrated that:

- Potential concentrations are greater than the applicable NAAQS or WAAQS;
- Potential concentrations are greater than the total value of the applicable PSD increments; or
- Potential visibility reduction and atmospheric deposition are greater than applicable AQRVs.

4.1.1 Proposed Action

Air pollutant emissions from the construction phase of the Proposed Action would occur during construction of well pads and access roads, diesel-fired heavy construction equipment, diesel-fired well drilling engines, pipeline construction, travel on unpaved roads to and from the construction sites, and wind erosion of disturbed areas. The existing network of roads within the Monell Unit would be utilized to the extent possible; therefore, road construction would be limited to those areas not already serviced by existing roads. PM_{10} and $PM_{2.5}$ emissions would result from well pad, access road, and pipeline construction and travel on unpaved roads, and NO_x, CO, VOC, and SO_2 emissions would occur from drilling engine operation, completion operations, and tailpipe emissions from heavy construction equipment. Air pollutant impacts from each well would

be temporary (i.e., occurring during the well construction period or pipeline construction period) and would occur in isolation, without significantly interacting with other sites under concurrent construction.

Although air emissions from fugitive dust-generating activities and from heavy equipment diesel combustion could occur at increased levels at locations adjacent to well and road construction sites, impacts would be temporary and would not be expected to violate ambient air quality standards or PSD increments, or significantly impact AQRVs.

NO_x emissions from the drilling of one well would be 2.0 tons per year (tpy). NO_x emissions from drilling engine diesel combustion were calculated based on two 800-hp engines operating 8 days per well, 24 hours per day, emissions factor from AP-42 for uncontrolled stationary diesel engines, and a load factor multiplier of 0.42. NO_x emissions from total wells drilled per year, conservatively estimated to be 31 wells per year, would result in total NO_x emissions of 62 tpy.

Air quality impacts from natural gas production would occur over the LOP from natural gas combustion in a production unit heater, and from employee travel on unpaved roads within the Monell project area. One production unit heater would operate year-round at each well site and would result in emissions of NO_x, CO, PM_{10}, and VOCs. Employee travel on unpaved roads to and from well sites in light pick-up trucks would result in emissions of PM_{10} and $PM_{2.5}$.

Annual pollutant emissions for each well site and from the total 126 wells proposed under the Proposed Action are provided in **Table 4.1-1**.

Table 4.1-1
Construction and Drilling Emissions from Wells

Pollutant	Emissions			
	Emission Factor (lb/hp-hr)	Hourly (lb/hr)	Per well (lb)	Annual (tpy)
NO_x	0.031	20.8	3,999.7	62.00
CO	0.00668	4.5	861.9	13.36
SO_x	0.0020	1.4	264.5	4.10
PM_{10}[1]	0.0022	1.5	283.9	4.40
CO_2[2]	1.15	772.8	148,377.6	2,299.8
Aldehydes	0.000463	0.3	59.7	0.93
Exhaust	0.00247	1.7	318.7	4.94
Evaporative	0	0	0	0
Crankcase	0.000044	0	5.7	0.09

[1]PM_{10} = particulate matter less than or equal to 10 µm aerodynamic diameter.
[2]Assumes 99 percent conversion of carbon in fuel to CO_2 with 87 weight percent carbon in diesel, 86 weight percent carbon in gasoline, average BSFC of 7,000 Btu/hp-hr, diesel heating value of 19,300 Btu/lb, and gasoline heating value of 20,300 Btu/lb.

4.1.2 No Action

Under the No Action Alternative, no additional development in the Monell project area would occur. Air quality impacts would remain at currently authorized levels.

4.1.3 Mitigation

No additional mitigation or monitoring is recommended.

4.1.4 Cumulative Impacts

The air quality study prepared for the Atlantic Rim Natural Gas Project/Seminoe Road Gas Development Project in 2003 analyzed cumulative impacts from air emissions sources in southwest Wyoming at PSD Class I and sensitive PSD Class II areas (TRC 2004). The document contains the most recent cumulative inventory of air emissions available in southwest Wyoming, and used a "reasonable but conservative" approach that included the modeling of regional sources at permitted emission rates. Industrial development from January 1, 2001, to March 31, 2004, was modeled in the analysis for permitted sources within a large study domain which included southwest Wyoming, northwest Colorado, southeast Idaho, and northeast Utah. The subset of these sources that had begun operation as of the inventory end-date was classified as state-permitted sources, and those not yet in operation were classified as reasonably foreseeable future actions (RFFA). Industrial sources proposed in the State of Wyoming under NEPA also were included in the regional inventory. The developed portions of these projects were assumed to be included in monitored ambient background or included in the state-permitted source inventory. The undeveloped portions of projects proposed under NEPA were classified as RFD. The regional emissions inventory and modeling analysis results accounted for industrial development prior to the baseline date by adding background ambient monitoring data collected for that period to modeled concentrations.

The Atlantic Rim Natural Gas Project/Seminoe Road Gas Development Project cumulative impact analysis for air quality predicted an increase of 14,655 tpy of NO_x emissions over the background emissions. The analysis predicted potential increases to ambient concentrations and atmospheric deposition in PSD Class I and Class II areas, potential changes to lake acidity in sensitive lakes, and potential changes in visibility at the PSD Class I and sensitive Class II areas. The addition of predicted impacts from the two referenced projects to background values would result in air quality below applicable ambient standards at all Class I and Class II areas. The study found no potential concentrations greater than applicable PSD increments. Potential impacts to atmosphere deposition at the Class I and sensitive Class II areas and acidity in the sensitive lakes were below

levels of concern. Potential visibility impacts were found to be significant at Bridger Wilderness PSD Class I area for a maximum of four days per year and at each PSD Class II area (Popo Agie Wilderness Area and Wind River Roadless Area) for a maximum of one day per year. With full development of the Monell Proposed Action, NO_x emissions in the cumulative study area would increase by 62 tpy, a 0.4 percent increase in emissions over those analyzed in the Atlantic Rim Natural Gas Project/Seminoe Road Gas Development Project air quality study. The Monell EOR Project would not significantly alter the overall assessment of cumulative impacts in the region.

4.2 Geology and Soils

4.2.1 Proposed Action

4.2.1.1 Geology

Geologic hazards are not expected to have impacts to the Proposed Action. Unique geologic features would be not be affected by the project.

4.2.1.2 Soils

Under the Proposed Action, construction-related activities would result in the removal of native vegetation, exposure of the soil, mixing of soil horizons, loss of topsoil productivity, soil compaction, and increased susceptibility to wind and water erosion. These impacts may result in increased runoff, soil erosion, and sedimentation to receiving waters without mitigation measures.

A total of 1,073 acres could be disturbed over the LOP. Approximately 813 acres would be stabilized and reclaimed within 1 to 2 years after being disturbed. The remaining 260 acres would not be reclaimed until wells, roads, and associated facilities are abandoned in 15 to 20 years. Successful reclamation (i.e., regenerating native species and soil stability) is anticipated within 3 to 5 years.

Biological soil crusts within the Monell EOR project area may be disturbed by the Proposed Action. Biological soil crusts are part of the topsoil. All biological soil crusts receive the same level of protection and are considered to be a valuable resource. The BLM mandates that a minimum of 6 inches of topsoil or suitable subsoil be salvaged from all areas that would be disturbed. It is unlikely that construction activities related to the Proposed Action would be located on contiguous areas of biological soil crusts.

Surface soils located within the 934-acre area that occurs in the southern portion of the project area would have reclamation limitations due to very high levels of sodium and salinity.

4.2.2 No Action

4.2.2.1 Geology

There would be no impacts to geology or from geologic hazards with regard to the No Action.

4.2.2.2 Soils

Under the No Action Alternative, the BLM would deny the Proposed Action and no additional disturbance/development beyond that which has already been authorized by the BLM would occur. Impacts to soil resources within the Monell project area would continue at current rates, being affected primarily by ongoing oil and gas activity.

4.2.3 Mitigation

4.2.3.1 Geology

No mitigation is proposed for geology or geologic hazards.

4.2.3.2 Soils

The following mitigation measure would be used to minimize potential impacts to soil resources as a result of project implementation.

S1 - If construction occurred during saturated soil conditions on BLM public land, vehicle traffic and equipment would be restricted to prevent rutting in excess of approximately 4 inches deep. Vehicle use would be restricted until soil becomes firm.

4.2.4 Cumulative Impacts

4.2.4.1 Geology

There would be no cumulative impacts to geology or from geologic hazards.

4.2.4.2 Soils

The CIAA includes 102,397 acres, of which approximately 2.5 percent (2,582 acres) has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonable foreseeable

future actions. The Proposed Action would add 1,073 acres of surface disturbance to the CIAA area. Disturbance activities are the result of numerous oil and gas projects in the CIAA including Bitter Creek Shallow Oil and Gas Development, Continental/Wamsutter II Natural Gas Project Divide, Patrick Draw, Copper Ridge Shallow Natural Gas Development, Higgins and Table Rock Oil and Gas Units, Table Rock-to-Brady Gas Pipeline Project, Monell CO_2 Pipeline, and Black Butte Coal Mine.

4.3 Mineral and Paleontological Resources

4.3.1 Proposed Action

4.3.1.1 Mineral Resources

Leasable Minerals

The production of fluid mineral resources (oil and natural gas) would be beneficial to the nation in that a resource that would otherwise be lost would be recovered. However, the production of oil and natural gas would be an irretrievable commitment of resources. The Proposed Action would not interfere with the development and extraction of other mineral resources. The coal seams that have been mined at Black Butte Coal Mine are too deep to be surface mined. The Proposed Action is located east of the Known Coal Recoverable Coal Resource Area (BLM 1996). Coal bed methane may be prospective within the Monell Unit, but potential future development of coal bed methane resources would not be precluded by tertiary recovery activities.

Other Mineral Resources

There would be no impacts to locatable and saleable minerals.

4.3.1.2 Paleontological Resources

Direct impacts could occur to paleontological resources, if surface disturbance associated with the Proposed Action results in exposure and destruction of important fossil resources, along with associated loss of geologic information. Potential indirect impacts could result from increased accessibility to fossil localities from improved access. Early Tertiary (Eocene) age sedimentary deposits represented by the Wasatch and Fort Union formations underlie the project area. Both of these formations have produced vertebrate fossils of scientific significance either directly in the project area or surrounding area.

In accordance with BLM's standard stipulations for surface-disturbing actions in formations with a high potential for paleontological resources, highly sensitive areas would be monitored during construction by a qualified paleontologist with a permit issued by the Wyoming State Office of the BLM. Should fossil materials of known or suspected scientific significance be encountered during excavation on the access roads, drill pads, or associated mud pits, the operator would stop work immediately in the vicinity of the discovery and the BLM Authorized Officer would be contacted. Activities would be redirected until the BLM Authorized Officer can assess the situation and advise on mitigation measure requirements before surface disturbing operations can continue. Construction personnel would be advised that removal and/or destruction of vertebrate fossils is illegal and that they and their company could face charges if they knowingly destroy or remove these fossils.

4.3.2 No Action

4.3.2.1 Mineral Resources

Under the No Action, hydrocarbons would continue to be produced in the tertiary recovery unit from existing production and injection wells and future wells that would be drilled on private or state minerals. However, the No Action would result in reduced recovery of the resource and monetary losses to the applicant, royalty owners (primarily the federal government), the local economy, and tax revenues to governmental entities. In addition, the No Action would not be protective of the federal government's correlative rights. If development does not occur on federal leases, it is possible that resources could be drained from beneath federal lands resulting in loss of resource and royalties to the U.S.

The No Action would have no impact on locatable mineral and saleable mineral resources.

4.3.2.2 Paleontological Resources

Under the No Action Alternative, impacts to paleontological resources from well field development would not occur. Continued erosional effects and collecting would continue at a rate similar to what is currently taking place in the area. Paleontological data that would have been obtained from mitigation of deposits that may have been impacted under the Proposed Action would not be collected.

4.3.3 Mitigation

4.3.3.1 Mineral Resources

No mitigation is proposed for mineral resources.

4.3.3.2 Paleontological Resources

Additional mitigation for paleontology would include the following measures:

PR1 – A paleontological survey will be conducted on public lands by a BLM-approved paleontologist in portions of the project area that contain exposed Wasatch and Fort Union formations.

PR2 – If paleontological resources are present within the project area, additional mitigation would occur such as construction monitoring and recovery. The completed survey and recommended mitigation would be submitted to the BLM for review prior to construction. Appropriate recommended mitigation when encountering bedrock will require a qualified paleontologist to be on-site along with spot-checks of spoil piles and trench sides. This requirement would only apply to public land portions of the project area.

4.3.4 Cumulative Impacts

4.3.4.1 Mineral Resources

Oil and gas production in the CIAA began in 1946 with the discovery of Table Rock Field (**Table 3.3-1**). Patrick Draw, discovered in 1959, is largely composed of the Arch and Monell Units. Since 1946, the CIAA has cumulatively produced over 100 million barrels of oil and 1.9 trillion cubic feet of gas. It is estimated that tertiary recovery in the Monell Unit would provide an additional 28 million barrels of oil and an undetermined amount of natural gas (Anadarko Petroleum Corporation 2005) or almost 30 percent of the cumulative oil production to date. The oil and gas development to date in the CIAA has resulted in the drilling of approximately 844 production and service wells (including previous EOR developments in the Monell Unit), of which 441 have been plugged and abandoned and the well locations and associated facilities presumably reclaimed (WOGCC 2005). The remaining 403 wells, whether dormant or active, represent a long-term disturbance of approximately 806 acres, based on LOP assumptions used for the Proposed Action (approximately 2 acres per well including pads, roads, and facilities). The cumulative effect of the Proposed Action LOP disturbance of approximately 260 acres is about one-third of the assumed existing long-term disturbance. The 79 wells already completed for the

Monell EOR Project represent about 158 acres of disturbance resulting in a total disturbance for the project of approximately 418 acres.

Additional future oil and gas projects in the CIAA are difficult to predict. The Copper Ridge and North Copper Ridge Units are dormant and it is not certain whether these exploratory coal bed methane projects would proceed into full development (Davis 2005). A total of 11 wells have been drilled and no Plan of Developments have been submitted for other coal bed development in the area (WOGCC 2005). The recently approved Bitter Creek Project could result in as many as 61 exploratory wells, many of which would be drilled in the CIAA. These wells could be regarded as RFD, although drilling success would determine the actual number of wells that would get drilled. Also in the RFD category, there is ongoing development drilling at other nearby fields in the CIAA. Based on current approved APDs, there may be as many as 10 development wells per year in other fields in the CIAA (WOGCC 2005).

The number of wildcat exploration wells would be speculative, but it would not be unreasonable that as many as five wells a year could be drilled in the CIAA, either as new field wildcats or deeper- or shallower-pool wildcats. The southeastern portion the CIAA (all of T17N, R98W, and the east half of T17N, R99W) is located in the Wamsutter Field, a recently approved development that may involve the drilling of hundreds of infill wells. At present, it is not known how many wells would get drilled in that portion of the Wamsutter Field that is within the CIAA because the more favorable development locations may be located further east. Another speculative oil and gas development potential in the CIAA would be tertiary recovery for the Arch Unit directly north of the Monell Unit in the Patrick Draw Field. The Arch Unit contains the same reservoir as the Monell Unit (Almond UA-5) and may also provide an opportunity for CO_2 flooding (Anadarko Petroleum Corporation 2004). It is not known at this time how many new wells would have to be drilled in the Arch Unit to conduct CO_2 flooding, but there could at least 100 or more.

4.3.4.2 Paleontological Resources

No cumulative adverse impacts are expected to occur to potential fossil resources beyond those discussed in Section 4.3.1 as a result of the Proposed Action in combination with existing, proposed, and reasonably foreseeable actions. Implementation of mitigation measures included in the Proposed Action would minimize any additional adverse impacts and would likely add to the knowledge of fossils within the project area.

4.4 Water Resources

4.4.1 Proposed Action

Potential water quality impacts to the Bitter Creek watershed would include increased salinity and erosion as a result of temporary surface disturbance. Most of the disturbance would occur in upland areas that are located considerable distances from the mainstem portion of Bitter Creek and its tributaries. Activities such as well development and construction of injector lines would occur near the Bitter Creek drainage. A directional bored crossing of Bitter Creek would occur at one location. A relatively small work area (approximately 1,600 feet^2) would occur on each side of the stream. Automatic shutoff valves would be used at the Bitter Creek fluid pipeline crossings to minimize spills or leaks. Erosion on the disturbed areas would increase above existing background conditions until reclamation is completed. No permanent structures would be placed in the Bitter Creek or Patrick Draw floodplains. Potential erosion and sediment input to Bitter Creek would be minimized through the implementation of applicant-committed measures, APD conditions, and BMPs involving erosion control procedures contained in the SWPPP.

Potential leaks or spills from construction equipment or chemical use during drilling and completion operations also could potentially affect water quality if contaminants entered the Bitter Creek drainage. However, periodic inspections of construction equipment for leaks would minimize fuel spill risks on water resources. Storage and containment requirements for chemicals at the well pad sites would minimize risks for contaminants entering surface water drainages. In addition, a SPCC Plan would be implemented to minimize or prevent contaminants to reach the Bitter Creek drainage.

Upon abandonment of the proposed project, all surface facilities would be removed, and the resulting disturbed ground would be reclaimed. Vegetation would be restored in the areas disturbed by abandonment activities to minimize any long-term sedimentation effects. The pipe would be abandoned in place.

Potential impacts to groundwater resources from the Proposed Action would include water consumptive use. Approximately 56.84 to 81.20 acre-feet would be obtained from existing wells in the area for drilling, completion, testing, and production operations. An additional 0.26 acre-feet per year would be used for dust control during drilling. No new water rights would be required. Water withdrawals would come from relatively deep aquifers (3,580 to 4,040 feet) in the Almond Formation. This formation is not connected to surface flows in Bitter Creek or other perennial streams in the area because of the capping by the Lewis Shale, which effectively isolates the water in the Almond from other overlying aquifers in the Fort Union Formation (see **Figure 3.2-1**).

No groundwater would be discharged into surface water drainages or allowed to flow out onto the surface around the drill pads.

During development of the oil wells, water and fluids used for drilling and completion operations would be stored in reserve pits at each well location. All pits would be lined to ensure that none of these fluids would enter groundwater. Other impact issues for groundwater quality include potential contamination cross-bore mixing through the well bore. Groundwater quality effects would be minimized by implementing drilling, casing, and cementing procedures in accordance with Onshore Oil and Gas Order No. 2. These measures would ensure that fracturing fluids would flow back to the wellbore and surface rather than entering aquifers.

4.4.2 No Action

Under the No Action Alternative, additional oil recovery at new wells would not occur. Therefore, no temporary localized sediment would occur in Bitter Creek and other intermittent drainages.

4.4.3 Mitigation

Potential impacts to surface water would be mitigated by the following measures. No mitigation is proposed for groundwater resources.

WR1: Potential water quality and channel alteration impacts to streams would be avoided by implementing a 500-foot buffer distance from the edge of wetland/riparian areas and 100 feet from the edge of inner gorges of intermittent and large ephemeral drainages. Surface disturbance could be allowed within these buffers with adequate measures to ensure that no runoff from disturbed areas entered the drainages or wetland/riparian areas were not affected. Additional mitigation measures would be determined during the APD onsite process.

WR2: Fuel or other chemicals would not be stored within 500 feet of Bitter Creek or other riparian areas and 100 feet from the edge of the inner gorge of intermittent or large ephemeral drainages. Exceptions would be considered on a case-by-case basis.

4.4.4 Cumulative Impacts

Water resources within the CIAA have and could continue to be affected by surface disturbance activities as a result of surface coal mining, oil and gas development, livestock grazing, and recreational use. The Proposed Action would result in temporary disturbance of approximately 1,073 acres and a permanent disturbance (after reclamation) of 260 acres. Most of this disturbance would occur in upland areas outside of the Bitter Creek floodplain (e.g., 116 of the

126 proposed wells would be greater than 1 mile from the Bitter Creek channel). The additional surface disturbance from the proposed Monell EOR Project, which is considered to be a relatively low magnitude, would combine with other past and present actions within the CIAA. Cumulative actions that are located within several miles of the Bitter Creek drainage include the Black Butte Coal Mine, Table Rock-to-Brady Gas Pipeline, Continental Divide Oil and Gas Development, and the Bitter Creek Oil and Gas Development. The estimated total disturbance from the cumulative actions that overlap the four watersheds is approximately 2,582 acres. It should be clarified that the surface disturbance in the Bitter Creek watershed has not occurred at the same time. By implementing erosion control measures on these actions, sediment and salinity input to Bitter Creek and its tributaries have been minimized. Reclamation activities also would stabilize soil and reestablish vegetation to predevelopment conditions. RFD actions such as development of the Arch Unit would not contribute additional sediment or salinity to Bitter Creek.

The proposed Monell EOR Project also would use approximately 56.84 to 81.20 acre-feet of groundwater from relatively deep aquifers in the Almond Formation for drilling, completion, testing, and production operations (see Section 3.4.2). This groundwater withdrawal would combine with other cumulative actions within the CIAA. None of groundwater withdrawals are derived from sources that are connected to surface flows in Bitter Creek or downstream resources such as the Green River.

4.5 Vegetation, Wetlands, Agriculture, and Range Resources

4.5.1 Proposed Action

4.5.1.1 Vegetation and Wetlands

Potential impacts to native vegetative communities would include direct disturbance, reduction or removal of vegetation, soil compaction, and increased soil erosion. Crytogamic soil crusts also could be disturbed, which could reduce soil stability, seedbed generation, and nutrient availability in scattered areas throughout the Monell Unit.

The Proposed Action would result in the removal of 1,073 acres of vegetation during construction activities. **Table 4.5-1** provides estimates of permanent and temporary disturbance for each vegetation type. Approximately 813 acres of vegetation would be temporarily disturbed. These areas would be reclaimed and would provide forage for livestock and wildlife grazing and wildlife habitat within 3 to 5 years following successful reclamation. However, it would likely require 20 to 30 years for vegetation communities, especially shrub communities, to return to pre-disturbance levels. The remaining 260 acres of vegetation (i.e., permanent disturbance) would be unavailable

for livestock or wildlife use for 20 to 25 years, at which time production operations would end and all remaining disturbance would be reclaimed and re-vegetated.

Based on GAP vegetation data, approximately 39.8 acres of wetland/riparian vegetation occurs within the Proposed Action area. However, site-specific field analysis indicated that the GAP results overestimated the amount of wetland/riparian vegetation. The majority of the areas identified as wetland/riparian in the GAP analysis is greasewood/saltgrass vegetation located within Patrick Draw (intermittent/ephemeral). In general, wells are not proposed for the Bitter Creek drainage. In addition, no disturbance would occur in wetland/riparian areas because of boring Bitter Creek and implementation of mitigation measure WR1, which restricts development within 500 feet of wetland/riparian areas.

Table 4.5-1
Summary of Affected Vegetation Types within the Proposed Action Area[1]

Vegetation Type	Permanent Disturbance (acres)	Temporary Disturbance (acres)	Total Disturbance (acres)
Sagebrush Shrubland	66.5	207.3	273.8
Salt Desert Shrubland/Greasewood	95.2	299.4	394.6
Mixed-Grass Prairie	26.2	81.6	107.8
Foothills Grassland	29.5	92.1	121.6
Riparian/Wetland[2]	0[2]	0[2]	0[2]
Urban/Developed	0.6	1.9	2.5
Barren	42.0	130.7	172.7
Total	260.0[3]	813.0[3]	1,073.0[3]

[1]Disturbance acreages were based on GAP vegetation data at proposed well locations. Since locations of 25 wells, roads, and other ROWs are not known, it was assumed the vegetation at known well sites would be representative of project disturbance areas.
[2]Implementation of mitigation measure WR1 would avoid wetland/riparian areas.
[3]Total disturbance acreages are approximate due to rounding.

Although GAP vegetation data were used to estimate impacts to wetland/riparian vegetation, potential impacts to jurisdictional wetlands and other waters of the U.S. within the project area can only be determined through the completion of a formal delineation of these areas prior to construction and subsequent determination by the USACE. The Proposed Action would result in short- and long-term impacts to wetlands and other waters of the U.S. Areas associated with temporary disturbance would be reclaimed and would provide forage for livestock and wildlife grazing and wildlife habitat within 3 to 5 years following successful reclamation. However, it would likely require 20 to 30 years for vegetation communities, especially shrub communities, to return to pre-disturbance levels. Areas associated with permanent disturbance would be unavailable for livestock or big game use for 20 to 25 years, at which time production operations would end and all remaining disturbance would be reclaimed and re-vegetated. Potential disturbance sites would be evaluated during the APD process and facilities would be relocated to avoid potential adverse

impacts. Coordination with the USACE would be conducted prior to construction to obtain proper authorization where avoidance would not be practicable.

4.5.1.2 Noxious Weeds

The Proposed Action would result in the removal of 1,073 acres of vegetation (including noxious and invasive weed species) during construction activities. Surface disturbance would create opportunities for the establishment of invasive and noxious weed species, such as perennial pepperweed, hoary cress, Canada thistle, Russian thistle, Russian knapweed, halogeton, cheatgrass, kochia, and dalmatian toadflax. Invasive and noxious weed species are easily established and commonly found on all newly disturbed and reclaimed sites throughout Wyoming. These species are fast growing, and could displace native species, increase the dangers of wildfires, and prevent the establishment of native grass, forb, and shrub species. Assuming permanent vegetation (i.e., those species that were intentionally seeded) eventually becomes established, invasive and noxious weed species can act to reduce soil erosion by stabilizing the soil, providing a soil microclimate which can reduce soil temperatures, lower wind speeds, collect snow fall, and reduce soil evaporation until such time as desirable plant species become established. However, the establishment of some invasive and noxious weed species (e.g., Russian thistle, Russian knapweed, and cheatgrass) can result in long-term reclamation problems. Cultural (i.e., mechanical or grazing methods) and chemical controls are generally required to eliminate or control these species.

To minimize potential impacts to noxious and invasive plant species, the project's Noxious Weed Management Plan would be implemented to prevent the spread of noxious weeds both during and following construction activities. These measures would include special handling of vegetation and soils stripped from the identified weed infestations, cleaning of equipment to prevent the transport of noxious weed seeds and propagules to other locations in the project area, the use of weed-free mulch and weed-free straw bales to control erosion, and follow-up monitoring and treatment methods that would be implemented following construction.

4.5.1.3 Range Resources

Temporary disturbance to rangeland vegetation would occur as a result of construction activities. Removal of rangeland vegetation within the proposed disturbance areas would result in the temporary loss of forage production on BLM-administered, state, and private land. The Proposed Action would result in the temporary loss of 65 AUM's during construction activities. An additional 21 AUM's would be unavailable for livestock or wildlife use for 20 to 25 years, at which time production operations would end and all remaining disturbance would be reclaimed and re-vegetated. Reductions in stocking rates would occur in the Rock Springs Allotment as a result

of project construction or operation. Forage production could take several years to return to pre-construction levels in areas with poor soils (e.g., rocky, shallow, saline, or alkaline). Long-term impacts to rangeland or livestock grazing operations are anticipated to be minimal as a result of project construction or operation activities. Construction could result in a loss of range improvements such as fences, gates, and cattle guards located within disturbance or access routes. Increased traffic during construction also could result in collisions with livestock.

4.5.1.4 Threatened, Endangered, Candidate, and Sensitive Plant Species

The impact analysis for sensitive plant species focused on those resources identified by the BLM, USFWS, and WNDD as potentially occurring in the project area (see Section 3.5.4). Two species, the Ute ladies'-tresses orchid and Nelson's milkvetch, were identified as having potential habitat in the area.

Ute Ladies'-tresses Orchid (Federally Threatened Species)

Ute ladies'-tresses orchid occurs in wet meadows and along moist streambanks. Potential habitat for this species was evaluated along Bitter Creek, the only perennial water source that occurs within the project area. During the August 2005 habitat survey in the project area, no suitable habitat was identified due to substantial sediment deposits, significant scouring of the stream channel, and moderately dense vegetation. As a result, it is unlikely that populations of Ute ladies'-tresses orchid would occur within the project area.

Determination

Effect to Critical Habitat. No critical habitat has been designated for this species in the project area.

Effect to the Species. The BLM has determined that the Proposed Action would result in a "no effect" determination for the Ute ladies'-tresses orchid. This determination is based on the implementation of mitigation measure WR1, which would restrict development within 500 feet from the edge of wetland/riparian areas and 100 feet from the inner gorges of intermittent and large ephemeral channels.

Nelson's Milkvetch (BLM Sensitive)

The Nelson's milkvetch is closely associated with alkaline clay flats, shale bluffs and gullies, and pebbly slopes. These habitat types were identified within the Proposed Action area during the August 2005 habitat surveys. Construction and operation of the Proposed Action could result in

the loss of individuals, if populations are located within previously undisturbed portions of the project area. Indirect impacts could result on adjacent populations from erosion associated with construction and operation.

Site-specific mitigation for the Nelson's milkvetch, if required, would be addressed during the APD process. Where warranted and directed by the BLM, surveys for the Nelson's milkvetch would be conducted using standard survey techniques and mitigation measures would be implemented to minimize potential impacts.

Effect on the Species. The BLM has determined that the Proposed Action may impact individual milkvetch, but is not likely to cause a trend to federal listing or loss of viability. This determination is based on the amount of suitable habitat that could be affected in relation to suitable habitat in the general region.

4.5.2 No Action

Under the No Action Alternative, the BLM would deny the Proposed Action and no additional disturbance/development beyond that which has already been authorized by the BLM would occur. Impacts to vegetation, wetland/riparian areas, and noxious and invasive weeds would continue to occur at current rates. No impacts beyond natural processes would occur for range resources and threatened, endangered, candidate, and sensitive plant species under the No Action Alternative (e.g., continued erosion, vegetation loss due to grazing, etc.).

4.5.3 Mitigation

The following mitigation measures are recommended to minimize or prevent adverse impacts to vegetation, wetland/riparian areas, noxious and invasive weeds, and range resources as a result of project implementation. Mitigation measures WR1 and WR2, as described in Section 4.4.3, Water Resources, also would eliminate potential impacts to wetland/riparian areas in Bitter Creek and intermittent/ephemeral drainages. Mitigation involving possible surveys in suitable habitat for Nelson's milkvetch would be determined as described in Sensitive Species Measure SS1 (Section 4.6.2.2). After implementing project-committed protection measures, no additional mitigation would be required for threatened, endangered, candidate, or sensitive plant species.

4.5.3.1 Vegetation and Wetlands

V1 – Off-road driving would be restricted to the ROW corridors, well pads, and approved temporary access roads. Signs would be used to identify approved and restricted (i.e., no access allowed) roads.

V2 – Revegetation procedures using native seed mixes would be developed in coordination with BLM for site-specific conditions regarding climate, soils, and vegetation to maximize reclamation success. Reclamation procedures (e.g., recontouring, topsoil distribution, seedbed preparation, seed mix application, and follow up monitoring) that would be followed to return the land to pre-existing vegetative cover and land uses would be described in APDs.

V3 – Fire prevention and suppression techniques that would be implemented to reduce the potential for a construction-related fire, which could potentially impact vegetation, and wildlife.

V4 – Application of herbicides or pesticides would follow these restrictions: boom and hand gun sprayers would not be used within 25 feet of surface water; broadcast backpack spraying would not occur within 10 horizontal feet of water; only wipe applications (or hand-directed spray using a backpack sprayer) would be allowed within 10 horizontal feet of surface water; and herbicides would not be mixed in an area where an accidental spill could enter a water body. Fertilizers, lime, or mulch would not be used in wetlands unless required by agencies. The use of pesticides would comply with the applicable Federal and state laws. Pesticides would be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides, the holder would obtain written approval of a plan from the authorized officer showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of storage and disposal of containers, and any other information deemed necessary by the authorized officer. Emergency use of pesticides would be approved in writing by the authorized officer prior to such use.

4.5.3.2 Noxious Weeds

NW1 – Invasive/noxious weed control measures would adhere to standards identified in the Decision Record for the Rock Springs District Noxious Weed Control EA or applicable updated guidance. Cooperate with the local weed district to identify appropriate methods of control if necessary. If treatment of invasive/noxious weeds is deemed necessary, a Pesticide Use Proposal (PUP) would be submitted to the BLM for approval. Pesticide applicators must be certified with an up-to-date Pesticide Applicator's License before permitting spraying work. The Pesticide Application Records would be submitted to the BLM each year. Treatments must comply with all federal and state regulations regarding use of pesticides.

4.5.3.3 Range Resources

R1 – Any range improvements such as fences, gates, and cattle guards located within disturbance areas would be repaired to the satisfaction of the BLM and in accordance with applicable agreements with private landowners.

R2 – Coordination with any potentially affected livestock operators would be conducted to ensure that livestock control structures remain functional during construction and operation.

4.5.4 Cumulative Impacts

4.5.4.1 Vegetation and Wetlands

The CIAA for vegetation includes 102,397 acres, of which approximately 2.5 percent (2,582 acres) of surface area and less than 1 acre of wetland has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonable foreseeable future actions. The Proposed Action would add 1,073 acres of additional surface disturbance to the CIAA area. Disturbance activities are the result of numerous cumulative actions in the CIAA including Bitter Creek Shallow Oil and Gas Development, Continental/Wamsutter II Natural Gas Project Divide, Patrick Draw, Copper Ridge Shallow Natural Gas Development, Higgins and Table Rock Oil and Gas Units, Table Rock-to-Brady Gas Pipeline Project, Monell CO_2 Pipeline, and Black Butte Coal Mine.

4.5.4.2 Noxious Weeds

Cumulative impacts for noxious and invasive weeds would be the same as discussed for vegetation. Surface disturbance activities associated with the Monell EOR would create possible establishment of noxious weeds in combination with other cumulative actions within the CIAA.

4.5.4.3 Range Resources

The CIAA on public land for range resources includes 110,599 AUM's, of which approximately 21 AUM's has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonable foreseeable future actions. The Proposed Action would add 20 AUM's of additional range resource loss, as well as additional indirect effects from increased habitat fragmentation, to the CIAA area. Disturbance activities are the result of numerous oil and gas projects in the CIAA including Bitter Creek Shallow Oil and Gas Development, Continental/Wamsutter II Natural Gas Project Divide, Patrick Draw, Anadarko's Copper Ridge Shallow Natural Gas Development, Table Rock-to-Brady Gas Pipeline Project, Monell CO_2 Pipeline, and Black Butte Coal Mine.

4.5.4.4 Threatened, Endangered, Candidate, and Sensitive Plant Species

Cumulative impacts to threatened, endangered, candidate, or sensitive plant species are not anticipated, since the species would not be affected as a result of the Proposed Action.

4.6 Wildlife

4.6.1 Proposed Action

4.6.1.1 Game and Nongame Wildlife Species

Impacts to wildlife resources from the Proposed Action would include: surface disturbance or alteration of native habitats; increased habitat fragmentation; animal displacement; changes in species composition; increased mortality due to poaching and harassment; and the increased likelihood of animal/vehicle collisions from increased traffic in the area. The severity of these effects on terrestrial wildlife would depend on factors such as the sensitivity of the species, seasonal use patterns, type and timing of project activity, and physical parameters (e.g., topography, cover, forage, and climate).

Assuming a maximum development of 126 wells and associated ancillary facilities (roads, treatment facilities and substation, pipelines, and injection headers), direct impacts would result in the surface disturbance (several years up to 20 years) of approximately 1,073 acres of potential wildlife habitat until successful reclamation is completed and vegetation becomes reestablished.

Big Game Species

Direct impacts to big game species (pronghorn and mule deer) would result in the incremental disturbance of approximately 1,073 acres of habitat and increased habitat fragmentation. However, these incremental losses of vegetation would represent a small percentage (less than 1 percent) of the overall available habitat within the project region. Although the loss of available vegetation would be long term (greater than 20 years), herbaceous species may become established within 3 to 5 years, depending on reclamation success, coupled with future weather conditions and grazing management practices in the project region. In most instances, suitable habitat adjacent to the disturbed areas would be available for these species until grasses and woody vegetation were reestablished within the disturbance areas. No direct impacts to designated big game seasonal ranges would occur from project construction.

Indirect impacts to big game species would include increased habitat fragmentation effects as a result of increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic (see Habitat Fragmentation below). Big game animals would likely decrease their use within 0.5 mile of surface disturbance activities (Ward

1996). Assuming that adjacent habitats are at or near carrying capacity, and given the current drought conditions and human development activities in the project region, displacement of wildlife species (e.g., big game) as a result of the proposed development would likely create some unquantifiable reduction in wildlife populations in the vicinity of the project.

Small Game Species

Direct impacts to small game (small mammals, upland game birds, waterfowl) would result in the incremental disturbance of approximately 1,073 acres of habitat and increased habitat fragmentation. Direct impacts to small game species also could include nest or burrow abandonment or loss of eggs or young. However, it is not likely that the expected losses would have a measurable effect on species populations. Indirect impacts would include increased habitat fragmentation effects as a result of increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic (see Habitat Fragmentation below). Potential effect to greater sage-grouse and pygmy rabbit are discussed further in Section 4.6.2, Special Status Species.

Nongame Species

Direct impacts to nongame species would result in the incremental disturbance of approximately 1,073 acres of habitat and increased habitat fragmentation. Impacts also could result in mortalities of less mobile species (e.g., small mammals, reptiles, amphibians, invertebrates), nest abandonment, and loss of eggs or young as a result of crushing from vehicles and heavy equipment. Development also would result in indirect impacts from habitat fragmentation effects such as increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic (see Habitat Fragmentation below). Assuming that adjacent habitats are at or near carrying capacity, and given the current drought conditions and human development activities in the project region, displacement of wildlife species from the project area would result in an unquantifiable reduction in wildlife populations.

Migratory Birds

In the event that project activities were to occur during the breeding season for migratory bird species within the project area (approximately April 1 through July 31), development activities could result in the abandonment of a nest site or territory or the loss of eggs or young, resulting in the loss of productivity for the breeding season. Loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of the MBTA. Potential impacts to breeding birds from wellfield development activities would be minimized through mitigation measures identified below in Section 4.6.1.3, Mitigation and Monitoring.

The conservation of migratory bird populations is promoted under the MBTA and EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, issued January 10, 2001. Once the BLM Memorandum of Understanding (MOU) with the USFWS has been finalized to implement the EO, any protection measures for migratory birds that are developed for this project would be superceded by the protection measures identified in the final MOU.

As discussed above a number of breeding raptor species could potentially occur within the project area. Potential direct impacts to raptors would result from the surface disturbance of approximately 1,073 acres of potential breeding and foraging habitat. If present in or adjacent to the project area, breeding raptors could abandon breeding territories, nest sites, or lose eggs or young as a result of project development and production activities. As discussed above, loss of an active nest site, incubating adults, eggs, or young would not comply with the intent of the MBTA and potentially could affect populations of important migratory bird species that may occur within the project area. Potential impacts to breeding raptors from wellfield development activities would be minimized through mitigation measures identified below in Section 4.6.1.3, Mitigation and Monitoring.

Development also would result in indirect impacts from habitat fragmentation effects such as increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic (see Habitat Fragmentation below). However, the degree of these potential impacts would depend on a number of variables including the location of the nest site, the species' relative sensitivity, breeding phenology, and possible topographic shielding.

Habitat Fragmentation

Considerable research has been conducted on the effects of habitat fragmentation on wildlife populations caused by a variety of human activities, including oil and gas development. Habitat fragmentation from oil and gas construction and operation has resulted in the direct loss of potential habitat from the development of roads, well pads, pipelines, and electrical power lines. Other fragmentation effects such as increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition from unpaved road traffic would extend beyond the boundaries of wellfield facilities. These effects result in overall changes in habitat quality, habitat loss, increased animal displacement, reductions in local wildlife populations, and changes in species composition. However, the severity of these effects on terrestrial wildlife depend on factors such as sensitivity of the species, seasonal use, type and timing of project activities, and physical parameters (e.g., topography, cover, forage, climate).

4.6.1.2 No Action

Under the No Action Alternative, the BLM would deny the Proposed Action and no additional impacts to wildlife species would occur from wellfield development activities beyond that which has already been authorized by the BLM.

4.6.1.3 Mitigation

The following mitigation measures would minimize or prevent adverse impacts to wildlife from wellfield development activities.

WL1 – Vegetation in the proposed disturbance areas would be removed outside of the breeding season for migratory bird species (April through July) in advance of construction activities in order to avoid impacts to nesting birds. Alternately, prior to surface disturbance activities during the breeding season, a qualified biologist would survey potentially suitable habitat for nesting activity and other evidence of nesting (e.g., mated pairs, territorial defense, birds carrying nest material, transporting food). If active nests are located, or other evidence of nesting is observed, appropriate protection measures, including establishment of buffer areas and constraint periods, would be implemented until the young have fledged and dispersed from the nest area. If no active nests are located, the BLM would consider an exception of this stipulation. These measures would be implemented on a site-specific and species-specific basis, in coordination with the BLM on federal sections.

WL2 – Prior to surface disturbance activities on federal sections (including workover activities) during the raptor breeding season (February 1 to July 10) as applicable, breeding raptor surveys (including burrowing owls [April 1 to June 30]) would be conducted by a qualified biologist through areas of suitable nesting habitat to identify any potentially active nest sites in the project area. If applicable, appropriate protection measures, including seasonal constraints and establishment of buffer areas would be implemented at active nest sites until the young have fledged and have dispersed from the nest area. These measures will be implemented on a site-specific and species-specific basis, in coordination with the BLM on federal sections.

WL3 – Raptor nests identified within the proposed disturbance areas would be avoided to prevent their abandonment.

4.6.1.4 Cumulative Effects

Pronghorn. Approximately 3.3 percent (60,846 acres) of the CIAA has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonably foreseeable projects. Disturbance

activities are the result of the Black Butte Coal Mine, roads, portions of Rock Springs, and approximately 3,640 oil and gas wells in various project areas including Bitter Creek, Patrick Draw, Table Rock to Brady Gas Pipeline Project, Continental Divide/Wamsutter II, Creston-Blue Gap, South Baggs, Vermillion Basin, Copper Ridge, Pacific Rim, Atlantic Rim, Desolation Flats, Mulligan Draw, and Dripping Rock.

The Proposed Action would add approximately 1,073 acres of surface disturbance as well as additional indirect effects from increased habitat fragmentation (e.g., increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition) within the herd unit area. However, as discussed above, no crucial habitat would be disturbed from the Proposed Action.

Mule Deer. Within the South Rock Springs Herd Unit, approximately 3.5 percent (52,165 acres) of the CIAA has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonably foreseeable projects. Disturbance activities are the result of the Black Butte Coal Mine, roads, portions of Rock Springs and Green River, and approximately 3,701 oil and gas wells in various project areas including Bitter Creek, Patrick Draw, Continental Divide/Wamsutter II, Vermillion Basin, Copper Ridge, and Pacific Rim. Within the Baggs Herd Unit, approximately 3 percent (24,658 acres) of the CIAA has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonably foreseeable projects. Disturbance activities are the result of approximately 200 oil and gas wells from the Higgins and Table Rock project areas and the additional disturbance of approximately 22,400 acres of habitat for the development of the Continental Divide/Wamsutter II area.

The Proposed Action would add approximately 1,073 acres (225 acres within the South Rock Spring Herd Unit and 848 acres within the Baggs Herd Unit) of surface disturbance as well as additional indirect effects from increased habitat fragmentation (e.g., increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition) within the herd unit areas. However, as discussed above, no crucial habitat would be disturbed from the Proposed Action.

Raptors and Other Bird Species. Approximately 3.0 percent (1,176 acres) of the CIAA has been disturbed, has been authorized to be disturbed, or could be disturbed by reasonably foreseeable projects. The 39,198-acre CIAA area for birds (the Monell Unit and a 2-mile buffer area around the Monell Unit) includes 8 known raptor nests located outside of the Proposed Action area and the possibility of multiple burrowing owl nests within the Proposed Action area. In addition, it is anticipated that a number of other shrubland and, to a limited extent, waterfowl and shorebird species breed, forage, and migrate through the CIAA area. Approximately 1,176 acres of habitat for breeding, foraging, and migrating bird species is currently disturbed, is authorized to be

disturbed, or could be expected to be disturbed. The Proposed Action would add 1,073 acres of surface disturbance as well as additional indirect effects from increased habitat fragmentation (e.g., increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition) within the CIAA area.

Other Nongame Species. The potential impacts to other nongame animals (small mammals, amphibians, and reptiles) would be the same as discussed above for birds. Approximately 1,176 acres of habitat within the CIAA area is currently disturbed, is authorized to be disturbed, or could be expected to be disturbed. The Proposed Action would add 1,073 acres of surface disturbance as well as additional indirect effects from increased habitat fragmentation (e.g., increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition) within the CIAA area.

4.6.2 Threatened, Endangered, and Sensitive Species

The impact analysis for sensitive wildlife resources focused on those species that were identified by the BLM, WGFD and WNDD as potentially occurring within the project area (see **Table 3.6-1**).

Black-footed Ferret. A total of 7 active white-tailed prairie dog colonies (approximately 1,910 acres) that meet the USFWS black-footed ferret habitat criteria were identified within known well site areas in the project area during the 2005 prairie dog surveys. If ferrets were present in prairie dog colonies within the project area, direct impacts would include increased habitat fragmentation of prairie dog colonies or complexes within the project area. Impacts also could result in direct mortalities of black-footed ferrets as a result of crushing from surface disturbance, vehicles, and heavy equipment. Indirect impacts to black-footed ferrets would include increased habitat fragmentation effects as a result of increased noise levels and human presence, dispersal of noxious and invasive weed species, and dust effects from unpaved road traffic. Indirect effects also could result in a reduction in habitat quality from the spread of infectious diseases (e.g., plague) within, otherwise, healthy prairie dog colonies complexes. Potential impacts to black-footed ferrets would be minimized through mitigation measures identified below in Section 4.6.2.2, Monitoring and Mitigation.

Determination

Effect to Critical Habitat. No critical habitat has been designated for this species.

Effect to the Species. The BLM has determined that the Proposed Action would result in a “no effect” determination on the black-footed ferret. This determination is based on the low potential

for occurrence by this species within the project area and mitigation measures (i.e., presence/absence surveys) that have been developed for the project.

BLM-Sensitive Species. Potential impacts to BLM-sensitive species would be similar to nongame species discussed above in Section 4.6.1, Recreationally and Economically Important Species and Nongame Wildlife. Direct impacts to BLM sensitive species would result in the incremental disturbance of approximately 1,073 acres of habitat and increased habitat fragmentation. Impacts also could result in mortalities of less mobile species (e.g., small mammals and amphibians), nest abandonment, and loss of eggs or young as a result of crushing from vehicles and equipment. Indirect impacts would include increased noise levels and human presence, dispersal of noxious weeds, and dust effects from unpaved road traffic. Assuming that adjacent habitats are at or near carrying capacity, and given the current drought conditions and human development activities in the project region, displacement of some species from the project area may result in an unquantifiable reduction in wildlife populations.

Potential impacts to sensitive species from wellfield development activities would be minimized through mitigation measures identified below in Section 4.6.2.2, Monitoring and Mitigation. If necessary, additional site-specific mitigation for sensitive species would be developed during the APD process.

As discussed above, approximately 1,946 acres of prairie dog colonies or complexes were identified within the project area during the 2005 prairie surveys. If white-tailed prairie dogs were to occur within proposed surface disturbance areas, impacts to the prairie dog could result in direct mortalities of individuals, as a result of crushing from construction activities, vehicles, and heavy equipment. However, it would not be anticipated that construction activities would permanently alter prairie dog colonies due to prairie dog adaptation to disturbed sites and tolerance to human activity. In fact, some habitat disturbance may encourage future colonization in the short term, based on the availability of soft, permeable soils that would be available from project activities. However, indirect effects could result in the reduction of habitat quality from the spread of infectious diseases (e.g., plague) within, otherwise, healthy prairie dog colonies complexes.

Because no occupied greater sage-grouse leks or suitable sagebrush habitat have been documented within the project area, the Proposed Action would not be expected to have impacts on local greater sage-grouse populations.

Suitable breeding habitat for the Great Basin spadefoot toad along Bitter Creek would not be affected by the project, since there would be no disturbance within 500 feet from Bitter Creek and associated wetland and riparian habitat.

Based on the discussion presented above, the Proposed Action would have negligible impacts to BLM-sensitive species and would not contribute to the need to list any BLM-sensitive species under the provisions of the ESA.

4.6.2.1 No Action

Under the No Action Alternative, the BLM would deny the Proposed Action and no additional impacts to sensitive species would occur from wellfield development activities beyond that which has already been authorized by the BLM.

4.6.2.2 Mitigation

Mitigation measures present above for nongame wildlife that would be applicable for sensitive species would include WL1, WL2, and WL3. Additional mitigation measures that would minimize potential impacts to sensitive species as a result of project activities include:

SS1 – Prior to the initiation of surface disturbance activities on federal sections (including workover and maintenance activities), applicable biological surveys would be conducted through areas of suitable habitat for sensitive species (i.e., federally listed species and BLM-sensitive species) during the appropriate season, as determined by the BLM. Additional mitigation measures would be determined during the APD onsite process.

SS2 – Prior to the initiation of surface disturbance activities on federal sections (including workover and maintenance activities), black-footed ferret clearance surveys would be conducted in active white-tailed prairie dog colonies, and active black-tailed prairie dog colonies that have a burrow density of eight burrows per acre or greater, and that would be directly disturbed by the Proposed Action. Additional mitigation measures would be determined during the APD onsite process.

SS3 – Prior to surface disturbance activities on federal sections (including workover and maintenance activities) during the mountain plover breeding season (April 10 to July 10), presence/absence surveys would be conducted within potentially suitable habitat (e.g., prairie dog colonies, shortgrass community, bare ground), in accordance with the USFWS 2002 Mountain Plover Survey Guidelines. If applicable, appropriate protection measures, including a 0.25-mile buffer area around the nest site will be implemented until the young have fledged and have dispersed from the nest area on federal sections. Additional mitigation measures would be determined during the APD onsite process.

4.6.2.3 Cumulative Effects

Approximately 2.6 percent (2,208 acres) of habitat within the CIAA area for terrestrial special status species (the Monell Unit and a 4-mile buffer area around the Monell Unit) is currently disturbed, is authorized to be disturbed, or could be expected to be disturbed. Disturbance activities within the CIAA are the result of the Black Butte Coal Mine and oil and gas projects including the Patrick Draw field, Bitter Creek. The Proposed Action would add 1,073 acres of additional surface disturbance as well as additional indirect effects from increased habitat fragmentation (e.g., increased noise, elevated human presence, dispersal of noxious and invasive weed species, and dust deposition) within the CIAA area. However, impacts likely would occur in direct proportion to the amount of their habitat that would be disturbed.

4.6.3 Wild Horses

4.6.3.1 Proposed Action

Direct impacts to wild horse populations could result from the loss of 1,073 acres of habitat due to vegetation removal; displacement of wild horses due to disturbance by project-related activities; and a slight risk of horse/vehicle collisions due to increased traffic. Impacts to vegetation would be limited because disturbance would be spread over a large area rather than a single block. The wild horse population in the Salt Wells WHHMA is currently at the appropriate management level, but there is sufficient and similar habitat for wild horses in areas surrounding the Proposed Action area. Overall, impacts to wild horse population in the Salt Wells WHHMA would be negligible.

4.6.3.2 No Action

Under the No Action Alternative, the BLM would deny the Proposed Action and no additional disturbance/development beyond that which has already been authorized by the BLM would occur. Impacts on wild horse populations would continue at present levels, with fluctuations due primarily to weather, disease, and other natural causes, and to herd reductions implemented by BLM.

4.6.3.3 Mitigation

No additional mitigation or monitoring is recommended for wild horses.

4.6.3.4 Cumulative Impacts

The CIAA for wild horses is the 1,193,283-acre Salt Wells WHHMA, of which approximately 3.8 percent (45,676 acres) has been disturbed, has been authorized to be disturbed, or could be expected to be disturbed. Disturbances include the Black Buttes Coal Mine (approximately 15,000 acres), roads (approximately 8,000), 1,829 oil and gas wells (approximately 9,000 acres), railroads (approximately 1,300 acres), and communities (approximately 2,500 acres). All or portions of the Continental Divide, Patrick Draw, Copper Ridge, Table Rock, Higgins, Pacific Rim, and Vermillion Basin project areas are included in the CIAA. Under the Proposed Action, an additional 260 acres would be disturbed, representing an additional less than 1 percent of the CIAA. Such an increase would create negligible cumulative impacts to wild horses. Cumulative impacts have not prevented the population from exceeding the herd-appropriate management level.

4.7 Aquatic Resources

4.7.1 Proposed Action

Impact issues evaluated for aquatic communities (i.e., fish, invertebrates, and amphibians) and sensitive fish species (flannelmouth sucker) included potential effects of project activities on water quality and quantity and habitat in the Bitter Creek drainage. The occurrence of nongame fish is limited to approximately a 3.3-mile perennial section of Bitter Creek within the project study area. The aquatic stages of amphibians could occur in Bitter Creek and playas or depressions that occasionally contain water. By avoiding construction work in the Bitter Creek channel, there would be no direct disturbance to instream habitat or adjacent riparian areas. Surface disturbance activities associated with construction of new roads and ROWs for underground electric transmission, injector, and fuel lines could result in soil erosion within the Bitter Creek floodplain. Construction activities could cause mortalities to amphibians during their occurrence in terrestrial habitats.

Potential contaminant spills or leaks from well drilling are not expected to affect Bitter Creek. Wells would be located at least 500 feet from the Bitter Creek channel. Storage and containment measures would be used at the well pads to eliminate any chemicals entering the Bitter Creek drainage. In addition, refueling would not be allowed within 500 feet of Bitter Creek. Automatic shutoffs also would be used for the Bitter Creek fluid pipeline crossings to minimize spills or leaks.

Water use for drilling and completion activities would not affect flows in Bitter Creek, since water sources involve existing groundwater wells in the area. As discussed in Sections 3.4.2 and 4.4, Water Resources, water withdrawals would come from relatively deep aquifers, which have no

connectivity to surface flows in Bitter Creek. Therefore, the Proposed Action would not affect habitat for flannelmouth sucker in Bitter Creek or federally endangered fish in the Green River.

Abandonment would involve leaving subsurface facilities such as injector lines and electrical line in place after the project is terminated; therefore, no new surface disturbance would affect aquatic biota and their habitat.

The following regulatory requirements or APD conditions would be used to minimize effects on aquatic communities and their habitat in Bitter Creek.

- Erosion and potential contaminant input to Bitter Creek would be minimized by implementing erosion control measures in the SWPPP.

- Spill or hazardous material input to the Bitter Creek drainage would be minimized by implementing spill and containment measures contained in the SPCC Plan.

- Reclamation of all disturbed areas to minimize sediment input to Bitter Creek.

4.7.2 No Action

Under the No Action Alternative, the Proposed Action would not be implemented and so no additional surface disturbance or development would occur in the project area other than actions already authorized by the BLM. Impacts to aquatic communities in the Bitter Creek drainage would continue at present levels as a result of natural conditions and existing development in the Monell project area.

4.7.3 Mitigation

Mitigation measures WR1 (disturbance buffer to Bitter Creek) and WR2 (restriction of refueling and chemical storage near Bitter Creek) would also be beneficial to protecting aquatic resources in Bitter Creek. No additional mitigation measures are recommended for aquatic resources.

4.7.4 Cumulative Impacts

The CIAA for fish, invertebrates, and amphibians is the 6th level watersheds that drain the Monell EOR project area. The estimated area of these watersheds is approximately 102,395 acres. The Proposed Action would not result in any direct alteration of habitat in Bitter Creek or reduce flows due to groundwater withdrawals. Project construction and operation would result in an initial temporary surface disturbance of 1,073 acres and 260 acres after reclamation is completed. The

Monell EOR Project would add a very small incremental effect on aquatic habitat in the CIAA in terms of sediment input from soil disturbance. Other cumulative actions within the CIAA have and could continue to disturb surface soils within the four 6th level watersheds, as discussed in Section 4.4, Water Resources.

4.8 Land Use and Recreation

Impacts to land use and recreation were analyzed using the following issues:

- Potential conflicts with existing land use designations;
- Potential conflicts with the plans, policies, or regulations established by the jurisdictional agencies;
- Potential permanent displacement of recreational sites; or
- Potential long-term displacement of recreational activities.

4.8.1 Proposed Action

4.8.1.1 Land Use

As a result of the Proposed Action, land ownership would not change. Current land uses would occur at near their current rates with some additional emphasis on oil and gas development which would slightly reduce livestock grazing, wildlife habitat, and recreation. Approximately 1,073 acres of land would be disturbed initially (385 acres federal, 25 acres state, and 663 acres private), decreasing to approximately 260 acres of disturbance for the life of the project (89 acres federal, 6 acres state, and 166 acres private), as disturbed areas are reclaimed. Once oil and gas production operations are completed, reclamation and re-vegetation would return the land to its pre-disturbance uses.

The project-related land uses would be compatible with the RMP and other policies, plans, and regulations for the project area. Therefore, land use impacts would be considered minor.

4.8.1.2 Recreation

Effects on recreation are identified as changes in the availability and quality of recreational opportunities. Availability is measured as a change in visitor days, where possible. Changes in the

quality of the recreational experience are measured in terms of improved or degraded quality and are more subjective.

Potential impacts to the recreational experience in the project area were evaluated from both a direct disturbance effect and from indirect or perceived effects. For example, pipeline construction may not physically affect big game populations; however, the recreational enjoyment of wildlife such as observation and hunting may be temporarily affected by pipeline construction activities, depending on season and location.

Effects to recreational use in the project area are expected to be minimal as construction would occur in limited locations phased over a period of approximately 3 to 6 years. Following construction, noise would return to near pre-construction levels. Displacement of dispersed recreationists would be minimal, since existing recreational use in the area in the project area is relatively low and there are other more attractive areas for dispersed recreation nearby.

Impacts to recreation would be considered minor because: 1) the project would not intersect developed recreational facilities or sites, 2) no long-term displacement of recreation activities would occur due to the short-term nature of the project, 3) measures would be implemented to minimize the visual effects of construction, 4) the checkerboard ownership pattern and controlled nature of the property reduces its use for recreation, and 5) the presence of other more potentially appealing areas in the general vicinity.

4.8.2 No Action

Under the No Action Alternative, the proposed project would not be constructed or operated. Existing land uses and recreation activities would continue without the addition of the construction and operation activities.

4.8.3 Mitigation

No additional monitoring or mitigation is recommended for land uses and recreation.

4.8.4 Cumulative Impacts

Related projects within a 4-mile radius of the proposed project include all or portions of the following projects: Monell Phase I, Table Rock-to-Brady Gas Pipeline, Table Rock and Higgins Oil and Gas Units, Bitter Creek Gas Development, Black Butte Coal Mine, and Continental Divide/Wamsutter. Where only a portion of these projects occur within the 4-mile radius, a proportional amount of surface disturbance is calculated based upon the total project disturbance.

Land use in the 83,358 acre CIAA would continue to include mining, oil and gas development, livestock grazing, wildlife habitat and recreational use. The Proposed Action would add approximately 1,073 acres of temporary surface disturbance to the 2,304 acres of existing and proposed temporary disturbance, and an increase of approximately 260 acres of permanent surface disturbance to the 1,117 acres of existing and proposed permanent disturbance.

4.9 Visual Resources and Noise

4.9.1 Proposed Action

4.9.1.1 Visual Resources

The VRM Class IV and V management designations allow for moderate to major changes in the existing landscape. The predominant characteristic landscape is that of mining, oil and gas development, and transportation. Therefore, the Proposed Action would not attract the attention of the casual observer and would continue the basic aesthetic elements of form, line, color, and texture of landform, vegetation, structures and sky that currently exist in the Monell EOR project area landscape.

The Monell project facilities and ancillary activities would blend with the natural topographic diversity and existing industrial development that occur in the area and would not dominate the view of the casual observer. Impacts to visual resources would be mitigated by minimization of disturbance, prompt reclamation of all short- and long-term disturbances, and utilization of screen techniques. The Monell project area would be visible from public roads, viewers along the Overland Trail would see the railroad, 120-foot-tall drill rings throughout approximately 90 percent of the project area, and the pump jacks and storage tanks throughout approximately 30 percent of the project area.

4.9.1.2 Noise

Noise would be generated by vehicles and equipment during access road and well pad construction, light and heavy traffic along access roads, well drilling operations, and reclamation activities. The noise level for receptors (i.e., wildlife, people using the roads, or local workers) would depend upon the distance to the receptor, screening effects from terrain and vegetation, wind speed, and other localized climate factors. Due to the large distance to residences in the Point of Rocks area (approximately 13 miles from the north boundary of the Proposed Action project area), impacts to residential areas are not an issue.

The federal standard noise effect level for receptors such as big-game and other wildlife is 55 dBA at a distance of 25 feet from the noise source. Temporary low to moderate noise levels would be produced during construction due to traffic and equipment operation. Temporary traffic-related noise also would occur along the access roads. Noise could increase to levels between 40 and 65 dBA. The duration of noise effects would vary depending upon the activity. Truck traffic would produce increased noise for several minutes as vehicles pass a particular point. Drilling and completion noise would continue for about 8 days for each activity. Temporary increased noise levels would result from drilling rigs and other heavy equipment. By using engines with mufflers, drilling and completion operations are predicted to produce noise levels below 55 dBA at approximately 500 feet from the source (BLM 1992). Noise impacts on wildlife are discussed in Section 4.6.

4.9.2 No Action

Under the No Action Alternative, no construction, drilling, or traffic-related noise impacts would occur in the Proposed Action portion of the Monell Unit. Visual and noise impacts would continue to occur within the portion of the Monell Unit with existing wells. New well development could occur on the privately-owned sections within the Monell Unit.

4.9.3 Mitigation

No additional mitigation is recommended for noise. The following mitigation measure would be used to reduce visual impacts of aboveground facilities.

VR1 – All facility structures would use colors to blend in with the surrounding landscape. Paint color should have a flat, non-reflective finish.

4.9.4 Cumulative Impacts

4.9.4.1 Visual Resources

The visual environment within the Monell project area and surrounding region has existing alteration from mining, oil and gas development, roads and railroad corridors, and other forms of disturbance. The Proposed Action would further alter the visual environment, but would correspond to the BLM VRM classifications and related management objectives in the area.

4.9.4.2 Noise

Present and future actions within the CIAA would produce noise as a result of vehicle traffic, equipment use, and facility operations. The Proposed Action would produce relatively low noise levels near roads, well pads, and facilities. When including adjacent cumulative actions within one mile of the Monell Unit boundary, the Proposed Action would add a relatively low noise level to similar activities in the Bitter Creek Oil and Gas Development, Continental Divide/Wamsutter II, and Arch Unit. However, the resulting combined noise effects of these cumulative actions would be considered mostly temporary and localized in terms of their effects on wildlife or human use of the area.

4.10 Socioeconomics

4.10.1 Proposed Action

Impacts to socioeconomic resources were evaluated using the following impact topics:

- Evaluation on whether the total population of the county would increase by 10 percent or more;
- The project-related demand would cause the vacancy rate for temporary housing to fall to less than 5 percent; or
- The estimated demand for public services from the project-related population would exceed the existing capacities of affected public services.

These impact levels were chosen as indicators where the local infrastructure and services may be insufficient to accommodate them.

Population and Communities. Construction of the proposed project would require approximately 153 workers. The total number of workers on site at any given time would be less than this amount. Most of the unskilled labor, approximately 25 percent of the work force, would be hired locally. Skilled laborers would be hired locally or brought in from outside the area, depending on availability. Given that the population of Sweetwater County is approximately 38,000, the local community would be able to supply the estimated number of workers or accommodate new employees moving to the area.

Temporary Housing. The influx of non-local workers would generate increased short-term demand for temporary housing in the Rock Springs area. It is anticipated that non-local workers would

primarily use trailers for temporary housing and would seek spaces in RV parks or campgrounds in the local area. A small percentage would seek hotel/motel room or rental accommodations. Availability of temporary housing at some locations may be limited because of tourist activity during the summer months at the end of the project construction, and competition for temporary accommodations could displace some tourists. This displacement is anticipated to be minimal.

Community Services and Facilities. The influx of workers to area communities would incrementally increase demand for local services such as law enforcement, fire protection, medical services, and school services. However, because of the short duration of the construction period and the limited amount of population increase, it is anticipated that increased demand could be adequately absorbed and accommodated by existing services and no new local expenditures for labor or capital would be required.

Tax Revenues and Public Finance. Construction of the project would increase sales tax revenues for State and county governments for the duration of the construction period. Sales tax revenues would result from the spending of workers' wages and Anadarko's purchases of goods and services in the local and regional economy. For the purposes of estimating tax revenues from employee wages, 20 percent of the total wages (153 workers multiplied by the average annual wage for construction and extraction occupations in southwest Wyoming [$34,881.60] for 3 years) are projected to be spent locally. Sales tax of 1.5 percent on $3,202,131 would result in revenues to Sweetwater County of over $48,000 over the course of 3 years.

In addition, the project would provide increased county property tax revenues over the LOP in the form of ad valorem taxes, severance taxes, federal royalties, and other taxes on facilities and production. Industrial properties assessed by the State are taxed at 11.98 mills on 11.5 percent of their assessed value. Property taxes are a primary source of county and school district revenue, and the contributions from the proposed project would benefit local government operations. Property tax payments would decrease over time as the infrastructure depreciates. For every $1 million worth of pipeline and facilities would result in approximately $1,378 in taxes in the first year, depreciating over time. Based on a total value of new pipeline and facilities of approximately $28 million, the tax revenues would be approximately $36,000 in the first year and gradually depreciating over time. The ad valorem tax rate for Sweetwater County is approximately 6.4 percent, and is applied to the previous year's production. For every $1 million in revenue, approximately $64,000 in revenue would be generated for Sweetwater County. If the average production over 20 years was $5 million annually, approximately $6.4 million in revenue would be generated. Severance taxes on oil production are 6 percent. For every $1 million worth of production would generate $60,000 in severance tax revenue. If the average production over 20 years were $5 million annually, approximately $6 million in revenue would be generated. This

amount would be reduced, if tax breaks for tertiary production or carbon sequestration applied to any or all of the production from the Monell Field.

Abandonment of the pipeline and facilities would decrease the tax base of Sweetwater County to pre-project conditions. At the time of abandonment, tax receipts would be reduced from the pipeline's in-service date to depreciation. Total decreases in tax receipts cannot be quantified at this time.

In summary, impacts from the proposed project on socioeconomic resources would be considered minor for the following reasons: 1) the influx of non-local project-related employees would result in a temporary population increase in surrounding communities of less than 1 percent; and 2) the demand for public services would not exceed existing capacities of affected public services. A beneficial impact of increased tax revenues would result from the operation of the proposed project. Tax revenues would return to pre-project levels at the time of abandonment.

4.10.2 No Action

Under the No Action Alternative, no impacts to socioeconomic resources would occur.

4.10.3 Mitigation

No additional mitigation is recommended for socioeconomic resources, since no significant impacts are anticipated.

4.10.4 Cumulative Impacts

Other oil and gas development within the CIAA would enhance the economic viability of Sweetwater County and the State of Wyoming, but could create rapid population growth and an increase in demand for housing. The Proposed Action would be yet another source of tax revenue for local and state governments, as well as the federal government.

Increases in mineral extraction activities over a short period of time can cause noticeable increase in housing demand, employment and income, which can lead to changes in population trends that could potentially have detrimental effects on community services, social structures and lifestyles. For example, the additional population gained through employment in the oil and gas sector could exacerbate law enforcement problems (e.g., methamphetamine use and trafficking), although a proven link has not been established in this area. Boom and bust cycles of oil and gas development can lead to short term pressures on existing social and physical infrastructure which can lead to building more infrastructure that may no longer be necessary during bust cycles and

can create a drain on local revenues when the population and incomes decline during a bust cycle. Given the relatively small amount of employment and infrastructure required by this project, the Monell project is not expected to add significantly to the need for new infrastructure but it would generate revenue that could improve local infrastructure.

The Monell EOR Project would contribute a relatively small amount to the cumulative impacts to socioeconomics in Sweetwater County, but its effect would be to generate more funds that would be available to improve the local physical and social infrastructure.

4.11 Environmental Justice

4.11.1 Proposed Action

As required by EO 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," the proposed Monell EOR Project was evaluated for any disproportionately high and adverse human health or environmental effects on minority communities and low-income communities within the context of NEPA. No minority or low-income communities would be encountered by the project.

4.11.2 No Action

Under the No Action Alternative, no impacts to minority or low-income communities would occur.

4.11.3 Mitigation

No additional mitigation would be required for minority or low-income communities.

4.11.4 Cumulative Impacts

There would be no cumulative impacts to minority or low-income communities.

4.12 Transportation

4.12.1 Proposed Action

Impacts to transportation resources were evaluated to determine potential conflicts with existing access to public and private lands crossed by the construction ROW and if new daily vehicle trips would diminish the level of service (LOS) of affected roads substantially. Access would be

maintained during project development; however, construction could cause short-term traffic delays at crossings of federal, state, county, and other rural roads.

Given that local roads currently have an LOS "A," it is not anticipated that approximately 40 more daily round trips with an additional 25 trips per well site (for bringing drilling-related equipment to well sites) would significantly impact traffic in the short term.

In summary, impacts from the proposed project on transportation would be minor because public and private road access would be maintained.

4.12.2 No Action

Under the No Action Alternative, no impacts to transportation would occur.

4.12.3 Mitigation

The following mitigation measure is proposed for public roads on BLM public land located within the Proposed Action area.

TR1 – Construction may be prohibited during periods when soil material is saturated, when vehicle traffic could cause rutting or compaction.

4.12.4 Cumulative Impacts

Related projects within a 4-mile radius of the proposed project include all or portions of the following projects: Monell Existing Oil and Gas Development, Table Rock-to-Brady Gas Pipeline, Bitter Creek Gas Development, Black Butte Coal Mine, and Continental Divide/Wamsutter. The projects in the CIAA and the Monell Project have relatively low numbers of daily trips and are not expected to affect local access and transportation significantly.

4.13 Cultural Resources/Native American Consultation

4.13.1 Proposed Action

4.13.1.1 Cultural Resources

During the Class III inventory of the Proposed Action study areas, 72 archaeological sites and 54 isolated finds were identified. Twenty-four (24) of the 72 sites and all of the isolated finds are recommended as not eligible for the NRHP. No further work is recommended for these cultural

resources. Four of the sites are recommended as eligible for the NRHP; avoidance is recommended for these sites. The remaining 44 sites are unevaluated. WAS will evaluate the sites for NRHP-eligibility if the 44 sites are situated in residual/colluvial deposits that can be evaluated with one or two shovel probes. However, if the sites are located in aeolian deposits or require more than minimal testing, the sites will remain unevaluated until Anadarko determines the location of the wells.

Development of Proposed Action could affect NRHP-eligible cultural resources, if they are present in proposed areas of disturbance. Direct impacts to NRHP-eligible cultural resources include, but are not limited to: physical destruction or damage to all or part of the site; alteration of a site, including restoration, rehabilitation, repair, maintenance, or stabilization; removal of the site from its prehistoric/historic location; change of the character of the site's use or physical features within the site's setting that contribute to its historic significance; and introduction of visual, atmospheric or audible elements that diminish the integrity of the site's prehistoric/historic features. Anadarko intends to avoid these resources to prevent direct impacts to NRHP-eligible sites. If avoidance is not feasible, impacts to NRHP-eligible sites would be mitigated by SHPO- and BLM-approved data recovery techniques. Data recovery on cultural sites could include surface collection, partial or complete excavation, surface mapping, artifact and feature analysis, architectural documentation, archival research, or some combination thereof. Construction monitoring also may be required in some cases. As a result of data recovery procedures implemented to mitigate adverse effects to NRHP eligible sites, beneficial information would be contributed to existing regional archaeological databases. Data recovery also would prevent loss of the information through unauthorized collecting and vandalism.

Increases in both surface activities and number of workers during construction could increase the potential for indirect impacts at archaeological sites. Studies indicate that human activities and increased access could result in both advertent and inadvertent harmful effects to these fragile resources. Indirect impacts are difficult to quantify and control, but they can include loss of surface artifacts due to illegal collecting and inadvertent destruction.

The southern portion of the Monell Unit boundary project area is located approximately 2.4 miles from the Overland Trail; therefore, no direct physical impacts to the Trail would occur. However, the project area is within the viewshed of the Trail and the proposed well field development could potentially create visual impacts to the setting of the Trail. At this time, the full extent of well field development has not been determined; therefore, impacts to the setting of the Trail are not known. In some portions of the project area, the setting of the Trail has been compromised by existing development (e.g., the Black Butte Coal Mine and Union Pacific Railroad) and by intensive modern well field development in the immediate area. Additionally, portions of the project area are shielded by topography; thus, development in these areas would not impact the

setting of the Trail. Based on these varying circumstances within the project area, WAS recommends that any proposed construction activity within the project area be analyzed on a case-by-case basis when determining potential visual impacts to the Overland Trail (Gardner 2005).

4.13.1.2 Native American Consultation

If necessary, Native American consultation would be initiated with those tribes that have been recognized as having a potential past or present affiliation with the project area. Letters would be sent to the identified tribal groups and, if requested by the tribes, meetings with tribal representatives would be conducted to identify places of traditional cultural importance to the tribes. The consultation process would be open to any tribe that expresses a desire for participation when a site of traditional cultural importance may be affected by the proposed oil field development.

Sites of traditional cultural importance to the tribes identified within the project area would receive the appropriate level of protection or recovery by implementing mitigation measures, treatment plans, or compliance actions (e.g., protection of burial sites). If a burial site were encountered during construction activities, work would cease immediately, and the appropriate jurisdictional agency would be notified. If the burial is identified as Native American, the find would be handled according to the provisions of the Native American Graves Protection and Repatriation Act. Surface-disturbing activities would not resume until a Notice to Proceed is issued by the BLM.

4.13.2 No Action

Under the No Action Alternative, the Proposed Action portions of the Monell Unit would not be developed and no additional disturbances/development beyond that which already has been approved by the BLM would occur. There would be no additional impacts to cultural resources.

4.13.3 Mitigation

Additional mitigation for cultural resources would include the following steps:

CR1 – Prior to project construction, Class III cultural resource inventories will be conducted on all previously uninventoried federal lands in proposed disturbance areas and all sites potentially eligible or eligible for the NRHP would be identified. All potentially eligible or eligible sites would be avoided by construction activities. If avoidance is not feasible, data recovery or other mitigation would be implemented as deemed appropriate by the BLM in consultation with the Wyoming SHPO.

CR2 – If previously undiscovered cultural resources are encountered during construction activities, work would be halted within 100 feet of the find, and the find would be reported to the BLM Authorized Officer. Treatment of any discovered cultural material would be conducted based on direction by the BLM.

CR3 – Anadarko-appointed onsite supervisory personnel would be educated about the sensitive nature of cultural resources and the steps to be taken if buried cultural material would be encountered during construction. Workers would be informed that destruction, collection, or excavation of cultural resources from federal land is illegal and they and their company could face charges if they knowingly destroy or remove cultural resources.

CR4 – If human remains are discovered during construction activities, work would be immediately halted within 100 feet of the discovery, and the discovery would be reported to the BLM Authorized Officer. Treatment of any human remains would be conducted based on direction from the BLM.

4.13.4 Cumulative Impacts

The cumulative impacts assessment area (CIAA) for cultural resources includes the Proposed Action portion of the Monell Unit plus an area that extends 5 miles beyond the project boundary. Numerous Class III cultural resources inventories have been conducted in the CIAA and various prehistoric and historic sites have been identified. The majority of prehistoric sites are open camps, lithic scatters, or quarries. Historic sites include, but are not limited to, debris scatters associated with ranching or stock herding activities, roads, ditches, trails, and trash scatters related to historic habitation and utilization of the area. Disturbance that has or would occur on federal lands is subject to laws and regulations that protect cultural resources, especially those eligible for the NRHP. However, much of the CIAA is in checkerboard ownership and some cultural resources on private surface may be disturbed or destroyed.

Class III inventories would be completed for any future proposed development on federal lands, thereby decreasing potential impacts on cultural resources. By avoiding known archaeological and historical sites during ground-disturbing activities associated with proposed development, the potential for incremental increases in cumulative impacts would be avoided. However, some additional vandalism could occur as a result of increased access. Completion of cultural resource inventories would have a beneficial cumulative impact on the level of cultural information regarding the project area.

4.14 Health and Safety

4.14.1 Proposed Action

Under the Proposed Action, the project would use hazardous materials and generate solid wastes. These materials can pose adverse potential impacts to the environment if accidentally spilled or released. In order to reduce the potential for such impacts, these materials would be stored and used according to applicable rules and regulations. In the project area, soil is the medium most likely to be affected by spills of such materials. Hazardous materials such as fuels and oil would be handled according to SPCC plans as required by OPA 90. Fueling would occur in areas away from surface water resources. Releases of hazardous substances in reportable quantities would be reported and dealt with according to CERCLA. Soil impacted by spills or releases would be dealt with according to applicable regulation, depending on the particular substance involved.

Hazardous materials regulated under SARA Title III (EPCRA) and Section 112(r) of the CAA would be inventoried and amounts on-hand reported to local emergency planning authorities. Local emergency responders would have prior knowledge of the materials used at the project site and would able to respond accordingly.

Spills and leaks cannot be completely prevented, but the regulatory structure that governs the storage, handling, spill reporting, and remediation of hazardous materials decreases the probability for the occurrence and severity of impacts. Therefore, the expected impacts of hazardous materials would be minimal.

4.14.2 No Action

Under the No Action Alternative, hazardous materials would be consumed and waste generation would continue from the existing well and project facilities, but at lesser amounts than for the Proposed Action. The impacts, as in the Proposed Action, would be minimal.

4.14.3 Mitigation

No project specific mitigation is proposed for hazardous materials use and waste generation.

4.14.4 Cumulative Impacts

The storage and use of hazardous materials would represent a small incremental increase in the overall storage and use of such materials in the general vicinity of the Proposed Action where

there are a number of oil, natural gas, and coal bed methane facilities. Therefore, cumulative impacts would be negligible.

5.0 CONSULTATION AND COORDINATION

This section summarizes the communication among agencies and the public relative to the environmental analysis of the proposed Monell EOR Project.

5.1 Public Involvement Process

A Notice of Scoping for the *Environmental Assessment (EA) for the Monell Enhanced Oil Recovery (EOR) Project, Sweetwater County* was issued on July 8, 2005, to 156 addresses on the BLM mailing list for a 30-day public comment period (July 8, 2005, through August 8, 2005) (Appendix B). The purpose of the Notice of the Scoping was to receive input on potential issues from government agencies, public land users and user groups, newspapers, radio stations, and television stations. The BLM received a total of seven comment letters including the USFWS, WDEQ, WGFD, Wyoming State Geological Survey, Pacific Power, Petroleum Association of Wyoming, and the Biodiversity Conservation Alliance.

Issues identified during the scoping process included specific resource concerns, alternative technologies for recovering oil and gas, compatibility with power lines, and required permits. WDEQ indicated that potential effects on water quality and riparian vegetation should be evaluated. WDEQ also identified three permits under their jurisdiction that may be required (Discharge, Storm Water, and Underground Injection Control). The USFWS identified impact considerations and protection for federally listed species. The WGFD identified impact and reclamation considerations for wildlife within disturbance areas and protection of riparian vegetation and aquatic species in the Bitter Creek drainage. Pacific Power requested that Anadarko contact them prior to construction in the vicinity of existing power lines. They also are concerned about the future removal of overhead power lines. The Biodiversity Conservation Alliance provided a list of comments regarding the NEPA process, use of remote monitoring, cumulative impacts, air quality issues, and wildlife and vegetation impacts. They also requested that the BLM require Best Management Practices and effective monitoring of project impacts. The Petroleum Association of Wyoming and the Wyoming State Geological Survey endorsed the proposed project. The Petroleum Association also indicated that beneficial economic impacts should be discussed in the EA.

5.2 Consultation

An EA must be prepared when a federal government agency considers approving an action within its jurisdiction that may impact the human environment. An EA aids federal officials in making decisions by presenting information on the physical, biological, and social environment of a

proposed project and its alternatives. The first step in preparing an EA is to determine the scope of the project, the range of alternatives, and the impacts of the Proposed Action.

During the preparation of the EA, the BLM and consultant interdisciplinary team (IDT) have communicated with, and received or solicited input from federal, state, county, and local agencies. Their comments were considered in preparation of this EA.

5.3 Coordination

Agencies and organizations that provided comments or were contacted on the proposed project during the preparation of the EA included:

- Biodiversity Conservation Alliance
- Pacific Power
- Petroleum Association of Wyoming
- Sweetwater Board of County Commissioners
- U.S. Army Corps of Engineers
- USFWS, Wyoming Office
- USGS
- Wyoming State Engineer's Office
- WDEQ
- WGFD, Cheyenne and Green River Offices

5.4 Team Organization and List of Preparers

The BLM Rock Springs Office was the federal lead agency for preparing the EA. The EA was prepared under a third-party. A list of preparers is provided in **Table 5-1**.

Table 5-1
List of Preparers / Internal Reviewers for the Monell EOR EA

BLM Specialist	Position	Office
Darlene Horsey	NEPA Coordinator / Project Lead	RSFO[1]
John MacDonald	Soils / AFM Lands and Minerals	RSFO
John Henderson	Fisheries Biologist	RSFO
Bonni Bruce	Archaeologist	RSFO
Jo Foster	Outdoor Recreation Planner	RSFO
Jim Glennon	Botanist	RSFO
Jim Dunder	Wildlife Biologist	RSFO
Dennis Doncaster	Hydrologist	RSFO
Jay D'Ewart	Range Management Specialist	RSFO
Susan Davis	Petroleum Engineer	RSFO
Kirk Rentmeister	Geologist	RSFO
Angelina Pryich	Writer Editor	RSFO
Patricia Hamilton	Realty Specialist	RSFO

Table 5-1 (Continued)

BLM Specialist	Position	Office
Susan Caplan	Air Quality Specialist	WYSO[2]
Roy Allen	Socioeconomics Specialist	WYSO
Janet Kurman	Environmental Protection Specialist / NEPA Coordinator	WYSO
Vicki Mistarka	Physical Scientist	WYSO
Brenda Neuman	Physical Scientist	WYSO
Walt George	Natural Resource Specialist	WYSO
Dale Hanson	Paleontologist	WYSO
ENSR Specialist	**Positions**	**Office**
Rollin Daggett	Project Manager / Water Resources and Fisheries Specialist	Fort Collins, CO
Vince Scheetz	Air Quality Specialist	Fort Collins, CO
Bill Berg	Geology, Minerals, and Hazardous Materials Specialist	Fort Collins, CO
Jon Alstad, Allie Grow	Vegetation, Soils, and Range Management Specialists	Fort Collins, CO
Charles Johnson	Wildlife and Sensitive Species Specialist	Fort Collins, CO
Todd White	Land Use, Recreation, Transportation, and Socioeconomics Specialist	Fort Collins, CO
Merlyn Paulson	Visual Resource Specialist	Fort Collins, CO
Kim Munson	Cultural Resource and Paleontology Specialist	Fort Collins, CO

[1]RSFO = BLM Rock Springs Field Office.
[2]WYSO = BLM Wyoming State Office.

6.0 REFERENCES

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APPENDIX A

CO_2 FLOODING PROCESS

CO_2 Flooding Process

Injection of CO_2 to increase oil recovery was first patented in 1952. The first commercial application of CO_2 flooding in Wyoming was Amoco's Bairoil Project, which began using CO_2 injection in 1986 (BLM 1989). Anadarko is currently using CO_2 flooding in the Salt Creek Field near Midwest, Wyoming in Natrona County. The source of CO_2 for the Monell EOR Project is a pipeline that was constructed in 2003. The pipeline transports CO_2 from a valve terminal that is part of the Exxon/Mobil Shute Creek CO_2 Distribution Pipeline System (BLM 2003b).

The method used to recover oil through CO_2 flooding involves a miscible displacement process that injects CO_2 and water. This process is depicted in **Figure A-1** and described using information from National Energy Technology Laboratory (2001). An initial step in preparing the reservoir for CO_2 flooding is to restore the pressure by pumping water through injection wells until the pressure reaches a desired level. After the pressure is restored, the reservoir is ready for CO_2 injection. The CO_2 works to increase the volume of recoverable oil in several ways. In most reservoirs, CO_2 is easily miscible with the oil and can be thoroughly mixed at relatively low pressures. Although CO_2 is not miscible with oil on first contact, a miscible front is created by a gradual transfer of smaller, lighter hydrocarbon molecules from the oil to the CO_2. This miscible front is in essence a bank of enriched gas that consists of CO_2 and light hydrocarbons. Under favorable conditions of pressure and temperature, this front becomes soluble with the oil making it easier to move toward the production wells. As CO_2 dissolves, it swells the oil and forces more oil out of the reservoir pores. In addition, the CO_2 also decreases the viscosity of the oil, allowing it to flow more freely. The initial CO_2 slug is typically followed by alternate water and CO_2 injection. The water is used to improve sweep efficiency and minimize the amount of CO_2 required for the flooding process.

Oil production occurs when the oil bank that forms ahead of the miscible front is pushed to a production well. As reservoir fluids are produced through production wells, the CO_2 reverts to a gaseous state and provides a "gas lift" similar to that of the original reservoir natural gas pressure. On the surface, the CO_2 is separated from the produced fluids and stored in the recompression facility and then used for reinjection to reduce the amount of new CO_2 required for the project.

APPENDIX B

NOTICE OF SCOPING

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901-3447

TAKE PRIDE IN AMERICA

Monell Enhanced
Oil Recovery Project
WY-040-EA05-161

July 8, 2005

Dear Reader:

Attached is a copy of the Notice of Scoping for the *Environmental Assessment (EA) for the Monell Enhanced Oil Recovery (EOR) Project, Sweetwater, Wyoming.* The project proponent will be Anadarko Petroleum Corporation. The U.S. Department of the Interior, Bureau of Land Management (BLM) has determined that an EA is required for the proposed potential drilling of a maximum of 126 wells; 47 on public, 77 on private and 3 on state lands as part of the Monell EOR project area.

Please contact Project Lead Darlene Horsey at the BLM Rock Springs Field Office, 280 Highway 191 North, Rock Springs, WY 82901; call (307) 352-0256; or e-mail Darlene_Horsey@blm.gov, if you have any questions or concerns about this proposal.

Sincerely,

John MacDonald
Assistant Field Manager,
Minerals & Lands

Attachement

1. Notice of Scoping

MONELL ENHANCED OIL RECOVERY PROJECT
Anadarko Petroleum Corporation

Description of Project

Anadarko Petroleum Corporation (Anadarko) has notified the Bureau of Land Management (BLM), Rock Springs Field Office regarding a proposal to develop an Enhanced Oil Recovery (EOR) Project in the Patrick Draw Field Monell Unit (Monell). Anadarko proposes to drill a maximum of 126 wells; 47 on public, 77 on private and 3 on state lands as part of the project. The EOR process would be accomplished using tertiary recovery methods involving carbon dioxide (CO_2) flooding. The proposed Monell EOR Project area is generally located in Sections 33, 34, and 36, Township 19 North, Range 99 West; Sections 30 and 31, Township 19 North, Range 98 West; Sections 1 – 4 and 10 – 15, Township 18 North, Range 99 West; Section 6, Township 18 North, Range 98 West, 6th Principal Meridian, Sweetwater County, Wyoming (see attached map).

The Monell EOR project would occur in an existing oil and gas production area of the Monell Unit, which contains a mixture of private, state, and public lands administered by the BLM, Rock Springs Field Office. The total project area encompasses 10,120 acres, of which approximately 4,457 acres (44 percent of the total area) are federal surface and minerals, approximately 649 acres (6 percent of the total area) are state lands, and approximately 5,014 acres (50 percent of the total area) are private surface and minerals. Overall disturbance on federal land would be approximately 385 acres initially and 89 acres after preliminary reclamation.

The Monell Unit was formed in 1964. In total, 146 producing wells have been drilled and developed. In addition, 123 non-producing wells have been plugged, abandoned, or reclaimed. Of the remaining 23 wells, 9 are active in production and 14 are monitoring wells. Existing infrastructure consists of access roads, pipelines, storage tanks, producing oil and gas wells, and other surface facilities which will be utilized to the maximum extent possible. To date, oil production in the Monell Unit has resulted from primary and secondary production methods. As of the first quarter of 2005, CO_2 flooding has been used in 79 active wells. In total, a maximum of 126 wells would be drilled and developed over a 3- to 6-year period with project life extending for over 20 years.

Proposed Operations

Access into the field would be provided by U.S. Interstate 80 (I-80), Sweetwater County roads (CR) No. 4-24 and CR 4-19, and existing lease roads. Development of the 126 wells would require the construction (upgrading) of approximately 127 miles of access roads and gathering lines (facility corridors). An estimated 12 miles of new roads

would be built on federal land and 20 miles of roads would be built on private or state land.

Ancillary facilities would include oil, gas, and water gathering lines; a power source; a central gathering/treating/metering facility (Main Gathering Battery); recycle compressor station within Main Gathering Battery; three test facilities; a Booster compressor station; and an underground electrical distribution system. Existing aboveground power lines would be dismantled.

The approximate size of each well pad would be 360 x 240 feet, including a 100 x 50 feet reserve pit representing an average surface disturbance of 2 acres per well. After reclamation of disturbed areas no longer needed for production, each producing location typically would occupy an area of approximately 1 acre.

It is anticipated to take approximately 8 days to drill, log, and case each well utilizing a conventional rotary drilling rig and associated rig equipment. Six additional days would be required to run a bond log, perforate, fracture, and set a pump with a completion rig. As the project develops, road and infrastructure construction would occur concurrently with well drilling and testing (access roads to a given well would be constructed prior to drilling and testing). Although some level of activity would be continual, peak drilling and construction would be scheduled for the second and third quarters of 2006 but could be earlier or later depended on circumstances.

Production collection lines for in-field fluid collection (gathering system) would be installed to bring oil/water/gas/CO_2 from individual well sites to the Central Gathering Facility (CGF) and the interconnect pipeline. Production collection lines would generally be located adjacent to roads or under the access road travel ways, where feasible, and all necessary authorizing actions for the lines would be addressed prior to installation. A total of approximately 95 miles of oil, gas, CO_2 and water collection and CO_2 injection lines would be installed.

A CO_2 recompression facility would be constructed within the Main Battery area, located in Section 35, Township 19 North, Range 99 West, on private lands. Anadarko plans to install 1,750 horsepower (hp) during the initial portion of the project, and up to 16,500 hp at full development. Compression horsepower would be electric powered. Methane and CO_2 from the exploration area would be delivered to the compressor station via gas gathering lines. Once the gas reaches the compressor station, dehydration units would remove residual water from the gas, and this water would be evaporated from the dehydration unit.

Relationship to Existing Plans and Documents

Resource Management Plan. The document which directs management of federal lands within the Rock Springs Field Office is the approved Decision Record of 1997, Green River Resource Management Plan (GRRMP). The objective for management of oil and gas resources, as stated in the GRRMP, is to provide for leasing, exploration, and development of oil and gas while protecting other resource values. In addition, the GRRMP states that public lands within the project area are open to mineral leasing and development in order to promote mineral recovery on behalf of the United States, along with appropriate mitigation of disturbance on a case-by-case basis.

The development of natural oil within the Monell Unit area is in conformance with the GRRMP. The environmental analysis that will be prepared for the proposed Monell EOR Project area will incorporate decisions, terms, and conditions of use as described in the GRRMP.

Use Authorizations. Use authorizations (e.g., rights-of -way, permits, etc.) for roads, powerlines, pipelines, and well site facilities would be processed through the BLM Applications for Permits to Drill (APD) and Sundry Notices as long as the appropriate facilities remain on the applicable federal lease and are owned and operated by the unit operator. Any facility located outside a federal lease would require individual rights-of-way permits.

Lease Stipulations. Some federal oil and gas leases within the proposed area may include special stipulations concerning occupancy. These stipulations are in addition to the standard lease terms and are designed to protect surface resources (such as soils, water, and wildlife) by restricting periods of activity and areas of disturbance. Application of these lease stipulations will be handled on a case-by-case basis for each APD submitted to the BLM.

National Environmental Policy Act

The proposed project will be analyzed in accordance with the requirements of the National Environmental Policy Act (NEPA). To comply with NEPA and applicable Council on Environmental Quality (CEQ) regulations (which implement NEPA), the BLM is required to prepare an environmental analysis. The environmental document will serve several purposes. It will: **(A)** provide the public and governmental agencies with information about the potential environmental consequences of the project and alternatives; **(B)** identify all practicable means to avoid or minimize environmental harm from the project and alternatives; and **(C)** provide the responsible official with information upon which to make an informed decision regarding the project.

One element of the NEPA process is "scoping." Scoping activities are initiated early in the process to:

1. identify reasonable alternatives to be evaluated in the environmental analysis;

2. identify issues of environmental concern related to the proposed project; and

3. determine the depth of analysis for issues addressed in the environmental document.

This Scoping Statement has been prepared to enable governmental agencies, the general public, and other interested parties to participate in and contribute to the analysis process. Public input is important in establishing the scope of analysis for any NEPA document, and the BLM encourages public participation.

Identified Resource Management Issues, Concerns, and Opportunities

As of this date, the following issues and concerns have been identified by an interdisciplinary team of BLM specialists. The issues identified below are not meant to be all-inclusive, but rather a starting point for public input:

- Potential increased traffic and associated impacts on existing county, state, and BLM roads.
- Potential socio-economic impacts to local communities.
- Potential impacts to surface and groundwater resources, including sedimentation/salinity to the Colorado River system.
- Potential impacts from emissions resulting from additional drilling and production activities.
- Potential impacts related to reclamation of disturbed areas and control of noxious weed invasions.
- Potential conflicts with livestock management operations in the analysis area, including possible impacts to range improvement projects.
- Potential impacts to cultural and historical values within the analysis area.
- Potential impacts to wildlife habitats within the analysis area, including big game and raptors.
- Potential impacts to the Salt Wells Wild Horse Herd Management Area and wild horses.
- Potential impacts to threatened, endangered, or candidate plant and animal species, including potential Colorado River depletion and effects on downstream listed fish species.

- Potential cumulative effects of drilling and development activities when combined with other ongoing and proposed developments on lands adjacent to the Bitter Creek project area.
- Potential conflicts between mineral development activities and recreational opportunities.

Interdisciplinary Team

Based on current understanding of issues, concerns, and opportunities, and established objectives from other plans, an interdisciplinary team made up of the following specialists has been tentatively identified:

Interdisciplinary Team Leader:
Air Quality Specialist
Soil Scientist
Range Management Specialist
Archeologist
Geologist
Realty Specialist
Recreation Planner
Wild Horse Specialist
Hydrologist
Petroleum Engineer
Wildlife Biologist
Socioeconomic Specialist
Environmental Scientist (surface protection)
Public Affairs Specialist

Timing Needs or Requirements

Public input is important in establishing the level and scope of the analysis. The public is encouraged to participate throughout the environmental analysis process to help identify the level of analysis needed, alternatives to the proposed actions, other issues or concerns that should be analyzed, mitigative opportunities, and any other comments or ideas to help ensure the completeness of the analysis process. It would best serve our needs for a concentrated analysis if you would have all comments returned but not limited to the due date listed below.

Comments are due by August 8, 2005. Please submit your comments to:

Address: Darlene Horsey, Project Lead
BLM - Rock Springs Field Office
280 Highway 191 North
Rock Springs, Wyoming 82901

Email: rock_springs_wymail@blm.gov (Please add "Monell EOR Project" in the Subject line)

Initial Mailing List:

The Scoping Notice initial mailing distribution includes the following agencies, individuals, industries, organizations and media:

Government Offices

Bureau of Land Management, Wyoming State Office (910, 912, 920, 930)
Bureau of Land Management, Rock Springs Field Office
Environmental Protection Agency, Region 8
Office of the Governor
U.S. Department of the Army, Corps of Engineers
U.S. Fish and Wildlife Service
Wyoming State Agencies
Wyoming Department of Environmental Quality
Wyoming Oil and Gas Conservation Commission
Wyoming Game and Fish Department (Cheyenne, Green River)

Elected and Other Officials

Mayors of Rock Springs, Green River, Wamsutter and Superior, Wyoming
State Senators: Rae Lynn Job, Tex Boggs, Grant Larson, Stan Looper
State Representatives: Stephen Watt, Marty Martin, Pete Jorgensen, John Hastert, Bill Thompson
Sweetwater County Commissioners
Sweetwater County Planner
Sweetwater County Libraries (Green River and Rock Springs, Wyoming)
U.S. Congresswoman Barbara Cubin (Bonnie Cannon, Representative)
U.S. Senator Mike Enzi (Lyn Shanaghy, Representative)
U.S. Senator Craig Thomas (Pati Smith, Representative)

Public Land Users and User Groups

Rock Springs Grazing Association
People for the West
Petroleum Association of Wyoming
Independent Petroleum Association of Mountain States
Native American Tribes: Eastern Shoshone, Northern Ute, Northern Arapaho and Shoshone-Bannock
Sierra Club (Northern Plains Representative)
Southwest Wyoming Industrial Association
Wilderness Society
Rocky Mountain Elk Foundation
National Wildlife Federation
Wyoming Wildlife Federation
Wyoming Association of Professional Archaeologists
Wyoming Outdoor Council
Wyoming Public Lands Council
Wyoming State Grazing Board
Wyoming Chapter of the Sierra Club
Environmental Defense Fund
Biodiversity Conservation Alliance

Newspapers

Pinedale Roundup
Sublette Examiner
Kemmerer Gazette
Rock Springs Daily Rocket-Miner
Casper Star-Tribune
Green River Star
Wyoming State Journal
Uinta County Herald

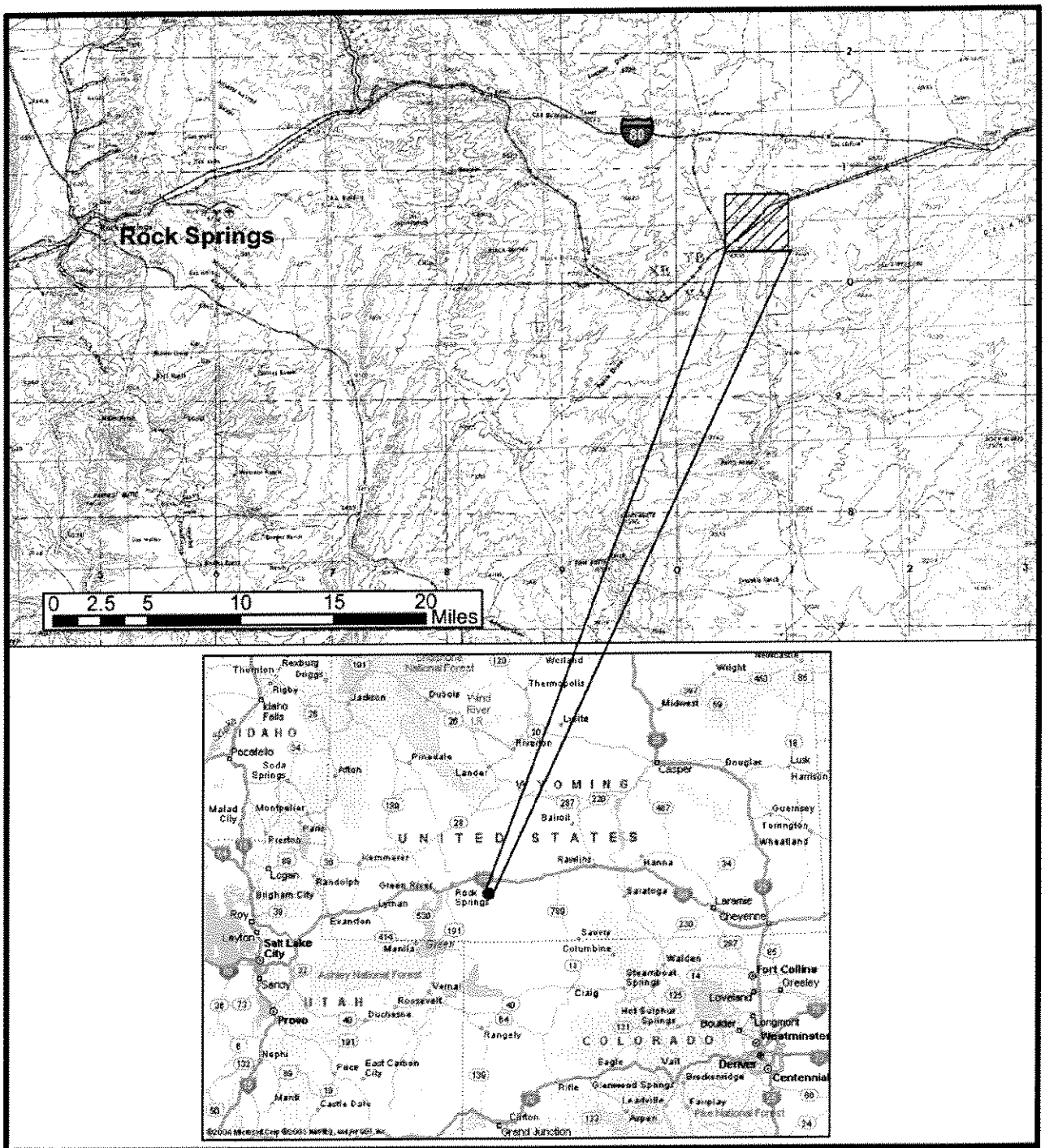
Radio Stations

KRKK/KQSW/KSIT - Rock Springs
KUGR/KYCS/KFRZ - Green River and Rock Springs
KMER – Kemmerer
KRAL - Rawlins
KUWR - University of Wyoming

Television Stations

KTWO-TV - Casper
KCWY-TV - Casper

KWFY-TV - Casper
KGWC-TV - Casper



Legend

Project Area

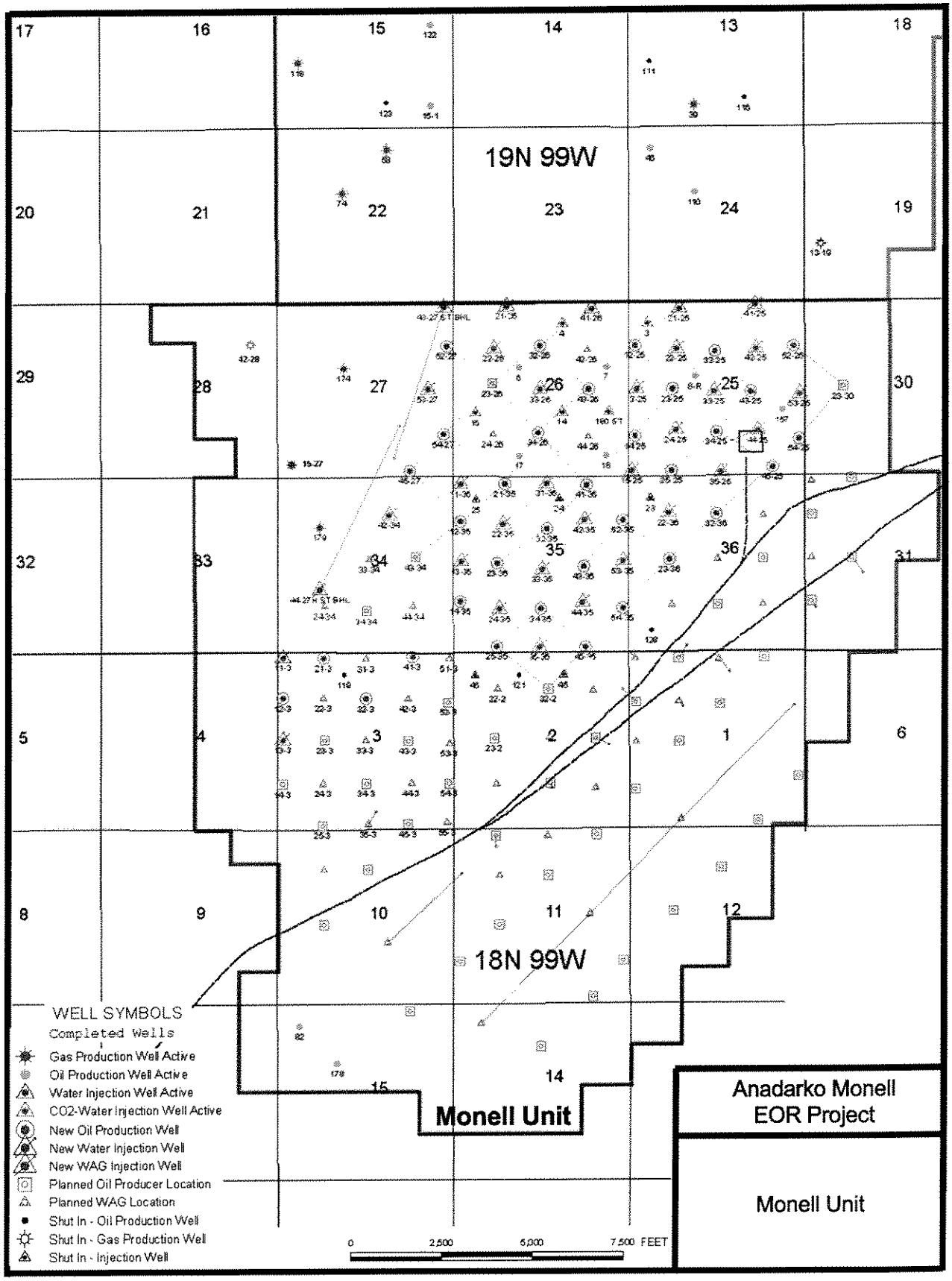
SH State Highway

N
W E
S

Anadarko Monell EOR Project

Project Location

5/3/05


19N 99W
18N 99W
WELL SYMBOLS
Completed Wells
Gas Production Well Active
Oil Production Well Active
Water Injection Well Active
CO2-Water Injection Well Active
New Oil Production Well
New Water Injection Well
New WAG Injection Well
Planned Oil Producer Location
Planned WAG Location
Shut In - Oil Production Well
Shut In - Gas Production Well
Shut In - Injection Well
0
2,500
5,000
7,500 FEET
Monell Unit
Anadarko Monell
EOR Project
Monell Unit

FINDING OF NO SIGNIFICANT IMPACT
MONELL ENHANCED OIL RECOVERY PROJECT

FINDING OF NO SIGNIFICANT IMPACT
MONELL ENHANCED OIL RECOVERY (EOR)
PROJECT

Based on my review of the analysis in the Monell Enhanced Oil Recovery Project Environmental Assessment (EA), I have determined that the Proposed Action is in conformance with the approved land use plan and will not have any significant impact on the human, natural, and physical environment. Therefore, an environmental impact statement is not required.

The EA shows that adverse impacts to surface ownership/land use and grazing; socioeconomics; air quality/noise; Native American/cultural resources; soils/watershed; water resources; geology/minerals/paleontology/; vegetation/wetlands/noxious weeds; wildlife/fisheries; threatened, endangered, candidate, and special status species; wild horses; visual resources; and from the use of hazardous materials would all be minor, short term, necessary and due impacts. Potentially, substantial positive economic impacts could result for the company, and local, state, and federal governments.

The Green River Resource Management Plan (GRRMP) provides for the use of these public lands for natural oil exploration and drilling such as this. The Proposed Action would be in conformance with these land use plans, and no amendments to our RMP would be necessary to implement the Proposed Action.

Michael R Hulbert
Rock Springs Field Manager

2/21/2006
Date