U.S. Department of the Interior
Bureau of Land Management
Wyoming State Office

Rawlins Field Office December 2003

ENVIRONMENTAL ASSESSMENT for the Atlantic Rim Coalbed Methane Project, Brown Cow POD, Carbon County, Wyoming

MISSION STATEMENT

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United States Department of the Interior

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

In Reply Refer To:
1790

November 7, 2003

Re: Environmental Assessment for the Atlantic Rim Interim Drilling Project, Brown Cow Pod

Dear Reader:

This is to inform you of the availability of the Brown Cow Pod Environmental Assessment (EA) at the Wyoming Bureau of Land Management's (BLM) website:

www.wy.blm.gov/rfo/nepa.htm

The Brown Cow Pod is an exploratory coalbed natural gas project associated with the Atlantic Rim Natural Gas Project. The Brown Cow Pod is located in one of nine areas proposed for interim drilling to provide information for use in the preparation of the Atlantic Rim Natural Gas Project Environmental Impact Statement (EIS). In order to satisfy the requirements of the National Environmental Policy Act, this EA was prepared to analyze impacts associated with the exploratory drilling of coal formations northeast of Baggs, Wyoming.

It is expected that this EA can be viewed at our website beginning November 7, 2003. This will begin the 30-day public review/comment period for the document. We will review all comments and will address substantive comments in the Decision Record. A substantive comment is one that would alter conclusions drawn from the analysis based on: 1) new information, 2) why or how the analysis is flawed, 3) evidence of flawed assumptions, 4) evidence of error in data presented, and 5) requests for clarification that bear on conclusions presented in the analysis.

Your comments should be as specific as possible. Comments on the alternatives presented and on the adequacy of the impact analysis will be accepted until December 8, 2003.

Comments may be submitted via regular mail to:

Travis Bargsten, Project Manager
Bureau of Land Management
Rawlins Field Office
P.0. Box 2407
Rawlins, Wyoming 82301

The may also be submitted electronically at the address shown below (please refer to the Brown Cow Pod):

e-mail: rawlins_wymail@blm.gov

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

The EA may also be reviewed at the following locations:

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

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

If you require additional information regarding this project, please contact Travis Bargsten, Project Manger, at the address shown above or phone (307) 328-4387.

Sincerely,

Kent J. Kotter

Field Manager

Enclosure

ENVIRONMENTAL ASSESSMENT

ATLANTIC RIM COALBED METHANE PROJECT
BROWN COW POD

Prepared for

Bureau of Land Management
Rawlins Field Office
Rawlins, Wyoming

Prepared by

This Environmental Analysis was prepared by *Gary Holsan Environmental Planning*, an environmental consulting firm, with the guidance, participation, and independent evaluation of the Bureau of Land Management (BLM). The BLM, in accordance with Federal regulation 40 CFR 1506.5(a) and (b), is in agreement with the findings of the analysis and approves and takes responsibility for the scope and content of this document.

December, 2003

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CHAPTER 1

PURPOSE AND NEED

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION AND LOCATION

Merit Energy Company (Merit) of Dallas, Texas notified the Bureau of Land Management (BLM), Rawlins Field Office, that the company proposes to explore and potentially develop coalbed methane (CBM) wells in the Brown Cow Pod of the Atlantic Rim Project Area (ARPA) of southcentral Wyoming (Figure 1-1). The Merit proposal is a part of interim drilling activity authorized by the BLM, Rawlins Field Office while an Environmental Impact Statement (EIS) is being prepared for the entire Atlantic Rim CBM project area.

The interim development project consists of twelve coalbed methane wells located in the Brown Cow Pod of the Atlantic Rim CBM project area. Initial drilling operations are proposed to begin in December 2003. The total life of the project (LOP) is estimated at 10 to 20 years. The proposed POD is located in an existing oil and gas field, with infrastructure (e.g. access roads, flow lines, produced water lines, water injection wells, and gas compression) available for support of new development.

The Brown Cow Pod is located within the administrative boundary of the BLM's Rawlins Field Office in Township 14 North, Range 91 West, Carbon County, Wyoming (Figure 1-1). Access to the Brown Cow Project Area (BCPA) is provided by the two-lane paved Wyoming State Highway 789 (SH 789) from Interstate 80 (I-80) at Creston Junction south towards Baggs, Wyoming, or north from Baggs, Wyoming. Access to the Brown Cow pod is by SH 789 north from Baggs for approximately 7.5 miles to the intersection with BLM Road 3309. The distance from SH 789 to the proposed pod is approximately 4 miles. The relationship of the Brown Cow Pod to other pods within the Atlantic Rim EIS project area is shown on Figure 1-2.

The Brown Cow Pod encompasses approximately 1,600 acres, all of which are federal surface and minerals.

1.2 PURPOSE OF AND NEED FOR ACTION

1.2.1 Purpose and Need For the Proposed Development

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

The purpose of the proposed CBM development is to exercise the lease holders' rights within the project area to drill for, extract, remove, and market gas products. National mineral leasing policies and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands so long as undue and unnecessary environmental degradation is not incurred.

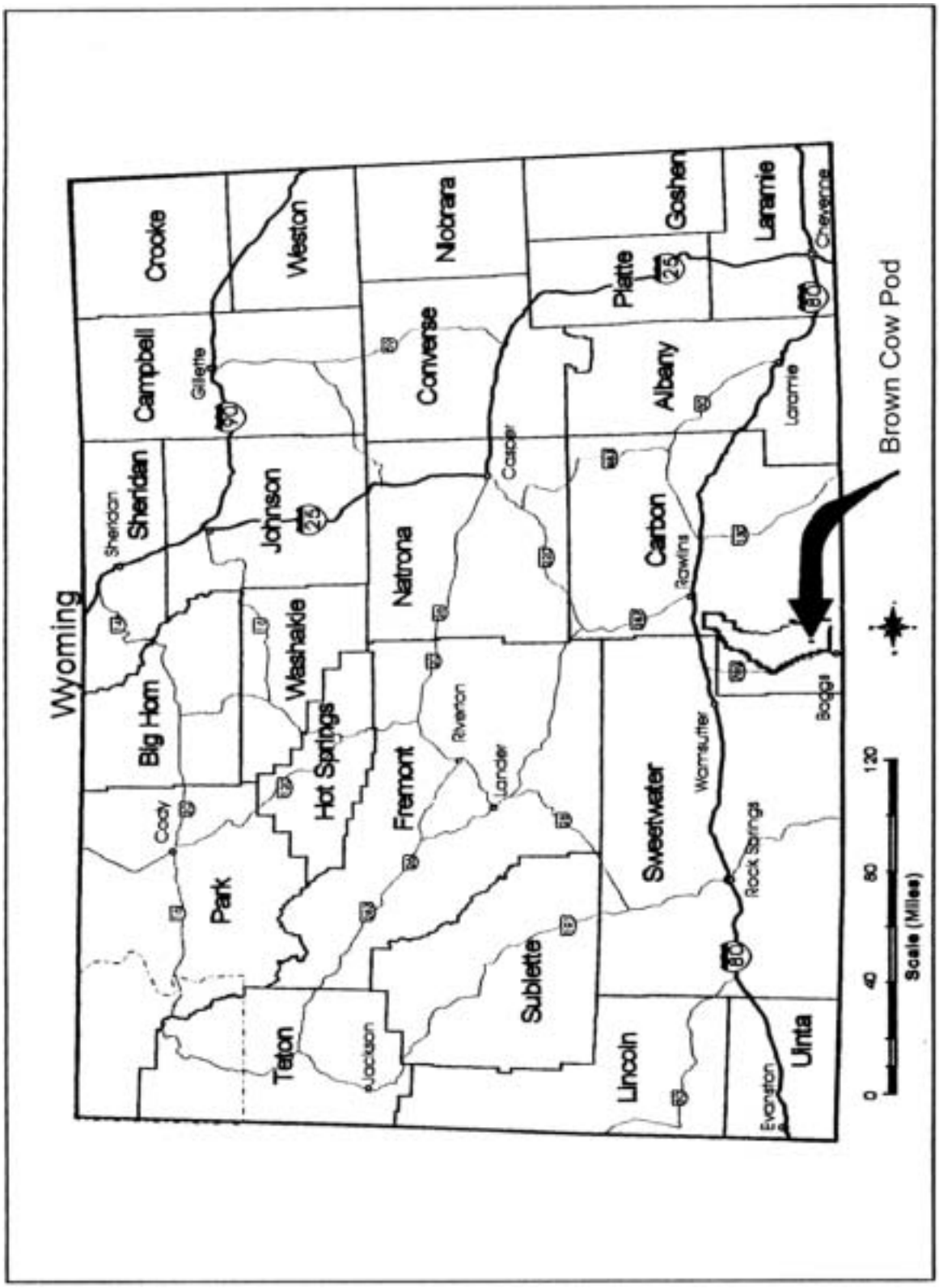


Figure 1-1. Location of the Atlantic Rim – Brown Cow Pod in Southcentral Wyoming.

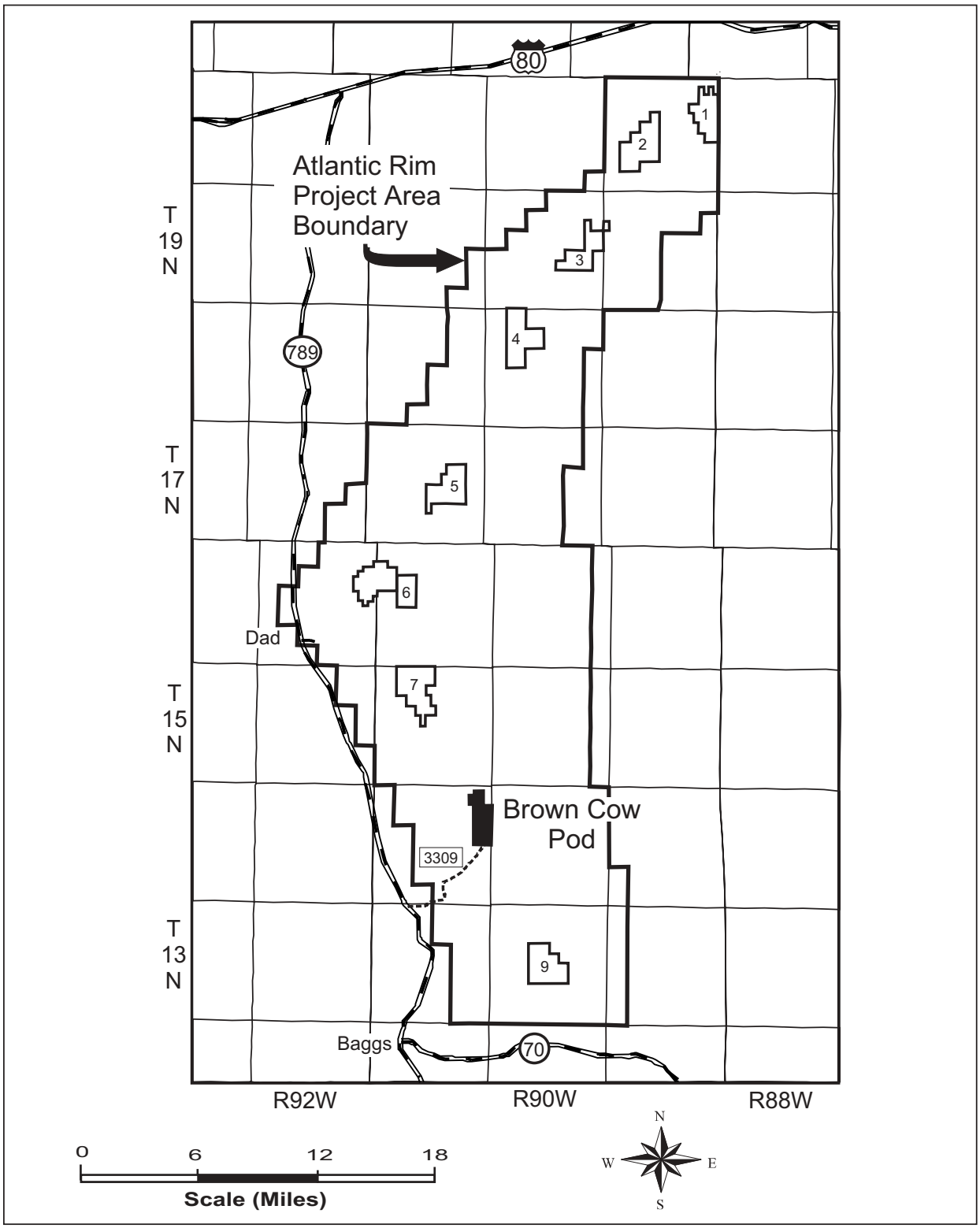


Figure 1-2. Brown Cow Pod in Relation to Other Pods within the Atlantic Rim EIS Project area.

Also included is the right of the lease holders within the project area to build and maintain necessary improvements, subject to renewal or extension of the lease or leases in accordance with the appropriate authority. The proposed project would allow Merit to determine through exploration and production of coalbed methane if larger scale development is feasible.

1.2.2 Purpose of the Environmental Analysis Process

The purpose of this environmental assessment (EA) is to provide the decision-makers with information needed to make a decision that is fully informed and based on factors relevant to the proposal. It also documents analyses conducted on the proposal and alternatives in order to identify environmental impacts and mitigation measures necessary to address issues. The EA also provides a vehicle for public review and comment on the Merit proposal, the environmental analysis, and conclusions about the relevant issues.

This EA has been prepared to evaluate and disclose the potential environmental impacts associated with the proposed coalbed methane project. The proposed exploration project would occur on Bureau of Land Management (BLM) lands managed by the Rawlins Field Office as shown on Figure 1-2.

Factors considered during the environmental analysis process regarding the exploratory CBM project include the following:

- A determination of whether the proposal and alternatives are in conformance with BLM and other agencies policies, regulations, and approved resource management plan direction.

- A determination of whether the proposal and alternatives are in conformance with policies and regulations of other agencies likely associated with the project.

- The location of environmentally suitable well pad locations, access roads, pipelines, and production facilities that best meet other resource activities and minimize surface resource impacts yet honor the lease rights within the project area.

- A determination of impacts resulting from the proposed action and alternatives on the human environment, if conducted in accordance with applicable regulations and lease stipulations, and the development of mitigation measures necessary to avoid or minimize these impacts.

1.3 RELATIONSHIP TO POLICIES, PLANS, AND PROGRAMS

This EA is prepared in accordance with the National Environmental Policy Act (NEPA) and is in compliance with all applicable regulations and laws passed subsequent to the act. This EA assesses the environmental impacts of the Proposed Action and No Action Alternatives and serves to guide the decision-making process.

1.3.1 Conformance with Great Divide Resource Area RMP

The BLM's Great Divide Resource Management Plan (RMP) and Record of Decision (ROD)(USDI-BLM 1987, 1988a, 1990) directs the management of BLM-administered lands within the project area. The objective for management of oil and gas resources as stated in the RMP is to provide for leasing, exploration and development of oil and gas while protecting other resource values. The ROD found that all public lands in the resource area are suitable for oil and gas leasing and development, subject to certain stipulations. The BLM considers existing oil and gas decisions to be appropriate for CBM and allows for the exploration and testing to determine the viability of CBM development.

1.3.2 Conformance With Interim Drilling Policy

The Brown Cow Pod project is one of nine pods that are proposed for exploration and development within the Atlantic Rim Coalbed Methane project area. Drilling and development is authorized per terms provided in the Interim Drilling Policy - Development Authorized Concurrent with EIS Preparation for the Atlantic Rim Coalbed Methane Project (See Appendix A).

1.3.3 Relationship to Other Plans and Documents

The proposed project is in conformance with the State of Wyoming Land Use Plan (Wyoming State Land Use Commission 1979) and the Carbon County Land Use Plan (Pederson Planning Consultants 1997, 1998) and would comply with all relevant federal, state, and local laws and regulations (see Appendix B).

The development of this project would not affect the achievement of the Wyoming Standards for Healthy Rangelands (August 1977).

1.3.4 ISSUES AND CONCERNS

Environmental and social issues of local importance associated with the Merit exploratory CBM project are identified as follows:

- Potential impacts to wildlife habitats within the project area and adjacent lands, primarily sage grouse and mule deer crucial winter range.

- The project area has recorded historical/cultural resource values. There is concern that site disturbing activities associated with exploratory drilling operations may impact historic and cultural values currently unrecorded.

- Reclamation of disturbed areas associated with construction activities and off-road travel is a management concern.

- Potential impacts to surface water quality is a management concern.

- There are concerns regarding potential impacts to air, soil, wildlife, and vegetation within the project area.

- Potential impacts to groundwater is a management concern.
- There are concerns regarding potential impacts to air quality (mostly from generators and processing).
- Cumulative impacts to all resources is a management concern.

CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

2.0 PROPOSED ACTION

The Merit Proposed Action consists of drilling, completing, and operating 12 new productive coalbed methane (CBM) wells, converting two existing shut-in wells to water injection service, and related production and water disposal facilities in the Brown Cow Pod project area (BCPA) of the Atlantic Rim CBM project area (ARPA) (Figure 2-1). The proposal is a part of the Interim Drilling Plan associated with the Atlantic Rim environmental impact analysis in Carbon County, Wyoming. The BCPA is located within the existing development of the Browning Field, an historic oil field comprised of 14 producing or shut-in oil wells. Access to this production is already established and currently in use.

The Atlantic Rim Environmental Impact Statement (EIS) was begun in 2001, and is expected to be completed on or around January 2005. During the interim period before the EIS is completed, the BLM, Rawlins Field Office (RFO) is planning to allow the drilling of up to 200 exploratory wells. Currently, oil and gas operators have identified 9 areas or "pods" where these exploratory wells would be located, one of which is the Brown Cow Pod.

In addition to well sites, other facilities, such as access roads, gas gathering and water disposal pipelines, electrical utilities, and compressors, would be developed to facilitate natural gas (methane) production in the well fields. The interim project would develop over a 6 to 12 month period. The productive life of the project is estimated between 10 to 20 years.

Specific components of the Brown Cow coalbed methane project are shown in the Master Surface Use and Master Drilling Plan (Appendix C), and summarized in the following sections of the Merit Plan of Operations. Additional site-specific environmental analyses and resource information would be contained in the individual well Application for Permit to Drill (APD) and/or Right-of-Way (ROW) application when submitted to the BLM. Merit bases this proposed activity on their preliminary development plans submitted to the BLM in 2003.

2.1 PLAN OF OPERATIONS

2.1.1 Preconstruction Planning and Site Layout

Merit would follow the procedures outlined below to gain approval for proposed activities on BLM-administered lands within the BCPA.

- Prior to the start of construction activities, Merit would submit a Notice of Staking (NOS), (a NOS was received on August 9, 2002 by the RFO for 11 of the 12 CBM wells in this project, the single remaining well (Brown Cow Federal #14-13) did not have a NOS submitted to the RFO), APD, or ROW Application to the BLM with a map showing the specific location of the proposed activity (e.g., individual drill sites, pipeline corridors, access roads, or other facilities). The application would include site-specific plans where necessary to describe the proposed development (i.e., drilling plans with casing/cementing program; surface use plans with road and drill pad construction details; and site specific reclamation plans, etc.). Approval of all operations would be obtained in accordance with authority prescribed in Onshore Oil and Gas Order No. 1 (Approval of Operations on Onshore Federal and Indian Oil and Gas Leases).

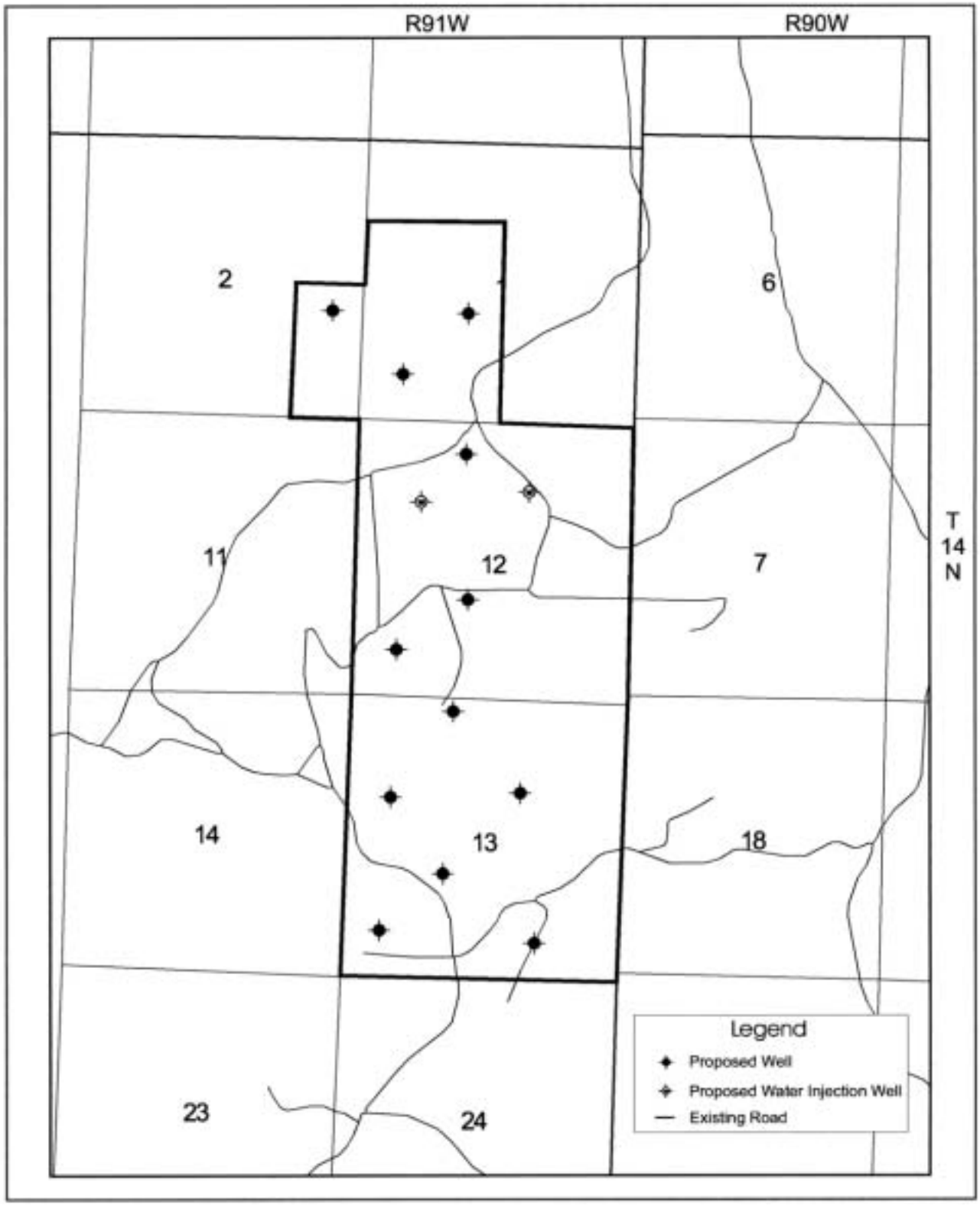


Figure 2-1. Brown Cow Pod - Atlantic Rim Coalbed Methane Project.

- The proposed project components have been staked by Merit and inspected at an onsite inspection on August 15, 2003 by Merit's permit agent and members of the BLM interdisciplinary team to ensure consistency with the approved Great Divide Resource Area RMP, best management practices, approved mitigation measures incorporated into the Atlantic Rim Interim Drilling Policy, and plans provided by Merit in the APD or ROW Application.

- More detailed construction plans, when required by the BLM for the proposed development, would be submitted to the BLM by Merit. The plans would address concerns that may exist concerning construction standards, required mitigation, etc. Changes in these plans between Merit and the BLM, if necessary to resolve differences, would be based on field inspection findings and would take place either during or after the BLM on-site inspection.

- Merit and/or its contractors would revise the APD or ROW Application as necessary per reviews with the BLM. The BLM would complete a project-specific environmental analysis that incorporates agreed upon construction and mitigation standards. The BLM would then approve the specific proposal and attach the Conditions of Approval to the permit. Merit must then commence with the proposed activity within one year. An extension to drill may be granted by the BLM.

Following is a general discussion of proposed construction techniques to be used by Merit. These construction techniques would be applicable to drill site, pipeline, and access road proposals within the BCPA, and may vary between the well sites.

2.1.2 Construction and Drilling Phase

2.1.2.1 Access Road Construction

The primary road access utilized by Merit to access the BCPA is Wild Horse Road, BLM Road 3309, from Wyoming State Highway 789 (Figure 1-2). Access to the pod is provided by existing one-lane graveled and partially graveled BLM and Carbon County roads as described in Chapter 1 (Section 1.1.2, Location). Access to drill locations from the existing road network already in place would be provided primarily by the upgrade of existing two-track roads traversing over natural terrain or along pipeline rights-of-way whenever feasible.

Merit proposes to construct required new access roads across public lands in accordance with BLM Manual 9113 standards for "Resource" roads. Newly constructed roads will be constructed as surfaced crowned and ditched roads (minimum 14 foot road with turnouts every 1000' in accordance with the BLM 9113 manual). Roads would be located to minimize disturbances and maximize transportation efficiency. Roads would be closed and reclaimed by Merit when they are no longer required for production operations, unless otherwise directed by the BLM.

Where two-track roads are not available for upgrade, or where existing two-track roads are aligned in an improper location, access roads would be constructed. The amount of new construction would be minimal because of the existing road system already in place. Several small areas involve steep slopes and would require road cutting (using balanced cut & fill techniques) for equipment access and daily visits during the testing phase. All such areas would be clearly marked in the field prior to any work. The top 6 to 8 inches of topsoil would be stockpiled in windrows in all areas where road cutting and/or surface material is needed.

Drainage crossings on the unimproved access routes within the project area would require crossings using culverts. Appropriately-sized culverts would be installed on all channel crossings. The total area to be disturbed would be flagged on the ground before construction

begins.

2.1.2.2 Well Pad Design and Construction

All of the proposed coalbed methane wells would be drilled on lands administered by the BLM. A graded well pad would be constructed at the well sites. Drilling operations on flat terrain would disturb an area approximately 190 feet by 240 feet (approximately 1 acre) at each well site.

One temporary reserve pit 65 feet wide by 10 feet deep by 100 feet long would be excavated at each well and reclaimed after completion operations. Topsoil would be removed and stockpiled prior to excavating the well pad and pit as required by BLM. Reserve pit fluids would be allowed to dry by evaporation for approximately 6 to 12 months prior to reserve pit closure and drill site reclamation. The pits will be fenced on 3 sides during drilling and the 4th side would be fenced prior to rig move to prohibit wildlife and livestock from falling into the pit.

Where drilling on steeper slopes is necessary, the use of cut and fill construction techniques would be utilized. The use of cut and fill construction techniques to level work areas would be limited to areas where the land surface is too steep to allow the drill rig to set up over natural terrain. Three of the 12 wells will be drilled from existing well pads which are temporarily abandoned or have been plugged and abandoned. On these 3 wells, minimal cuts and fills will be necessary with the exception of the reserve pit, which would be located outside the old reclaimed reserve pit area. Drilling operations would be confined within a 190 feet by 240 feet well site area that is leveled and cleared of vegetation. (See Figure 2-2 for a typical CBM drill site layout). All vegetation would be removed and topsoil stockpiled on every location.

In the event drilling is non-productive, all disturbed areas, including the well site and new access road, would be reclaimed to the approximate landform that existed prior to construction within 2 years following drilling operations. Reclamation and site stabilization techniques would be applied as specified in the APD Surface Use Plan or the Right-of-Way Plan of Development (POD).

If drilling is productive, all access roads to the well site would remain in place for well servicing activities (i.e., maintenance, improvements, etc.). Partial reclamation would be completed on portions of the well pad(s) and access road ROW no longer needed within 2 years following drilling operations.

2.1.2.3 Drilling and Completion Operations

Drilling of the CBM well(s) would utilize a truck-mounted drilling rig. Additional equipment and materials needed for drilling operations would be trucked to the well site. Water for use in drilling the initial well in each pod would be obtained from a local source near the project area (Municipal Water Supply in Baggs, Wyoming). Depending on water quality, produced water from the initial CBM wells could be used as drilling water on future wells. Approximately 600 barrels of water (25,200 gallons) would be needed for drilling each well. Actual water volume used in drilling operations would be dependent upon the depth of the well and any fluid losses that might occur during drilling. The proposed project would require approximately 84,000 gallons (or 0.26 acre-feet) of water per well for cement preparation, well stimulation, and dust control. Drilling mud usually is native mud and bentonite. As hole conditions dictate, small amounts of polymer additives and/or potassium chloride salts may be added for hole cleaning and clay stabilization. Weight material consisting of barium sulfate probably will be required to control drilling pressures. Each well would require 2,600 barrels of water from the Colorado River system. For the entire project, drilling water requirements would be no more than 4.02 acre-feet. Drilling water requirements may be reduced if it is determined to be feasible to re-use

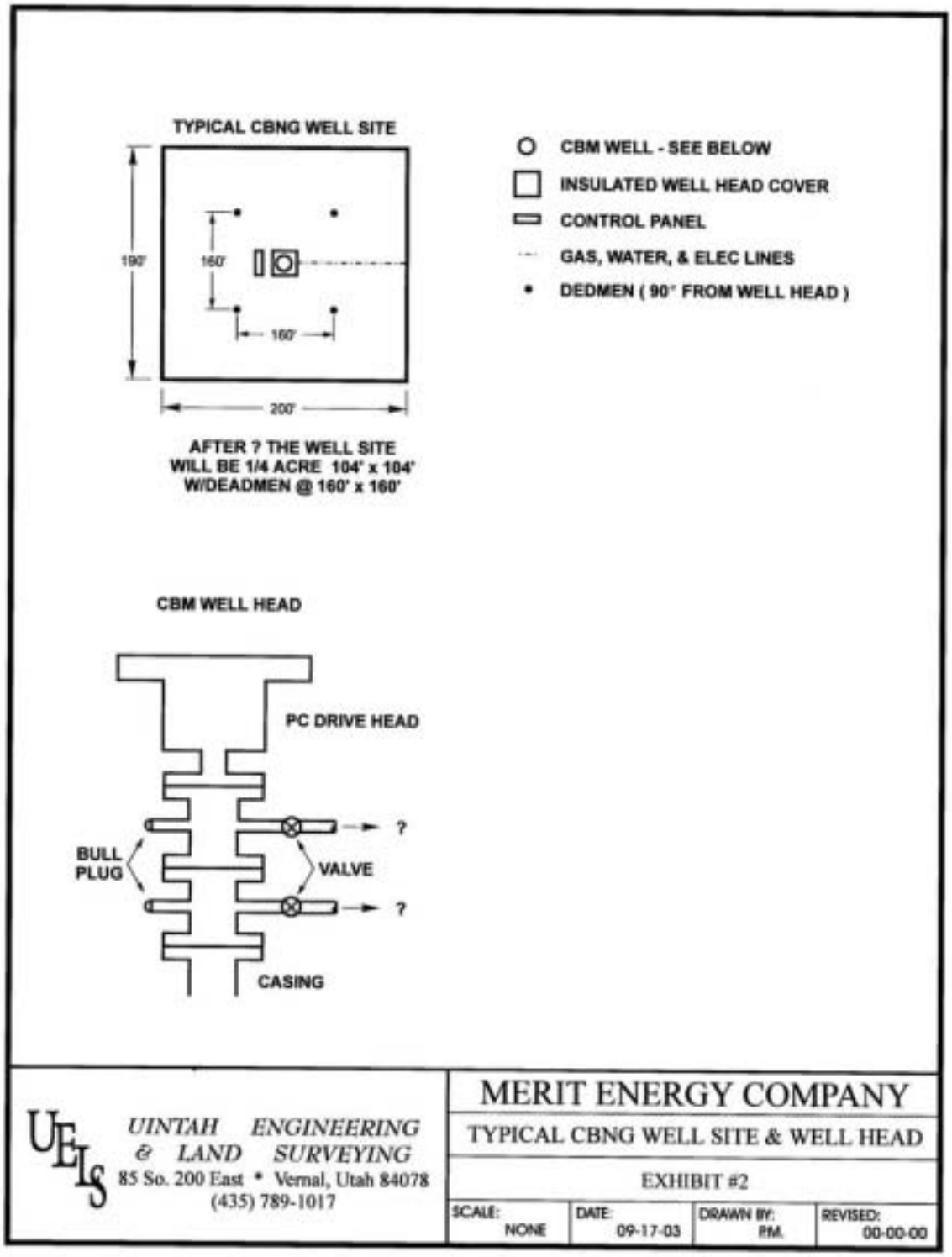


Figure 2-2. Typical CBM Drill Site Layout - Brown Cow Pod.

some of the drilling water from previously-drilled wells.

Depending on the depth of the coal seam, each producing well would be drilled to a depth of 350 feet to 1,200 feet or deeper, and would have steel casing cemented from the top of the coal seam to the surface. The well control system would be designed to meet the conditions likely to be encountered in the hole and would be in conformance with BLM and State of Wyoming requirements.

The drilling and completion operation for a CBM well normally requires a maximum of 10 to 15 people at a time, including personnel for logging and cementing activities. Each well would take 6 days to drill, 4 days to complete, and 5 days to test. A well completion program will be initiated to determine gas and water production characteristics in preparation for production of gas from the drilled, cased, and cemented well. A mobile completion rig similar to the drill rig will be transported to the well site and used to complete a well. Methane gas may be vented and water temporarily discharged to a storage facility for a very short period of time during testing to determine whether wells would be produced. Once determined to be productive, wells would be shut-in until pipelines and other production facilities are constructed If the well is determined not to be productive, it will be properly abandoned after obtaining concurrence with the BLM.

Conversion of existing gas wells for use as injection wells would be accomplished with the equipment and personnel used to complete the CBM wells. Depth of the injection wells is expected to range from 3,000 to 5,000 feet. Completion of each of the injection wells is expected to take approximately 7 to 14 days. Installation of surface equipment, holding tanks and pumping equipment would take approximately 14 days. A schematic of a typical injection facility is shown on Figure 2-3.

2.1.3 Production Operations

2.1.3.1 Well Production Facilities

Wellhead facilities would be installed if the CBM wells are productive. A weatherproof covering would be placed over the wellhead facilities. At this time, no additional facility would be constructed at the well site for gas-water separation facilities. A downhole pump would be utilized to produce water from the uncased open hole or perforated interval. Methane gas would flow to the surface using the space between the production casing and the water tubing. The long-term surface disturbance (10 to 20 years) at each productive well location where cut and fill construction techniques are utilized would encompass approximately 0.005 acre. Well site production facilities typically would be fenced or otherwise removed from existing uses. A typical CBM production wellsite is described on Figure 2-2.

Pipeline trenches for well gathering lines are expected to disturb portions of 20 to 30-foot wide corridors temporarily and to be reclaimed as soon as practical after construction is completed. Trenches would be constructed along the access roads wherever possible. Separate gathering lines would be buried in the trenches and would transport methane gas to production pod facilities and produced water to injection wells. Central production facilities would be located at the existing Browning 3-12 location (Figure C, Appendix C).

At the conclusion of the project, roads, culverts, cattleguards, pipelines, stock watering facilities, or other structures could be left in place for any beneficial use as designated by the BLM. Water and produced water would be available to the BLM, with appropriations rights already properly filed with the Wyoming State Engineer's Office. All federally-owned surfaces that contain disturbed areas or facilities that are no longer needed would be reclaimed.

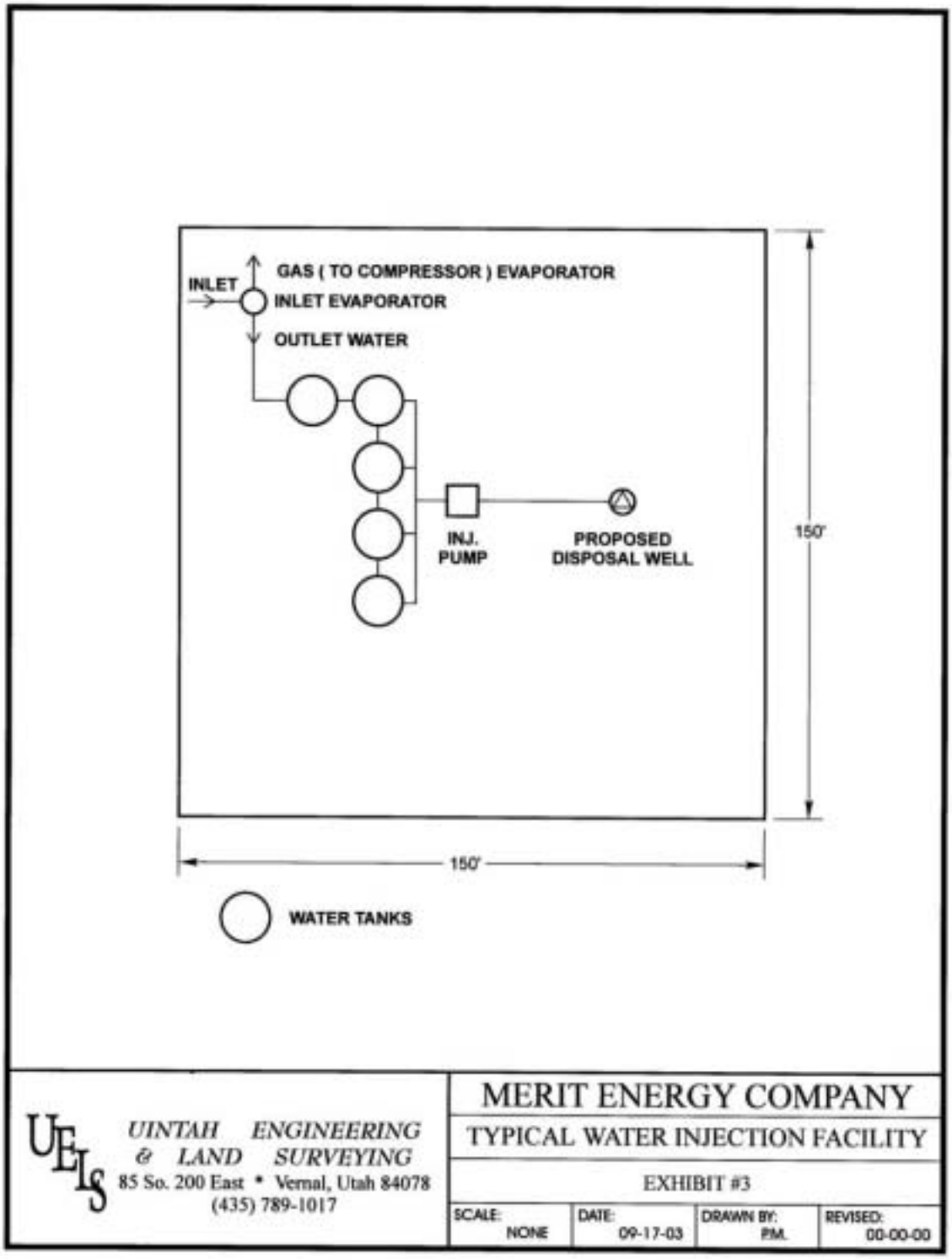


Figure 2-3. Schematic of a Typical Water Injection Facility.

2.1.3.2 Power Generation

Electricity would be used to power pumps during well development and to initiate and maintain production. Both natural gas-fired and diesel engine-powered generators would be used on a temporary basis at individual wells until electrical distribution lines are constructed. Either electrical motors or natural gas-fired reciprocating or microturbine engines would power booster or blower units. Future compressors are anticipated to be natural gas-fired or electrical units. Electrical lines would be buried along corridors of existing disturbance, on the opposite side of roadways from the water and gas gathering pipelines.

2.1.3.3 Pipelines

Two types of pipelines would be constructed as part of the proposed project:

1. Gas-gathering pipeline systems (low pressure, from wellhead to pod building, and from pod building through trunkline to the compressor station).

2. Produced water-gathering pipeline systems.

An existing high pressure gas line would be utilized to transport gas from the field to interstate pipelines. Reclamation of pipeline corridors would occur as soon as practical after pipeline construction is completed.

2.1.3.3.1 Gas-Gathering Pipeline Systems

As part of the transportation corridor system linking the wells and ancillary facilities, gas-gathering pipelines and produced water-gathering pipelines would be constructed, placed together in the same trench/ditch, when practical, and buried. Construction and installation of pipelines would occur immediately after well drilling. Access roads typically would follow the pipeline right-of-way, except in a limited number of cases where topography dictates or as required by the BLM. Separate gathering lines would transport methane gas to production pod facilities and produced water away from wells to injection wells.

Pod gathering lines, a total of approximately 5.28 miles in length, are expected to disturb portions of 30-foot wide corridors, and would transport gas from each compression station to a trunkline.

Gas-delivery pipelines connecting compressor stations with existing transmission pipelines are expected to be located along existing roads. Disturbance related to these delivery lines is expected to be confined to areas not wider than 20 to 30 feet, located within rights-of-way to be established. The proposed gas-delivery system for the BCPA is shown on Figure D, Appendix C.

Development would be constrained by the gas production from the coal seam(s) and by the pipeline capacity available to transport compressed gas to markets. Currently, the pipeline capacity within the project area is 12-60 MMCFD, depending on the pipeline connecting locations.

2.1.3.3.2 Produced Water-Gathering System and Injection Facilities

Produced water from individual wells would be collected and injected at the primary disposal well, the #1-2 well located in Section 2, T14N, R91W. The #3-12 and #4-12 shut-in gas wells in Section 12, T14N, R91W would be converted for use as injection wells as needed based on water flowrates (See Figure 2-1). Produced water-gathering pipelines would be constructed

along the well access road wherever feasible, from the wellhead to injection well locations. The water lines would be placed together in the same trench/ditch as gas gathering lines wherever practical, and buried.

Transfer pumping stations would be utilized during production operations to transfer produced water from the coalbed methane well(s) to the disposal well. The transfer pumping stations are needed in those areas where elevation differences require supplemental pumping to transfer the produced water. Location of the transfer pumping stations would be identified on the plan overview for the Pod. The pumping station would consist of a 400 barrel water tank and a small centrifugal water pump. The pumping station would be confined to a 120 foot by 120 foot area. An approximate 3-foot berm would be constructed around the perimeter of the pumping station area to contain any potential spills. A small pump house would be constructed immediately outside of the bermed area to house the centrifugal pump. A typical water transfer facility is shown on Figure 2-4.

As explained in the Proposed Action discussion, no produced water would be discharged to surface drainages within the project area. This method of water disposal eliminates the need for a federal water management plan.

2.1.3.3.3 Gas-Delivery Pipelines and Compression

Produced natural gas (methane) under wellhead pressure would move through the low pressure gas gathering system to a compressor station. Typical gathering system line pressure is less than 100 pounds per square inch (psi). Gas arriving at the compressor station would be compressed from line pressure to facilitate transport and introduction of the gas into an existing transmission pipeline. Merit intends to utilize an existing gathering pipeline to transport Brown Cow Pod field gas to an existing compressor station.

Compression of the gas at a field compressor station would increase the pressure to an estimated 700 to 1,450 psi. Merit expects to utilize the existing Wild Cow compression station for the gas produced in the Brown Cow Pod. The Wild Cow compressor currently has one 1,520 hp natural gas fired engine driven compressor. Merit is not planning additional compression at this time. However, one electric-powered screw compressor would be constructed in the SW ¼ NW ¼ of Section 12 (see Figure 2-1) if operating conditions require it. A typical compressor station and meter facility is shown on Figure 2-5.

2.1.4 Ancillary Facilities

The Proposed Action would utilize the existing ancillary facility infrastructure within the BCPA where possible, including water disposal facilities and gas gathering pipelines. All wells, pipelines, and associated ancillary production facilities such as water wells and water treatment and disposal facilities would be operated in a safe manner by Merit as set forth by standard industry operating procedures. Routine maintenance of producing wells would be necessary to maximize performance and detect potential difficulties with gas production operations.

Each well location would be visited about every other day to ensure operations are proceeding in an efficient and safe manner. The visits would include checking separators, gauges, valves, fittings, and on-site storage of produced water. Routine on-site equipment maintenance would also be performed as necessary. Additionally, all roads and well locations would be regularly inspected and maintained to minimize erosion and assure safe operating conditions.

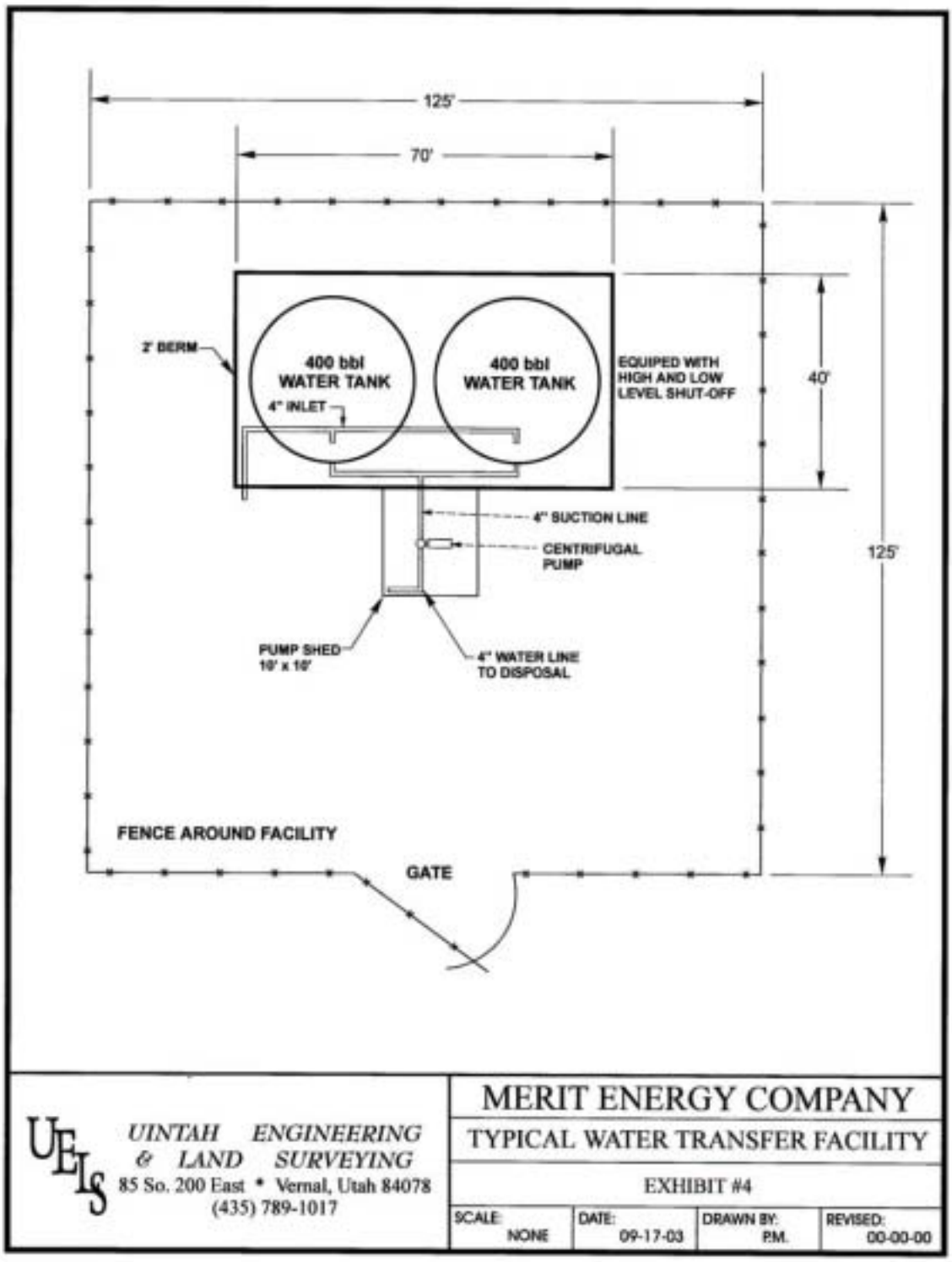


Figure 2-4. Typical Water Transfer Facility.

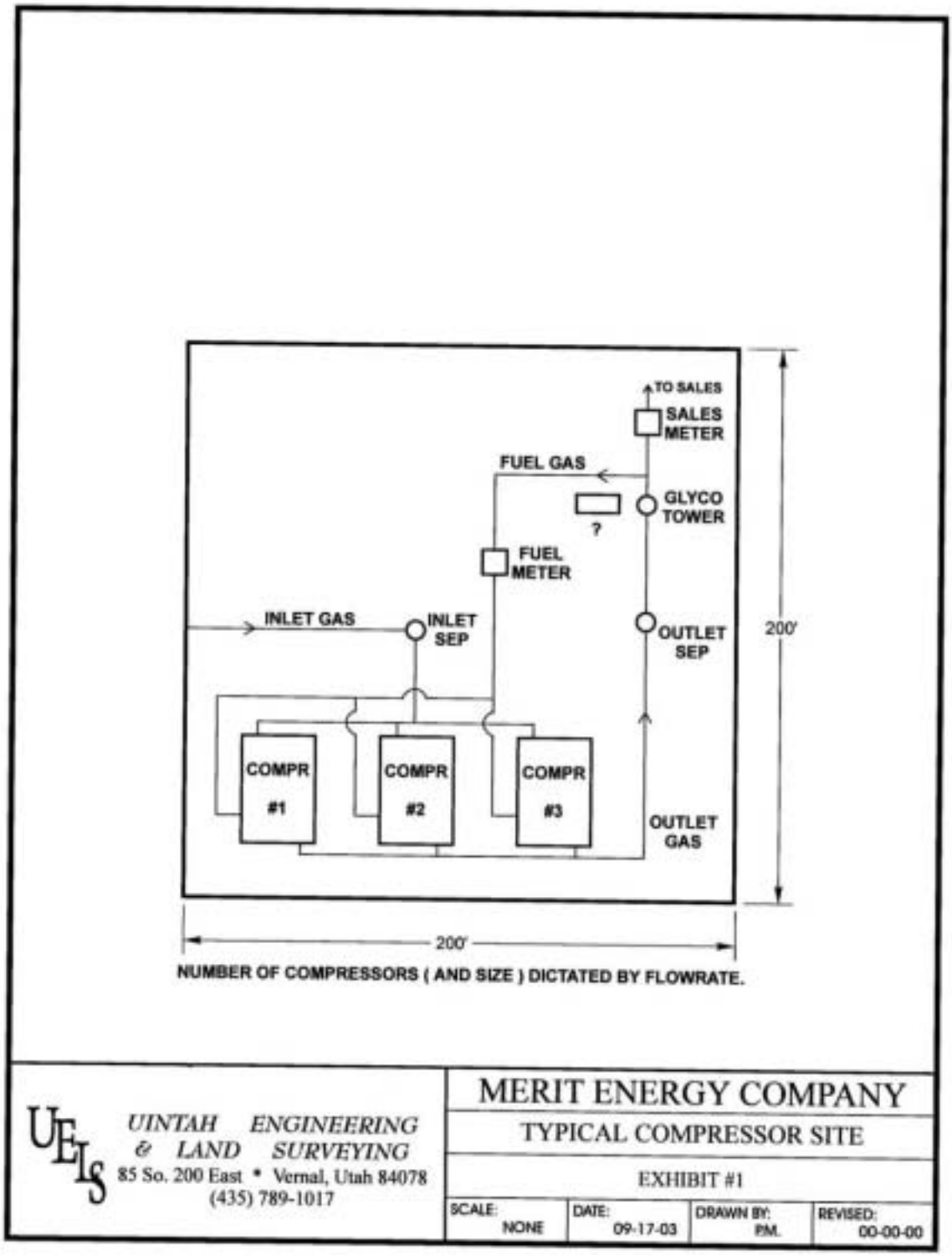


Figure 2-5. Typical Compressor Station and Meter Facility.

2.1.5 Traffic Estimates and Work force Loading Schedule

Estimated traffic requirements for drilling, completion, and field development operations are shown in Table 2-1. The TRIP TYPE column lists the various service and supply vehicles that would travel two and from the well sites and production facilities. The ROUND TRIP FREQUENCY column lists the number of trips both external (i.e., to/from the pods), and internal (within the pod). The figures provided in Table 2-1 should be considered general estimates. Drilling and production activity levels may vary over time in response to weather and other factors.

Table 2-1. Traffic Estimates

TRIP TYPE	ROUND TRIP FREQUENCY	
Drilling (2 rigs, 2 crews/rig)	**External (to/from pod)**	**Internal (within pod)**
Rig supervisor	4/day	same
Rig crews	4/day	same
a Engineers	2/week	1/day/rig
Mechanics	4/week	same
b Supply delivery	1/week	2-4/day
c Water truck	1/month	2 round trips/day
Fuel trucks	2 round trips/well	same
d Mud trucks	1/week	2/day
e Rig move	8 trucks/well	8 trucks/well
Drill bit/tool delivery	1 every 2 weeks	same
Completion		
Smeal rig/crew	1/day	same
Cement crew	2 trips/well	same
Consultant	1/day	same
Well loggers	3 trips/well	same
Gathering systems	8/day	same
Power systems	2/day	same
Compressor stations	2/day	same
Other field development	3/day	same
Testing and operations	2/day	same

Notes:

a Engineers travel to pod weekly and stay in a trailer in the pod during the week.
b Current plans are to establish a central supply area within a pod and deliver supplies on a weekly basis.
c Water trucks would deliver water to rigs from a location within the pod.
d Current plans are to establish a central mud location within a pod and deliver mud on a weekly basis.
e It would require 4 trucks to move each rig to a pod. Upon completion of drilling in a pod, each rig would move to the next pod.

2.1.6 Site Restoration and Abandonment

Merit proposes to completely reclaim all disturbed areas not needed for production activities. Reclamation would generally include: (1) complete cleanup of the disturbed areas (drill sites, access roads, etc.), (2) restoration of the disturbed areas to the ground contour that existed prior to construction, (3) replacement of topsoil over all disturbed areas, (4) ripping of disturbed areas to a depth of 12 to 18 inches, and (5) seeding of reclaimed areas with a BLM approved

seed mixture.If the well proves productive, all disturbed areas unnecessary for production operations would be reclaimed within 2 years after drilling operations cease. If the well does not prove to be feasibly productive, or once production operations have ceased and the well is plugged and abandoned, the entire disturbed area would be reclaimed within 2 years following the end of operations.

2.1.7 Summary of Estimated Disturbances

The following Table 2-2 summarizes the estimated disturbances that would result with implementation of the BCPA project.

Table 2-2. Disturbance Estimates - Brown Cow Pod.

Merit - Brown Cow Pod				
Facility	**Development Phase**			**Operations**
	Length (feet)	Width (feet)	Acres	Acres
New Roads (includes gas and water ROWs)	6,273	40	5.76	5.76
Existing Roads to be upgraded	4,023	0	0	0
Gas Lines (to sales line)	27,261	30	18.77	0
Drill Pads (12)	190	240	12.6	0.06
Compressor Station (0)	0	0	0	0
Injection Well (2)	150	150	1.03	1.03
Pumping Stations (2)	120	120	0.66	0.66
Total Disturbance			**38.82**	**7.51**

2.1.8 Project-Wide Mitigation Measures and Procedures

Merit proposes to implement the following mitigation measures, procedures, and management requirements on public lands to avoid or mitigate resource or other land use impacts. An exception to a mitigation measure and/or design feature may be approved on public land on a case-by-case basis when deemed appropriate by the BLM. An exception would be approved only after a thorough, site-specific analysis determined that the resource or land use for which the measure was put in place is not present or would not be significantly impacted.

2.1.8.1 Preconstruction Planning and Design Measures

1. Merit and the BLM have made on-site interdisciplinary (ID) team inspections of each proposed and staked facility site (e.g., well sites), new access road, access road reconstruction, and pipeline alignment projects so that site-specific recommendations and mitigation measures can be developed. Inspections were completed August 15, 2003.

2. New road construction and maintenance of existing roads in the BCPA would be accomplished in accordance with BLM Manual 9113 standards.

3. Merit would prepare and submit an APD for each drill site on federal leases to the BLM for approval prior to initiation of construction. Also, prior to construction, Merit or its contractors would submit Sundry Notices and/or ROW applications for pipelines and access road segments on federal leases. The APD would include a Surface Use Plan that would show the layout of the drill pad over the existing topography, dimensions of the pad, volumes and cross sections of cut and fill (when required), location and dimensions of reserve pit(s), and access road egress and ingress. The APD, Sundry Notice, and/or ROW application plan would also itemize project administration, time frame, and responsible parties.

4. Access road Plan & Profile drawings prepared by a licensed surveyor will be submitted to the BLM for review and approval prior to the approval of Brown Cow Federal #12-13 and Brown Cow Federal #32-13.

2.1.8.2 Resource-Specific Requirements

Merit proposes to implement the following resource-specific mitigation measures, procedures, and management requirements on public lands.

2.1.8.2.1 Range Resources and Other Land Uses

Mitigation requirements listed under Soils, Vegetation and Wetlands, and Wildlife also apply to Range Resources and Other Land Uses.

1. Merit would coordinate with the affected livestock operators to ensure that livestock control structures remain functional during drilling and production operations

2.1.8.2.2 Air Quality

1. All BLM conducted or authorized activities (including natural gas development alternatives) must comply with applicable local, state, tribal and Federal air quality regulations and standards. Merit would adhere to all applicable ambient air quality standards, permit requirements (including preconstruction, testing, and operating permits), motorized equipment and other regulations, as required by the State of Wyoming, Department of Environmental Quality, Air Quality Division (WDEQ-AQD).

2. Merit would not allow burning garbage or refuse at well locations or other facilities. Any open burning would be conducted under the permitting provisions of Section 13 of the Wyoming Air Quality Standards and Regulations (WDEQ-AQD 1989).

3. On Federal land, Merit will initiate immediate abatement of fugitive dust (by application of water, chemical dust suppressants, or other measures) during road construction operations and during subsequent use.. The BLM would approve the control measure, location, and application rates. If watering is the approved control measure, the operator must obtain the water from state-approved source(s).

2.1.8.2.3 Transportation

1. Existing roads should be used as collectors and local roads whenever possible. Standards for road design should be consistent with BLM Road Standards Manual Section 9113.

2. Roads not required for routine operation and maintenance of producing wells and

ancillary facilities would be permanently blocked, reclaimed, and revegetated.

3. Areas with important resource values, steep slopes and fragile soils should be avoided where possible in planning for new roads.

2.1.8.2.4 Minerals/Paleontology

Mitigation measures presented in the Soils and Water Resources sections would avoid or minimize many of the potential impacts to the surface mineral resources. Protection of subsurface mineral resources from adverse impacts would be provided by the BLM casing and cementing policy.

Paleontological resource values would be protected through the following mitigation measure:

1. If recommended by the BLM, each proposed facility located in areas with known and potential vertebrate paleontological resource significance (Class II) would be surveyed by a BLM-approved paleontologist prior to surface disturbance (USDI-BLM 1987b; 1990a). Also, if paleontological resources are discovered at any time during construction, all construction activities would halt and BLM personnel would be immediately notified. Work would not proceed until paleontological materials are properly evaluated by a qualified paleontologist.

2.1.8.2.5 Soils

1. Reduce the area of disturbance to the absolute minimum necessary for construction and production operations while providing for the safety of the operation.

2. Where feasible, locate pipelines immediately adjacent to roads to avoid creating separate areas of disturbance and in order to reduce the total area of disturbance.

3. Avoid using frozen or saturated soils as construction material.

4. Minimize construction activities in areas of steep slopes (in excess of 25%).

5. Design cutslopes in a manner that would allow retention of topsoil, surface treatment such as mulch, and subsequent revegetation.

6. Selectively strip and salvage topsoil or the best suitable medium for plant growth from all disturbed areas to a minimum depth of 6 inches on all well pads.

7. Where possible, minimize disturbance to vegetated cuts and fills on existing roads that are improved.

8. Install runoff and erosion control measures such as water bars, berms, and interceptor ditches if needed.

9. Install culverts for ephemeral and intermittent drainage crossings. Design all drainage crossing structures to carry the 50-year discharge event, or as otherwise directed by the BLM.

10. Implement minor routing variations during access road layout to avoid steep slopes adjacent to ephemeral or intermittent drainage channels. Maintain a 100-foot wide buffer strip of natural vegetation where possible (not including wetland vegetation) between all construction activities and ephemeral and intermittent drainage channels.

11. Include adequate drainage control devices and measures in the road design (e.g., road berms and drainage ditches, diversion ditches, cross drains, culverts, out-sloping, and energy dissipators) at sufficient intervals and intensities to adequately control and direct surface runoff above, below, and within the road environment to avoid erosive concentrated flows. In conjunction with surface runoff or drainage control measures, use erosion control devices and measures such as temporary barriers, ditch blocks, erosion stops, mattes, mulches, and vegetative covers. Implement a revegetation program as soon as possible to re-establish the soil protection afforded by a vegetal cover.

12. Upon completion of construction activities, restore topography to near pre-existing contours at the well sites, along access roads and pipelines, and other facilities sites; replace up to 6 inches of topsoil or suitable plant growth material over all disturbed surfaces; apply fertilizer as required; seed; and mulch.

2.1.8.2.6 Water Resources

Other mitigation measures listed in the Soils, and Vegetation and Wetlands sections would also apply to Water Resources.

1. Limit construction of drainage crossings to no-flow periods.

2. Minimize the area of disturbance within perennial, ephemeral and intermittent drainage channel environments.

3. Prohibit construction of well sites, access roads, and pipelines within 500 feet of surface water and/or riparian areas. Possible exceptions to this would be granted by the BLM based on an environmental analysis and site-specific mitigation plans.

4. Design channel crossings to minimize changes in channel geometry and subsequent changes in flow hydraulics.

5. Maintain vegetation barriers occurring between construction activities and ephemeral and intermittent channels.

6. Design and construct interception ditches, sediment traps/silt fences, water bars, silt fences and revegetation and soil stabilization measures if needed.

7. Construct channel crossings by pipelines such that the pipe is buried a minimum of four feet below the channel bottom.

8. Regrade disturbed channel beds to the original geometric configuration and the same or very similar bed material replaced.

9. Case wells during drilling, and case and cement all wells in accordance with Onshore Order No. 2 to protect all high quality water aquifers. High quality water aquifers are aquifers with known water quality of 10,000 TDS or less. Include well casing and welding of sufficient integrity to contain all fluids under high pressure during drilling and well completion. Further, wells would adhere to the appropriate BLM cementing policy.

10. Construct the reserve pits in cut rather than fill materials or compact and stabilize fill. Inspect the subsoil material of the pit to be constructed in order to assess soil stability and permeability and whether reinforcement and/or lining are required. If lining is required, line the reserve pit with a reinforced synthetic liner at least 12 mils in thickness and a bursting strength of 175 x 175 pounds per inch (ASTMD 75179). Consideration

should be given to use of closed or semi-closed drilling systems in situations where a liner may be required.

11. Maintain two feet of freeboard on all reserve pits to ensure the reserve pits are not in danger of overflowing. Shut down drilling operations until the problem is corrected if leakage is found outside the pit.

12. Extract all water used during construction activities from sources with sufficient quantities and through appropriation permits approved by the State of Wyoming.

13. Discharge all concentrated water flows within access road ROWs onto or through an energy dissipator structure (e.g., riprapped aprons and discharge points) and discharge into undisturbed vegetation.

14. Develop and implement a storm water pollution prevention plan (SWPPP) for storm water runoff at drill sites as required per Wyoming Department of Environmental Quality (WDEQ) storm water National Pollution Discharge Elimination System (NPDES) permit requirements. The WDEQ requires operators to obtain a field permit for fields of 20 wells or more.

15. Exercise stringent precautions against pipeline breaks and other potential accidental discharges of toxic chemicals into adjacent streams. If liquid petroleum products are stored on-site in sufficient quantities (per criteria contained in 40 CFR Part 112), a Spill Prevention Control and Countermeasures (SPCC) plan would be developed in accordance with 40 CFR Part 112, dated December 1973.

16. Coordinate all crossings or encroachments of waters of the U.S. with the U.S. Army Corps of Engineers (COE).

2.1.8.2.7 Fisheries

1. No fisheries mitigation is needed beyond that indicated under Water Resources (2.1.8.2.7) and Special Status Species Fish (2.1.8.2.10).

2.1.8.2.8 Vegetation and Wetlands

Other mitigation measures under Soils and Water Resources would also apply to vegetation and wetlands.

1. Evaluate all project facility sites for occurrence and distribution of waters of the U.S., special aquatic sites, and jurisdictional wetlands. All project facilities would be located out of these sensitive areas. If complete avoidance is not possible, minimize impacts through modification and minor relocations. Coordinate activities that involve dredge or fill into wetlands with the COE.

2.1.8.2.9 Wildlife

1. During reclamation, establish a variety of forage species that are useful to resident herbivores.

2. Prohibit unnecessary off-site activities of operational personnel in the vicinity of the drill sites. Inform all project employees of applicable wildlife laws and penalties associated with unlawful take and harassment.

3. Limit construction activities as per BLM authorizations within big game crucial winter range from November 15 to April 30.

4. Survey and clear well sites within one mile of raptor nests identified in the raptor survey prior to the commencement of drilling and construction during the raptor nesting period (February 1 through July 31).

5. When an `active' raptor nest is within 0.75 to one mile (depending on species and line of sight) of a proposed well site, restrict construction during the critical nesting season for that species.

6. Do not perform construction activities within 0.25 mile of existing, active sage grouse leks..

7. Provide for sage grouse lek protection during the breeding, egg-laying and incubation period (March 1 - June 30) by restricting construction activities within a two-mile radius of active sage grouse leks. Exceptions may be granted if the activity would occur in unsuitable nesting habitat.

2.1.8.2.10 Special Status Species

Special Status Plants

1. Employ site-specific recommendations developed by the BLM IDT for staked facilities.

2. Minimize impacts due to clearing and soil handling.

3. Monitor and control noxious weeds.

4. Comply with Section 404(b)(1) guidelines of the federal Clean Water Act (CWA).

5. Perform clearance surveys for plant species of concern.

Special Status Animals

1. Implement measures discussed in Chapter 4 (Section 4.8.5) in compliance with the Endangered Species Act (ESA),

2.1.8.2.11 Visual Resources

1. Utilize existing topography to screen roads, pipeline corridors, drill rigs, well heads, and production facilities from view.

2. Paint well and central facilities site structures with flat colors (e.g., Carlsbad Canyon) as recommended by the BLM, that blend with the adjacent surrounding undisturbed terrain, except for structures that require safety coloration in accordance with Occupational Safety and Health Administration (OSHA) requirements.

2.1.8.2.12 Noise

1. Muffle and maintain all motorized equipment according to manufacturers' specifications.

2.1.8.2.13 Recreation

Measures under Wildlife, Transportation, Soils, Health and Safety, and Water Resources apply to Recreation.

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

2.1.8.2.14 Socioeconomics

1. Implement hiring policies that would encourage the use of local or regional workers who would not have to relocate to the area.

2. Coordinate project activities with ranching operations to minimize conflicts involving livestock movement or other ranch operations. This would include scheduling of project activities to minimize potential disturbance of large-scale livestock movements. Establish effective and frequent communication with affected ranchers to monitor and correct problems and coordinate scheduling.

3. Merit and its subcontractors would obtain Carbon County sales and use tax licenses for purchases made in conjunction with the project so that project-related sales and use tax revenues would be distributed to Carbon County.

2.1.8.2.15 Cultural Resources

1. If a site is considered eligible for, or is already on the National Register of Historic Places (NRHP), avoidance is the preferred method for mitigating adverse effects to that property.

2. Adverse effects to eligible cultural or historical properties that cannot be avoided would be mitigated by preparing and implementing a cultural resources mitigation plan on a case by case basis.

3. If cultural resources are discovered at any time during construction, all construction activities would halt and the BLM Authorized Officer (AO) would be immediately notified. Work would not resume until a Notice to Proceed is issued by the BLM AO.

4. Open trench inspections and construction monitors would be employed by Merit for all surface disturbing activities.

5. Cultural inventories would be completed prior to construction activities as a part of the APD/ROW approval process. Should any finds be made during the inventories, additional work may be required as determined on a case by case basis.

2.1.8.2.16 Health and Safety

Measures listed under Air Quality and Water Quality also apply to Health and Safety.

1. Sanitation facilities installed on the drill sites would be approved by the WDEQ.

2. To minimize undue exposure to hazardous situations, require measures that would preclude the public from entering hazardous areas and place warning signs alerting the

public of truck traffic.

3. Haul all garbage and rubbish from the drill site to a State-approved sanitary landfill for disposal. Collect and store any garbage or refuse materials on location prior to transport in containers approved by the BLM.

4. During construction and upon commencement of production operations, Merit would have a chemical or hazardous substance inventory for all such items that may be at the site. Merit would institute a Hazard Communication Program for its employees and would require subcontractor programs in accordance with OSHA 29 CFR 1910.1200. These programs are designed to educate and protect the employees and subcontractors with respect to any chemicals or hazardous substances that may be present in the work place. It would be required that as every chemical or hazardous material is brought on location, a Material Safety Data Sheet (MSDS) would accompany that material and would become part of the file kept at the field office as required by 29 CFR 1910.1200. All employees would receive the proper training in storage, handling, and disposal of hazardous substances.

5. Spill Prevention Control and Countermeasure Plans would be written and implemented as necessary in accordance with 40 CFR Part 112 to prevent discharge into navigable waters of the United States.

6. Chemical and hazardous materials would be inventoried and reported in accordance with the Superfund Amendments and Reauthorization Act (SARA) Title III. 40 CFR Part 335, if quantities exceeding 10,000 pounds or the threshold planning quantity (TPQ) are to be produced or stored in association with the Proposed Action. The appropriate Section 311 and 312 forms would be submitted at the required times to the State and County Emergency Management Coordinators and the local fire departments.

7. Any hazardous wastes, as defined by the Resource Conservation and Recovery Act (RCRA), would be transported and/or disposed of in accordance with all applicable federal, state, and local regulations.

8. Merit plans to design operations to severely limit or eliminate the need for Extremely Hazardous substances. Merit also plans to avoid the creation of hazardous wastes as defined by RCRA wherever possible.

2.2 ALTERNATIVE A - NO ACTION

Section 1502.14(d) of the National Environmental Policy Act (NEPA) requires that the alternatives analysis in the environmental impact statement (EIS) "include the alternative of no action". "No Action" implies that on-going natural gas production activities would be allowed to continue by the BLM in the BCPA, but the proposed field development program (Proposed Action) would be disallowed. Additional APDs and ROW actions would be considered by the BLM for federal land on a case-by-case basis consistent with the scope of existing environmental analysis. Transport of natural gas products would be allowed from those wells within the BCPA that are currently productive. Additional gas development could occur on private lands within the project area under APDs approved by the WOGCC.

The U.S. Department of the Interior's (USDI) authority to implement a "No Action" alternative is limited because the public lands have already been leased. An explanation of this limitation and the discretion the USDI has in this regard follows.

- An oil and gas lease grants the lessee the "right and privilege to drill for, mine, extract, remove and dispose of all oil and gas deposits" in the leased lands, subject to the terms and conditions incorporated in the lease (Form 3110-2). Because the Secretary of the Interior has the authority and responsibility to protect the environment within federal oil and gas leases, restrictions are imposed on the lease terms.

- Leases within the ARPA contain various stipulations concerning surface disturbance, surface occupancy and limited surface use. In addition, the lease stipulations provide that the USDI may impose "such reasonable conditions, not inconsistent with the purposes for which [the] lease is issued, as the [BLM] may require to protect the surface of the leased lands and the environment." None of the stipulations, however, would empower the Secretary of the Interior to deny all drilling activity because of environmental concerns.

- Provisions in leases that expressly provide Secretarial authority to deny or restrict APD development in whole or in part would depend on an opinion provided by the U.S. Fish and Wildlife Service (FWS) regarding impacts to endangered or threatened species or habitats of plants or animals that are listed or proposed for listing (e.g., bald eagle). If the FWS concludes that the Proposed Action and alternatives would likely jeopardize the continued existence of any endangered or threatened plant or animal species, then the APD(s) and Atlantic Rim development may be denied in whole or in part.

2.3 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

The BLM requires the development of alternatives when there are unresolved conflicts involving alternative uses of available resources. Based upon scoping comments received for the Atlantic Rim EIS, and interdisciplinary review of the proposed action, no unresolved conflicts were identified to drive another alternative for analysis in the environmental assessment.

CHAPTER 3

AFFECTED ENVIRONMENT

3.0 INTRODUCTION

The Affected Environment chapter of this environmental assessment (EA) for the proposed Brown Cow coalbed methane project discusses environmental, social, and economic factors as they currently exist within the Brown Cow project area (BCPA). The material presented here has been guided by management issues identified by the Bureau of Land Management (BLM), Great Divide Resource Area (GDRA); public scoping; and by interdisciplinary field analysis of the area.

This proposal could potentially affect critical elements of the human environment as listed in BLM's National Environmental Policy Act (NEPA) Handbook H-1790-1 (USDI-BLM 1988). The critical elements of the human environment, their status in the BCPA and their potential to be affected by the proposed project are listed in Table 3-1.

Table 3-1. Critical Elements of the Human Environment[1], Brown Cow CBM POD Development Project Carbon County, Wyoming

Element	Status on the Project Area	Addressed in text of EA
Air Quality Issues	Potentially affected	Yes
Areas of critical environmental concern	None present	No
Cultural resources	Potentially affected	Yes
Environmental justice	Potentially affected	Yes
Prime or unique farmlands	None present	No
Floodplains	None present	No
Native American religious concerns	Potentially affected	Yes
Invasive plants	Potentially affected	Yes
Threatened and endangered species	Potentially affected	Yes
Hazardous or solid wastes	Potentially Affected	Yes
Water quality (surface water)	Potentially affected	Yes
Wetlands/riparian zones	Potentially affected	Yes
Wild and scenic rivers	None present	No
Wilderness (study area)	None present	No

[1] As listed in BLM *National Environmental Policy Act Handbook H-1790-1* (BLM 1988b) and subsequent Executive Orders

CHAPTER 3: AFFECTED ENVIRONMENT

In addition to the critical elements, this EA discussed potential effects of the project on range resources, transportation, geology/minerals/paleontology, soils, fisheries, vegetation, wildlife, special status species, visual resources, noise, recreation, socioeconomics, and health and safety.

3.1 GEOLOGY/PALEONTOLOGY

3.1.1 Geology

3.1.1.1 Regional Geologic Overview

The BCPA lies within the southeastern arm of the Washakie Basin sub-basin region of the Greater Green River Basin of southernmost central Wyoming. Bedrock in the area dips westward off the structural high of the Precambrian-cored Sierra Madre Range into the eastern edges of the Washakie Basin, the southeastern part of the Greater Green River Basin. Dips in upper Cretaceous and Paleocene rocks are steep. Dips lessen upward into younger rocks of early Eocene age and westward away from the mountain flank.

Along its western flank the Sierra Madre is bounded by a major eastward dipping reverse fault system along which it was elevated over the eastern edge of the Washakie Basin during the Laramide Orogeny in late Cretaceous through Early Tertiary time. These reverse faults are not exposed at the surface, but rather lie buried beneath Early Tertiary sediments that filled the basin and lapped onto the mountain flank. The Washakie Basin to the west, into which the surface rocks dip, is bound by east-west oriented structural highs, the Wamsutter Arch and Cherokee Ridge, to the north and south, respectively. The structural axis of Cherokee Ridge trends east-west along the Wyoming-Colorado State line and separates the Washakie Basin from the Sand Wash Basin of Colorado, to the south.

Numerous faults, chiefly normal faults, occur along Cherokee Ridge and the western flank of the Sierra Madre (Love and Christiansen 1985; Winterfeld and Bown 2003). Many of these faults show evidence of recurrent motion throughout the last 20 million years, however, none show any indication of Quaternary movement (Case and others 1994).

Geologic mapping by the USGS and Wyoming Geologic Survey (Weitz and Love 1952, Love and Christiansen 1985, Love et al. 1993, and Roehler 1973, 1977, 1985) document that the BCPA is underlain at the surface by sedimentary deposits of Quaternary and Late Cretaceous age. These deposits are underlain by Phanerozoic age sedimentary rocks of Cretaceous to Cambrian age, which are in turn underlain by Precambrian metamorphic bedrock that comprises part of the ancient North American craton and exceeds 2 billion years in age. Although they have been mapped in the Atlantic Rim project area, no sediments of early Tertiary age actually occur in the BCPA.

Information on geologic units preserved at the surface and beneath the project is provided in Table 3-2. Additional details on surface deposits are provided below.

TABLE 3-2. SURFACE AND SUBSURFACE GEOLOGIC DEPOSITS BROWN COW POD AREA (Source Weitz and Love 1952, Love and Christiansen 1985, Love, Christiansen and Ver Ploeg 1993)

Geologic Deposit	Geologic Age	Environment/Lithology	Resources/BLM Paleontology Condition (Surface exposed formations only)
Surface Deposits			
Unnamed Quaternary Deposits	Holocene-Pleistocene	Eolian/fluvial/ landslide. sand, gravel, clays, weathered in place residuum from exposed outcrops	none reported within area, economic deposits of windblown sand reported 20-30 miles NNE of the town of Baggs, Wyoming, just east of the project area
Wasatch Formation	Early Eocene	Terrestrial:fluvial/flood plain/swamp, drab to varicolored mudstone, sandstone, carbonaceous shale and coal.	Vertebrate, invertebrate and plant fossils (BLM Condition 2). Coal. Petroleum in subsurface. Uranium reported in adjacent areas near Wamsutter Creston and Latham
Lance Formation	Late Cretaceous	Terrestrial: fluvial/flood plain/swamp, brown and gray sandstone , shale and mudstone, coals, and carbonaceous shales.	Vertebrate, invertebrate and plant fossil (BLM Condition 2). Coal. Coal Bed Methane.
Lewis Shale Fox Hills Sandstone	Late Cretaceous	Fox Hills: Marine - shoreline, light-colored sandstone and gray sandy shale, Lewis Shale: Marine – near shore to offshore, gray shale containing gray, brown sandstones	Fox Hills: Vertebrate and invertebrate fossils (BLM Condition 3) No mineral resources reported, Lewis Shale Invertebrate fossils. Petroleum in Espy Field

Geologic Deposit		Geologic Age	Environment/Lithology	Resources/BLM Paleontology Condition (Surface exposed formations only)
Subsurface				
Mesaverde Group	Almond Formation	Late Cretaceous	Marine, Terrestrial, deltaic: white and brown sandstone, sandy shale, coal, carbon-aceous shale	Vertebrate, invertebrate and plant fossils (BLM Condition 2) Coal. Coalbed methane. Petroleum in Baldy Butte, Cherokee Creek, Cow Creek, Creston, Deep Gulch, Espy, Savery Fields.
	Pine Ridge Sandstone (=Williams Fork Formation)	Late Cretaceous	Marine: coastal plain, estuary/beach , white sandstone, lenticular conglomerate, coal	
	Allen Ridge Formation (= Iles Formation)	Late Cretaceous	Terrestrial, coastal plain white to brown sandstone, shale, mudstone, coal	
	Haystack Mountains Formation	Late Cretaceous	Marine:	
Subsurface				
Steele Shale (includesShannon, Sussex Sandstones)		Late Cretaceous	Marine, gray shale, with numerous bentonites, sandstone	Petroleum in Browning Cherokee Creek, Cow Creek, Deep Creek, Deep Gulch, Sierra Madre Fields.
Niobrara Formation		Late Cretaceous	Marine, light-colored limestone, gray limey shale	Petroleum in Espy Field.
Frontier Formation		Late Cretaceous	Marine: deltaic, gray sandstone and sandy shale	Petroleum in Browns Hill, Cherokee Creek, Cow Creek, Deep Gulch, Sugar Creek Fields.
Mowry Shale		Late Cretaceous	Marine: silver-gray, hard siliceous shale, with abundant fish scales and bentonites	Bentonites, mined about 10 miles east of area.
Muddy Sandstone		Early Cretaceous	Marine: deltaic, gray to brown sandstone, conglomeratic	Petroleum in Browning, Deep Creek, Sugar Creek Fields.
Thermopolis Shale		Early Cretaceous	Marine, black, soft, fissile shale	none reported, oil and gas source rock

Geologic Deposit	Geologic Age	Environment/Lithology	Resources/BLM Paleontology Condition (Surface exposed formations only)
Cloverly Formation (=Dakota Sandstone)	Early Cretaceous	Terrestrial, variegated mudstone, bentonitic, conglomeratic sandstone	Petroleum in Browning, Cherokee Creek Fields.
Morrison Formation	Jurassic	Terrestrial, varicolored mudstones, white sandstone, bentonite	Petroleum in Browning Field.
Sundance Formation	Jurassic	Marine, green-gray glauconitic sandstone and shale, underlain by red and gray non-glauconitic shale and sandstone	none reported
Nugget Sandstone	Triassic to Jurassic	Eolian, gray to red, massive to cross-bedded sandstone	Petroleum in Cow Creek, Deep Gulch Fields.
Chugwater Formation	Triassic	Terrestrial/mud flat, red shale and siltstone, sandstone	Petroleum in Browning Field.
Goose Egg Formation	Permian to Triassic	Marine, gray to olive dolomitic siltstone; red sandstone and siltstone, gypsum, halite, purple to white dolomite and limestone	none reported
Tensleep Sandstone	Pennsylvanian	Marine, white to gray sandstone with limestone and dolomite	Petroleum in Browning, Espy, Sugar Creek Fields.
Amsden Formation	Mississippian to Pennsylvanian	Marine, red and green shale and dolomite, persistent red to brown sandstone at base	none reported
Madison Limestone	Mississippian	Marine, glue-gray massive limestone and dolomite	none reported
Flathead Sandstone	Cambrian	Marine/shoreline, red, banded, quartzose sandstone	none reported
unnamed metamorphic rocks	Precambrian	Igneous/metamorphic, granitic and/or intrusive	none in area but in Sierra Madre contain ores of uranium, copper, silver, lead, zinc, gold, and barium industrial (building and decorative) grades of quartzite, marble, and granite

3.1.1.2 Surface Deposits

Quaternary Deposits

Quaternary deposits in the BCPA include gravels, colluvium and slope wash, as well as residuum developed on formations of Cretaceous (Lance Formation) age. Younger soils have formed on these deposits in places. Additional descriptions of the soil units are provided in Section 3.5.

Tertiary B Wasatch Formation

Outliers of Tertiary age rocks Have been mapped at three places within the BCPA: (1) just northeast of the town of Baggs, in Sec. 35, T13N, R91W, where they overlie the Paleocene Fort Union Formation; and (2) as two distinct outliers capping the highest hills in the E 2 T14N, R91W, overlying rocks of the Upper Cretaceous Lance Formation and Lewis Shale. Weitz and Love (1952) mapped the outlier rocks as the Wasatch Formation of Eocene age. Later Love and Christiansen (1985) mapped them as rocks of the Browns Park Formation of Miocene age. Field examination of these outlier outcrops reveals that they are neither the Wasatch nor Browns Park Formations. In actually they represent weathered and flat-lying Lewis Shale that may represent a small structural flexure or a weather zone developed into the underlying Lewis Shale.

Upper Cretaceous B Lance Formation

The Lance Formation of latest Cretaceous age crops out only along the westernmost (W 2 Sec 14 and W 1/4 Sec 23, T41N, R91W) and southernmost (S 1/4 Sec 23, T41N, R91W) parts of the BCPA.

Regionally, the Lance Formation consists of about 2,890 feet of interbedded gray sandstone and mudstone, carbonaceous shale and coal (Hettinger et al. 1991, Hettinger and Kirschbaum 1991). Sandstones of the formation, abundant at its base in the BCPA, are relatively resistant to erosion and form ridges that hold up the major highlands in the BCPA area.

Upper Cretaceous B Lewis Shale

The Lance Formation is underlain by the Lewis Shale, and this relatively nonresistant unit underlies most of the BCPA. The Lewis Shale consists of up to 1,500 feet of near shore marine shale, and thin, discontinuous stringer sandstones (Smith 1961, Roehler 1993). With the exception of the uppermost part of the formation, which contains a series of laterally extensive sandstones that weather to ridges and small cliffs, the Lewis Shale is not very resistant to erosion and forms a broad strike valley.

The Lewis Shale interfingers westward into the upper part of the Mesaverde Group, the Fox Hills Sandstone, and the lower part of the Lance Formation. In the BCPA, the Lewis Shale is underlain by the Mesaverde Group; however, farther north and east (seaward at the time of deposition), along the Sierra Madre Range and in the Laramie Basin, respectively, the Lewis Shale directly overlies the Steele Shale (Ritzma 1949; Roehler 1993) and the Mesaverde is absent.

3.1.1.3 Mineral Resources

With the exception of gravel deposits, no economic deposits of locatable minerals are known to occur within the BCPA. Gravel, preserved as Quaternary terrace and channel remnants, occurs at the top of Wild Horse Butte and along Deep Creek Rim. The gravels along Deep Creek Rim are staked as a gravel mine.
Coal and coalbed methane occur in Cretaceous age geologic formations and oil and gas occurs in geologic formations of Cretaceous, Jurassic, Triassic, and Pennsylvanian age underlying the BCPA.

Coal and Coalbed Methane

Lance Formation

Coals occur discontinuously in outcrop in the Lance Formation from I-80 south to about T15N. Averaging about 5 feet in thickness, but ranging from a few inches to 22 feet thick, coals are thicker, more abundant, and laterally extensive in the lower part of the formation. The coals have limited lateral extent and usually cannot be traced more than a few hundred to several thousand feet.

Lance Formation coal beds are minor coalbed methane targets (Scott and others 1994, 1995), but because the formation occurs only along the westernmost and southernmost margin of the BCPA, chiefly stratigraphically above the rest of the area, it cannot be considered a potential target.

Mesaverde Group

Coals occur in outcrops in the Mesaverde Group, which stratigraphically underlies the Lewis Shale, in several places along the western flank of the Sierra Madre. These are best developed high in the Mesaverde Group (Pine Ridge Sandstone) near its contact with the overlying Lewis Shale in exposures several miles to the east of the BCPA (Atlantic Rim and Green River Coal Fields) and in T15-16N, R90-91W (an unnamed coal field). These fields have moderate KMDA value (less than $1 million, based on 1981 prices) and include about 230,400 leasable acres. Coals are also developed sporadically lower in the Mesaverde Group (Allen Ridge Sandstone), but these coals are thin and discontinuous and areas containing them are rated as having a low KMDA value. Based on vitrinite reflectance percentages from wells in the Sand Wash Basin, Mesaverde, coals underlying the BCPA rank as high volatile C bituminous, high volatile B bituminous, and high volatile A bituminous.

Coals in the Pine Ridge (=Williams Fork) Formation include the thickest and most extensive coals of the Upper Cretaceous in the Greater Green River Basin and are the basin=s prime coalbed methane targets. The maximum net coal thickness of about 220 feet, contained in 40 individual coal beds occurs near Craig, Colorado. The coal beds thin in a westerly and northerly direction, so that in the southeastern part of Carbon County, underlying the BCPA net coal thicknesses range from 40 to 90 feet. The coals of the Pine Ridge Formation are interpreted to have accumulated in coastal plain environments and fluvial dominated, wave modified deltas, along a southwest-northeast oriented strand (beach) line that faced southeastward into the Cretaceous epicontinental seaway. Three depositional coal cycles are represented that accumulated in response to progradation as a result of sea level drop or changes in delta location, or both. The thickest coals in these cycles overlie shoreline sandstones with thinner

and less continuous coals developed between deltaic distributary channel sandstones.

Gas content values for coals developed in the Pine Ridge Sandstone (= Williams Fork Formation) range from less than 1 to more than 540 scf/ton, but are generally less than 200 scf/ton. Samples from the Sand Wash Basin indicate a gradual increase in gas content with increasing burial, but that coal rank does not increase significantly with depth. Gas contents of samples taken shallower than 1,000 feet are less than 20 standard cubic feet per ton (scf/ton) suggesting that coalbed gases may have migrated out of the system because either confining pressures were low, the overlying seals were absent, or both. Analysis of 36 coal samples from 6 wells provided a gas dryness range from 0.79 to 1.0 with an average of 0.95, carbon dioxide content of less than 1 to more than 25%, with an average of 6.7 %, and a nitrogen content of less than 1 to 20 % with an average of 4 %. Coals having a high carbon dioxide content are characterized by high C1-C1-5 values.

Based on gas content values, Scott and others (1994, 1995) estimated coal gas reserves in the in the western and southwestern parts of Carbon County, Wyoming, underlying the BCPA, to be less than or equal to 10 bcf/mi2 near the eastern margins of its subcrop and 8 to 40 bcf/mi2 in the extreme southwestern corner of the county.

Coals in the Allen Ridge (=Iles) Formation are thinner and not as well developed as those in the Pine Ridge and the formation is considered a minor coal-bearing unit and coalbed methane target. A maximum net coal thickness of 32 feet occurs in the easternmost part of the Great Divide Basin, but most other places it is typically less than 15 feet. These coals are interpreted to have accumulated in a variety of swampy environments above shoreline sandstones and in flood plains adjacent to delta river channels.

Based on samples from wells primarily in the Rock Springs Uplift, gas content values in the Allen Ridge (=Iles) Formation range from 0 to more than 650 scf/ton. No estimates of total coal gas reserves are available for this unit.

Oil and Gas

Areas adjacent to the BCPA have produced significant quantities of oil and natural gas. Production is chiefly from Cretaceous geologic units including the Mesaverde Group, Steele Shale, Niobrara Shale, Frontier Formation, Muddy Sandstone, and Cloverly Formation. In addition, Jurassic rocks of the Morrison Formation, Triassic rocks of the Chugwater Formation, and Pennsylvanian rocks of the Tensleep Sandstone have proved productive. Oil and gas fields of interest (The Oil and Gas Fields Symposium committee 1957 1979 1992, Gregory and DeBruin 1991, DeBruin and Boyd 1991, and DeBruin 1996 Cronoble 1969; DeBruin, 1993; Kaiser et al. 1994) include the Baldy Butte (T17N, R92W), Browning (T14N, R91W), Browns Hill T16N, R90-91W), Cherokee Creek T15N, R91W), Cow Creek (T16N, R92W), Deep Creek (T16N, R90-91W), Deep Gulch (T16N, R91W), Dixon (T12-13N, R90W), Espy (T19N, R89W), Sierra Madre (T13N, R89-90W), and Sugar Creek (T19N, R90W). Oil and gas is produced from combined stratigraphic and faulted structural (anticlinal) traps.

3.1.1.4 Geologic Hazards

Naturally occurring geologic hazards (excluding soil hazards which are discussed in Section 3.3.3) include fault generated earthquakes, floods, and landslides or other mass movements of earth materials. The most likely of these to affect the BCPA are mass movements that could be initiated on steep slopes.

There are no known faults with evidence of Quaternary movement or earthquake epicenters mapped within the BCPA (NEIC 2002, WGS 2002). The nearest recorded epicenter, that of a 4.3 Richter magnitude earthquake occurred April 4, 1999, near Baldy Butte in T17N, R92W (41.45ºN, 107.74ºW) a few miles north of the BCPA. No other earthquake epicenters have been recorded in or immediately adjacent to the area in the past 100 years. This indicates that this quake may have been an unusual event and that the area may not be very seismically active.

Pyrophoricity

Pyrophoricity (spontaneous combustion) has been cited as potential hazard of coal gas development. Spontaneous combustion of coal has long been a concern for mankind and shallow coal mine fires in areas of abandoned mines are today still an environmental concern throughout the world (Lyman and Volkmer 2001).

Spontaneous combustion of coal is unlikely to occur in naturally exposed outcrops of coal because by the time coal is exposed by erosion it is already too degassed to ignite spontaneously (Coates and Heffern, 1999). Studies of in-situ coal gasification conducted during the 1970's in Wyoming suggest that even under extreme efforts to maintain combustion (by injecting air into the burn zones) in underground coals ignited in bore holes, coal burning away from the ignition area cannot be sustained. Loss of permeability associated with plugging of fissures by tar and combustion products resulted in the fires burning themselves out rather quickly. In their study of Powder River Basin CBM wells, (Lyman and Volkmer 1999) found that spontaneous combustion of coal beds during coalbed methane production is unlikely because completion methods, although Aopen-hole@, configure the well to keep air, necessary for combustion, out of the system. Even where the coal has been completely dewatered, insufficient oxygen is present for oxidation to be carried forward. After coal gas extraction is complete, CBM wells leave no underground voids susceptible to subsidence and associated coal ignition as seen in abandoned underground mines, which unlike CBM wells, are susceptible to spontaneous ignition.

Subsidence

Ground subsidence (resulting from withdrawal of coalbed-methane related water) has also been cited as a potential hazard of CBM development. A number of documented cases have demonstrated the association of withdrawal of underground fluids and subsidence. The best examples include specific sites in the San Joaquin Valley in California, Las Vegas, New Orleans, Houston, and Mexico City. Subsidences in these areas are all chiefly related to removal of water for human consumption or agricultural use. Removal of water from underlying saturated, chiefly unconsolidated and porous sand and gravel aquifers lowers the water table, and causes the previously saturated zones to compress, causing subsidence. Saturated unconsolidated sands and gravels and porous clays can compress significantly. In some cases as much as 29 feet of subsidence in these areas has resulted. The subsurface geologic conditions in the BCPA, however, differ significantly from these areas. The bedrock underlying the area is compacted and consolidated and porosity is much lower. In comparison, unconsolidated sands and gravels and clays have porosity values as high as 50% and 88%, respectively (Poland 1984), whereas, values for consolidated clay (shale) and sand (sandstone) in the BCPA have porosity values at most as high as 10% and 30%, respectively (Freeze and Cherry 1979).

Mass Movement

Mass movement (including earth flowage, landsliding, slumping, and creep) are associated with and accentuated by topographic relief and slope. Surface elevations within the BCPA range from a high of 7,220 feet atop an unnamed hill in the NW 1/4 of Sec 24, T14N, R91W and along the northern extension of Deep Creek Rim in the SW 1/4 of Sec 23, T14N, R91W to a low of about 6,600 feet along Wild Horse Draw in the SW 1/4 of Sec 23, T14N, R91W. Relief is approximately 620 feet. Slopes within the area are generally undulating, broken by areas of steeper (10 to 40 percent) and very steep slope to vertical faces (rock outcrops). Maximum slope over a one mile intersect is about 7.5 % grade (400 feet rise in 5,280 ground feet) and the minimum slope is about 2.3 % grade (120 feet rise in 5,280 ground feet) in the SW 3 Sec 19, T14N, R90W.

Mass movement of earth materials occurs around Wildhorse Butte (T14N, R91W) and is associated with steep slopes developed in the Lewis and Lance formations. These geologic units contain clay-rich shale beds that are susceptible to mass movement when water saturated, especially where exposed on steep or undercut slopes. Of the two formations, the Lewis Shale is most susceptible to mass movement. A small rotational slump has developed in the formation in the NW 1/4 of Sec 24, T14N, R91W. The Lewis Shale is also extensively involved in earth flow to the south and east. It is susceptible to mass movement because it forms broad exposures of shale that are actively being eroded. Sandstones and mudstones of the Lance Formation are less likely to be involved in mass movement. Both the Lewis and Lance Formation which dip steeply westward are more susceptible to mass movement along the western side of their exposures in places where down hill, down dip, toe support of the formation is removed or undermined.

Mass movement associated with soils is discussed in Section 3.3.3.

3.1.2 PALEONTOLOGIC RESOURCES

Geologic mapping and field evaluation documents four geologic deposits exposed at the surface in the BCPA. These include, from youngest to oldest: (1) unnamed deposits of Quaternary (Holocene) age; (2) Lance Formation of Latest Cretaceous age; and (3) Lewis Shale of late Cretaceous age. The Lewis Shale underlies most of the project area.

Holocene deposits (including soils) are widespread in the BCPA and too young to contain fossils. Exposures of the Lance and Wasatch Formations, which are known to contain scientifically significant fossils are restricted to the western-most and southern-most margins and top of Wild Horse Butte and Deep Creek Rim, respectively, and are not aerially extensive. The Lewis Shale, which is known to contain invertebrate fossils and occasionally significant vertebrate fossils, is the most widely exposed geologic unit in the BCPA.

Although no fossils have been reported from the BCPA to date, scientifically significant fossil vertebrates have been recovered from the Lance Formation from exposures along the Sierra Madre to the north (Morris 1954, Honey 1988, Roehler 1972, 1991 a-b, 1992 a-c, 1993, Roehler et al. 1988, Rigby 1980, Dorf 1942a, 1942b; Estes 1964, Clemens 1966; Clemens and others 1979; 1986; Weishample, 1992; Archibald, 1993 Lillegraven, 2002, Honey, 2003). The Lewis Shale is known to produce remains of marine reptiles and fish (Breithaupt, 1985).

Based on descriptions included in the BLM's Paleontological Resource Management Handbook 8270-I, the Lance Formation meets Condition 2 and the Lewis Shale meets Condition 3, with

regard to fossil resources. These conditions are as follows:

Condition 2: Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The presence of geologic units from which such fossils have been recovered elsewhere may require further assessment of these same units where they are exposed in the area of consideration.

Condition 3: Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils based on their surficial geology, igneous or metamorphic rocks, extremely young alluvium, colluvium or eolian deposits or the presence of deep soils. However, it possible it should be noted at what depth bedrock may be expected in order to determine if fossiliferous deposits may be uncovered during surface disturbing activities.

3.2 CLIMATE AND AIR QUALITY

3.2.1 Climate

The Brown Cow project area is located in a semiarid (dry and cold), mid-continental climate regime. The area is typified by dry, windy conditions, with limited rainfall and long, cold winters. The nearest meteorological measurements were collected at Baggs, Wyoming (1979-2000), approximately 3 miles southwest of the project area at an elevation of 6240 ft (WRCC 2003). Because of the wide variation in elevation and topography within the study area, site-specific climatic conditions vary considerably.

The annual average total precipitation at Baggs is 10.7 inches, ranging from 18.5 inches (1983) to 4.6 inches (1989). Precipitation is evenly distributed throughout the year, with minor peaks in May, July, and October. An average of 38.8 inches of snow falls during the year (annual high 104.0 inches in 1983), with December and January the snowiest months. Table 3-3 shows the mean monthly temperature ranges and total precipitation amounts.

Table 3-3. Mean Monthly Temperature Ranges and Total Precipitation Amounts.

Month	Average Temperature Range (°F)	Total Precipitation (inches)
January	5-33	0.56
February	9-36	0.43
March	20-47	0.44
April	28-59	0.82
May	34-68	1.52
June	41-79	0.89
July	48-86	1.33
August	46-84	0.99
September	38-74	1.14
October	27-61	1.39
November	16-43	0.66
December	7-34	0.54
ANNUAL	42.6 (mean)	10.71 (mean)

Source: (WRCC 2003)

The Baggs region has cool temperatures with average daily temperatures (in degrees Fahrenheit; °F) ranging between 3 °F (low) and 33 °F (high) in mid winter and between 56 °F (low) and 75 °F (high) in mid summer. Extreme temperatures have ranged from –50 °F to 100 °F (both occurring in 1984). The frost-free period (at 32 °F) generally occurs from mid-May to mid-September.

The project area is subject to strong and gusty winds, reflecting channeling and mountain valley flows due to complex terrain. During the winter months strong winds are often accompanied by snow, producing blizzard conditions and drifting snow. The closest comprehensive wind measurements are collected at the Rawlins, Wyoming, airport nearly 60 miles north-northeast of the project area. However, hourly wind data measurements for December 1994 through November 1995 were collected near Baggs, Wyoming during the Mount Zirkel Wilderness Area Visibility Study. Due to the proximity to the analysis area, these data (rather than the more distant Rawlins wind data) were used to describe the wind flow patterns in the region. Figure 3-1 shows the relative frequency of winds, with radial distributions by speed class, indicating the direction of the wind source. Table 3-4 provides the wind direction distribution in a tabular format. From this information, it is evident that the winds originate from the south to southwest nearly 37 percent of the time. The annual mean wind speed is nearly 10 mph.

Table 3-4. Wind Direction Frequency Distribution for Baggs, WY.

Wind Direction	Percent of Occurrence
N	5.2
NNE	3.8
NE	2.7
ENE	3.8
E	4.8
ESE	8.9
SE	6.9
SSE	7.6
S	13.8
SSW	13.4
SW	10.0
WSW	5.1
W	4.4
WNW	4.0
NW	2.6
NNW	3.1

The frequency and strength of the winds greatly affects the dispersion and transport of air pollutants. Because of the strong winds in the project area, the potential for atmospheric dispersion is relatively high, although nighttime cooling will enhance stable air, inhibiting air pollutant mixing and transport. Dispersion conditions will be the greatest to the north and along the ridge and mountain tops.

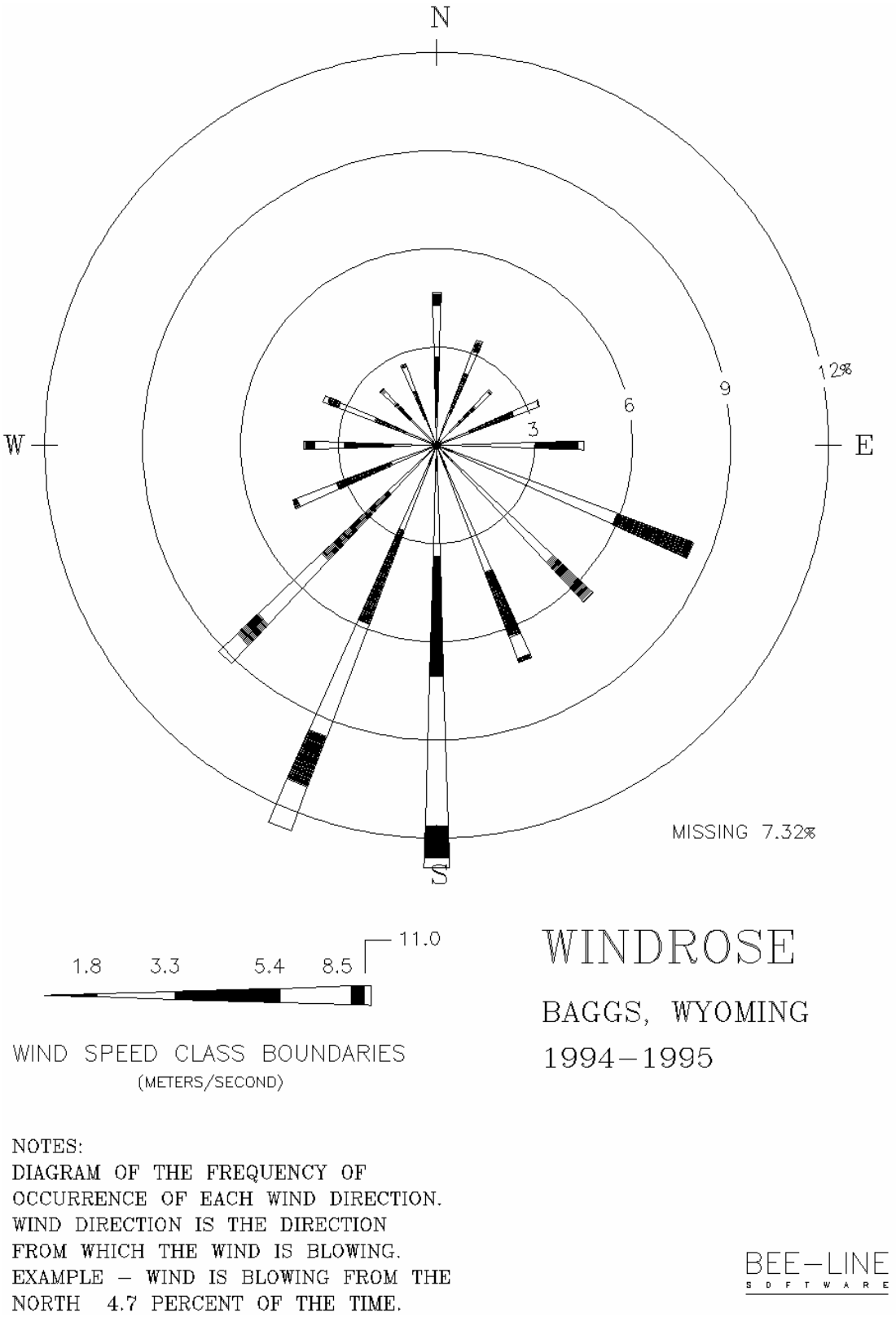


Figure 3-1. Wind Rose for the Brown Cow Pod Region.

Table 3-5 shows the frequency distribution of wind speed and atmospheric stability class. The atmospheric stability class is the measure of atmospheric turbulence, which directly affects pollutant dispersion. The stability classes are divided into six categories designated "A" (unstable) through "F" (very stable). The "D" (neutral) stability class occurs more than half of the time.

Table 3-5. Wind Speed and Stability Class Distribution.

Wind Speed (miles/hour)	Percent of Occurrence	Stability Class	Percent of Occurrence
0-4.0	6.4	A (unstable)	6.0
4.0-7.5	33.0	B	8.2
7.5-12.1	29.8	C	14.8
12.1-19.0	21.7	D (neutral)	56.6
19.0-24.7	5.4	E	9.9
Greater than 24.7	3.7	F (very stable)	4.5

3.2.2 Air Quality

The Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) set absolute upper limits for specific air pollutant concentrations at all locations where the public has access. Although specific air quality monitoring has not been conducted within the project area, regional air quality monitoring has been conducted. Air pollutants measured in the region for which ambient air quality standards exist include: carbon monoxide (CO), nitrogen dioxide (NO2), ozone, particulate matter less than 10 microns in effective diameter (PM10), particulate matter less than 2.5 microns in effective diameter (PM2.5), and sulfur dioxide (SO2). Background pollutant concentrations for these pollutants are compared to the WAAQS and NAAQS in Table 3-5.

As shown in Table 3-6, regional background values are well below established standards, the project area is designated as attainment for all criteria pollutants. These regional monitoring results also indicate that air quality conditions within the project area are likely to be very good, supported by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions. These factors generally contribute to relatively low ambient air pollutant concentrations.

Federal air quality regulations adopted and enforced by WDEQ-AQD limit incremental emissions increases to specific levels defined by the classification of air quality in an area as either Prevention of Significant Deterioration (PSD) Class I or Class II. Limitations on additional air pollution allowed in PSD Class I areas are very strict. Less stringent incremental air quality increases are allowed in PSD Class II areas. The Brown Cow Pod is classified as PSD Class II.

3.3 SOILS

Soil development is a function of parent material, living matter, climate, relief or topography, and time.

Parent Materials

Parent materials in the BCPA include chiefly the marine sandstones and shales of the Lewis Formation (Upper Cretaceous) and to a much lesser extent the fluvial sandstones and variegated mudstones of the Wasatch (Eocene) and Lance (Cretaceous) Formation. Slopewash debris and colluvium derived from those units also constitute parent materials for colluvial soils.

Table 3-6. Air Pollutant Background Concentrations, State and Federal Ambient Air Quality Standards (ug/m3)

Pollutant/Averaging Time	Measured Background Concentration	State and National Ambient Air Quality Standards
Carbon Monoxide (CO) [1]		
1-hour	3,336	40,000
8-hour	1,381	10,000
Nitrogen dioxide (NO_2) [2]		
Annual	3.4	100
Ozone [3]		
1-hour	169	235
8-hour	147	157
Particulate Matter (PM_{10}) [4]		
24-Hour	47	150
Annual	16	50
Particulate Matter ($PM_{2.5}$) [4]		
24-Hour	15	65
Annual	5	15
Sulfur dioxide (SO_2) [5]		
3-hour (National)	132	1,300
24-hour (National)	43	365
24-hour (Wyoming)	43	260
Annual (National)	9	80
Annual (Wyoming)	9	60

1 Background data collected by Amoco at Ryckman Creek for an 8-month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983).

2 Background data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period January-December 2001 (ARS 2002).

3 Background data collected at Green River Basin Visibility Study site, Green River, Wyoming, during period June 10, 1998, through December 31, 2001 (ARS 2002).

4 Background data collected by WDEQ-AQD at Emerson Building, Cheyenne, Wyoming, Year 2002.

5 Background data collected at LaBarge Study Area the Northwest Pipeline Craven Creek Site 1982-1983.

Living Matter

Living matter provides the biological community that changes inert rock material into soil. Under shrubs and grasses soils tend to have slight organic accumulations and different vegetative cover gives rise to different soil characteristics. Very wet soils tend to have more accumulation of organic material on the surface. The dominant vegetation in the BCPA is sage, which

commonly grows in patches or thickets. Growing between the patches of sage and along larger drainages, are desert grasses, greasewood, bunch grass, cactus, rabbit brush, moss, lichens, and a variety of wild flowers. The area is largely devoid of trees with the exception of juniper which grow on sandstone exposures at higher elevations.

Climate

Climate has a direct and indirect effect on soil development through its principal components, precipitation, temperature, humidity, wind, and sunshine. Precipitation promotes leaching and physical, chemical and biological activity and temperature affects bedrock by expansion, contraction and frost action. Humidity promotes plant growth. The climate of the project area is that of a semiarid windy desert. The annual precipitation ranges from about 7 to 14 inches including snow, and the annual temperature varies from about B30 degrees F during the winter months to more than 100 degrees F in summer. Wind is a very important component because it transports sand and to a lesser extent clay everywhere and this material is incorporated into the upper soil profile diluting organic material of a soils A horizon.

Relief

Relief or topography influences soils principally though its effect on microclimate and runoff. The BCPA is typical of a desert intermontane basin in that its physiography is dominated by: (1) hogbacks and strike valleys; (2) flat-topped stripped bedrock surfaces (strath surfaces or terraces); (3) pebble/gravel/cobble stream terraces; and (4) alluvial fan and slopewash deposit. Topography and slope are discussed in Section 3.2.

Time

The length of time for soils to form depends largely on other factors involved. Soils form more rapidly on sandstone than on granite, and more rapidly on sand than sandstone. A soil derived from granite will differ chemically from a soil derived from sandstone soil, and a soil formed on sandstone might closely resemble one formed on loose sand. Mature soils are in equilibrium with their surroundings, and begin to show the development of horizons. Very young soils lack horizons. In general, the best-developed (most mature) soils form on stable surfaces that are geomorphically at equilibrium with their surroundings and the highest of these stable surfaces are the oldest and will generally exhibit the thickest soil horizons. Soil horizonation is the development of different stratified textures and chemical properties that are ordered, from top to bottom, within the soil. The development of soil horizons is largely the result of translocation; that is, the depletion (eluviation) of the topsoil of some elements (e.g., clay, iron oxides), and their concentration (illuviation) in the subsoil.

3.3.1 Project Area Soils

Soils within the BCPA occur in Wyoming Soil Zone 9 as defined by Munn (1998)--intermontane basin, frigid and aridic. Baseline soils information was extracted from several sources, including BLM in house reports and the University of Wyoming Internet Map Server (http://www.sdvc.uwyo.edu) and supplemented by field survey.

Two Munn Soil Map Units: WY34 Ustic Haplargids and Ustic Natrargids, fine-loamy, frigid and WY35 Typic Natrargids and Typic Torriorthents, fine, frigid, and a single Stratsgo soil unit, the Delphill-Blazon-Landspring (WY138) Association is mapped in the BCPA. The Delphill-Blazon-Landspring is composed of the following components:

Landspring 15%, fine sandy loam, moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures. Well drained.

Delphill 25% loam, slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures. Well drained.

Blazon 20% loam, Blackhall 10% sandy loam, Rentsack 10%, Moyerson 10% silty clay loam, Rock Outcrop 5% unweathered bedrock WINT 5%

Blazon, Blackhall, Rentsack, Moyerson, Wint components and Rock Outcrop are generally clayey, have a high water table, or are shallow to an impervious layer. All except Wint, which is somewhat excessively drained, are well drained with very slow infiltration rates

Winterfeld and Bown (2003) mapped four specific geomorphic soil types within the BCPA: (1) *Gravel Terraces (GT)* with minimal soil development occur atop the highest points of the area; (2) *Residual-Colluvial soils* occur on steeper slopes and are underlain at a shallow depth by bedrock; (3) *Upland Slope Soils* are developed in less steep, more stable areas; and (4) *Strath Surface Soils* occur on remnant terraces formed on underlying bedrock. Soil sampling of these soil types did not reveal impervious layers as indicated by Stratsgo mapping.

Specific characteristics of these four soils are discussed below and a map of the distribution of the soil types is provided in Figure 3-2.

Gravel Terraces

Gravel terraces occur in the BCPA at an elevation of about 7,120 to 7,140 feet along the Deep Creek Rim and an unnamed hill in the NW 1/4 of Sec 24, T14N, R91W on top of the Lewis, Lance, and Wasatch formations. The terraces are formed by small boulder, cobble, as well as gravel clasts. The clasts are composed chiefly of Precambrian age igneous and metamorphic rocks.

Upland Slope Soils

Upland Slope Soils are shallow to moderately thick soils, that occur on gentle to moderate slopes, are very permeable and well-drained, are generally noncalcareous, and base-neutral loamy sands, sandy loams and sandy clay loams. They are developed on sloping surfaces on bedrock of the Lance Formation and Lewis Shale at elevations ranging from 6,680-6,942 feet, and on slopes varying from 1-5%.

Strath Surface Soils

Strath Surface Soils are medium thickness soils that occur on gentle-moderate slopes, are well-drained, slightly to moderately calcareous, slightly acidic, loamy sand, sandy loam and clay. They are developed on lower level stripped surfaces (bedrock, or strath terraces), at elevations of about 6,720-7,080 feet on slopes of 0-3%.

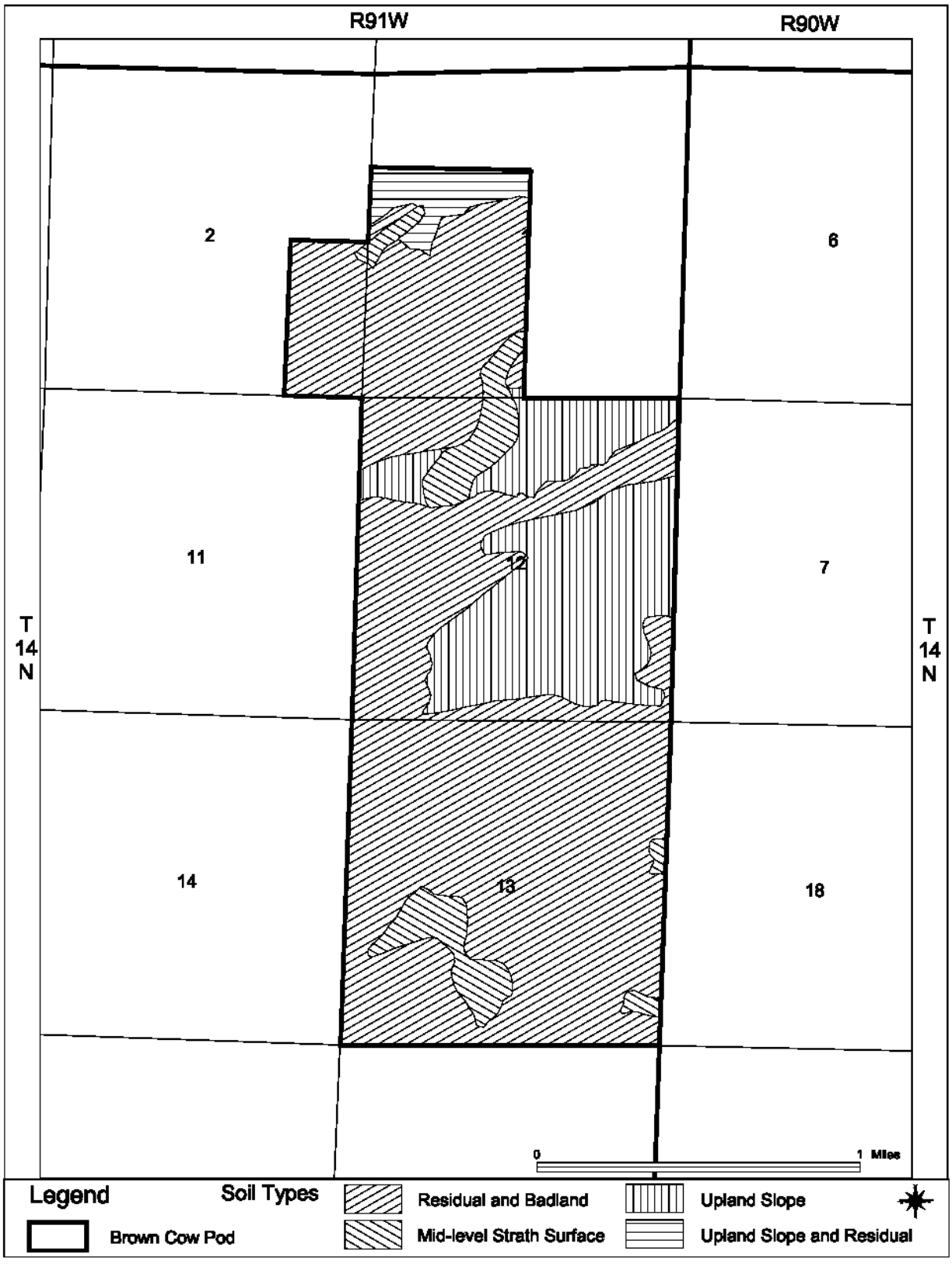


Figure 3-2. Soils Map of the BCPA.

Residual Colluvial Soils

Residual Colluvial Soils are shallow to deep soils that occur on gentle to steep slopes, are generally poorly-drained. They occur at all elevations within BCPA. Residual colluvial soils range from Apopcorn@-like crusts on mudstones and shales to accumulations of sandstone boulders at the bases of cliffs. Most of these soils, however, occur as thin zones of weathered, dislodged, or partially disaggregated bedrock on all slope gradients. The texture and composition of this soil varies with, and is nearly identical to, the bedrock formation it is developed on.

3.3.2 Erosion

Flowing water causes the erosion of soil material and can cause soil and geologic hazards associated with mass movement. Part of the process of water erosion involves detachment of soil material by the impact of raindrops. Loosened soil material is then carried off in suspension in runoff. Four kinds of water erosion are generally recognized sheet, rill, gully, and pipe (tunnel) erosion.

Sheet erosion involves the removal of soil from an area without the development of conspicuous channels. The channels instead are numerous and unstable in that they enlarge and straighten as the volume of runoff increases. Sheet erosion can be serious on soils with slope gradients of only 1 or 2 percent, but becomes more serious as gradient increases.

Rill erosion involves the removal of soil through cutting of many small, but conspicuous channels where runoff concentrates. The channels are small enough though that they are easily obliterated by tillage.

Gully erosion occurs when water cuts down into the soil along a line of flow. Gullies form in exposed natural drainages, in animal trails, in vehicle ruts, and below broken man-made terraces or stock ponds. Gullies cannot be obliterated by ordinary tillage and deep gullies cannot be easily crossed. The maximum depth to which gullies cut is determined by resistant layers in the soil, by bedrock, or by the local base level. Many gullies develop headward; that is, they extend up the slope, as the gully deepens in its lower part.

Piping or tunnel erosion can occur in soils with subsurface horizons or layers that allow water to pass more freely than the surface horizon or layer. Freely flowing water enters the soil through surface-connected macro-pores such as rodent burrows. Soil material entrained in the moving water moves downward within the soil and may move out of the soil completely if there is an outlet. The result is the formation of pipes or tunnels which enlarge and coalesce and can eventually collapse. Piping is also favored by the presence of appreciable exchangeable sodium.

To assess a water erosion problem or potential problem soil characteristics and rainfall and runoff factors must be considered. The impact of raindrops can break up soil aggregates and disperse soil material. Very fine sand, silt, clay and organic matter can be removed easily by raindrop splash and runoff, whereas greater energy or runoff is needed to remove sand and gravel particles. Soil movement caused by rainfall is usually greatest and most noticeable during short-duration, high intensity storms, however, less spectacular, long-lasting and less-intense storms can also result in significant soil movement. The effect of runoff can be compounded by soils that have reduced infiltration capacity.

BCPA soils are also eroded by wind action. Fine sands, loamy sands, and coarse sandy loams are most susceptible to erosion by wind. Overall wind erosion potential is moderate, but ranges from slight to severe.

Soil Erodibility

Soil erodibility is an estimate of the ability of soils to resist erosion, based on its physical characteristics. In general soils with faster infiltration rates, greater organic matter and improved soil structure have a greater resistance to erosion. Sand, sandy loam and loam textured soils tend to be less erodible than silt, very fine sand, and certain clay textured soils. Decreased infiltration and increased runoff can result from compacted subsurface soil layers. A decrease in infiltration can also be caused by a formation of a soil crust, which seals off the surface. A soil crust might decrease the amount of soil loss from sheet or rain splash erosion, but it might cause a corresponding increase in the amount of runoff water and contribute to greater rill erosion problems.

Past erosion also has an effect on a soils erodibility. Exposed subsurface soils on eroded sites tend to be more erodible than the original soils, because of their poorer structure and lower organic matter. Lower organic matter supports lesser vegetation and promotes poorer vegetative cover, which provides less protection for the soil.

Slope Gradient and Length

The steeper the slope of the land, the greater the amount of soil loss from erosion by water. Soil erosion by water also increases as slope length increases due to the greater accumulation of runoff. Consolidation of small slopes into larger ones results in longer slope lengths with increased erosion potential, due to increased velocity of water, which permits greater scouring.

Vegetation

Soil erosion potential is increased if the soil has little or no vegetative cover. Plant cover protects the soil from raindrop impact and splash, tends to slow down the movement of surface runoff and allows excess surface water to infiltrate, where part of it is absorbed by roots. The erosion-reducing effectiveness of vegetative cover depends on the type, extent and quantity of the cover.

3.3.3 Soil Hazards and Limiting Factors

Some soil properties hold significance for the engineering properties of the soils, and can limit the utility of specific soilsCin particular areasCfor a variety of uses. In general, the utility of a particular soil for a specific use is based on knowledge of the climate and existing or potential geologic hazards of the area under study, as well as a combination of one or more of the following soil properties: (1) slope, or surface inclination, on which the soil formed; (2) the permeability of the soil, both at the surface (as this affects runoff potential) and at depth (as this may affect the development of mass-wasting, piping, soil shifting, and soil collapsibility); (3) vegetation cover on the existing soil; (4) the soil parent material; and (5) the overall clay and type of clay content of the soil.

Several hazards relate to soil type. Chief among these are the relatively rapid mass-wasting effects of earth flow and slumping. Earth flow commonly results from the saturation of soils on

slopes and the collection of water and ensuing loss of cohesion along the plane separating the subsoil from the soil parent material (for example, in the case where a permeable, waterlogged soil might lie on a steeply sloping shale underlain by impermeable sandstone). Similarly, rapid rotational slumping can occur when soils and underlying parent materials are undercut by streams, or when the toe of a mass of soil or sediment is supersaturated or eroded away or removed by excavation. Both mass-wasting and slumping result from a combination of soil parameters (slope, permeability, nature of parent materials) acting in conjunction with two climatic aspects: precipitation and its spacing throughout the year.

Earth flow and rotational slumping can occur within spans of days or hoursCeven secondsChowever, other mass-movements take place over a period of weeks or months to years. Soil creep is the slow, downward movement of soils or soil materials on slopes. Creep can affect residual and colluvial soils as well as soils with sharply marked horizons, and this process results in phenomena as divergent as the piling-up of boulders at the bottom of an outcrop hill to the downhill tilt of trees. Soil collapse results from the frequent wetting and drying of mixed layer illitic/smectitic (expanding) clays in soils with thick (generally texturally unsorted) subsurface horizons rich in those clay minerals. Soil piping (tunneling) is especially prevalent in badland regions with large volumes of mudstone (an unsorted mixture of sand, silt, and clay), but is also common in soils rich in clay but with relatively unsorted textures. Pipes can collapse and piping is a major factor in the development of gullying by means of headward erosion along established stream courses. Piping, collapse, and headward erosion can occur on slopes of less than 1% grade, however, extensive or rapid gullying generally requires significant water runoff on steeper, less permeable soils.

In the BCPA, incipient creep of Residual Colluvial Soils is common on the dip slopes of the steeper hogbacks, in which colluvial debris (including sandstone blocks and shale bundles) has migrated downslope from its place of origin. Soil piping and headward erosion of gullies are ubiquitousCoccurring in to some degree everywhere in the project area and in all arid and semiarid areas. Gullying in the areas surrounding the BCPA is clearly exhibited below previously breached stock tanks and along slopes of varying degree along existing rutted, two track roads and animal trails.

3.4 WATER RESOURCES

Water resources in the project area include both surface water and groundwater. Surface waters include the perennial Little Snake River, the intermittent to perennial Muddy Creek, ephemeral Dry Cow Creek and several unnamed ephemeral channels and man-made ponds. Groundwater resources include free water contained within relatively shallow aquifers that are or could be utilized for culinary, agricultural, and/or industrial purposes. The occurrence and distribution of water resources in the project area are dependent on climate, soils, and structural geology.

3.4.1 Precipitation and Climate

The project area occurs in a continental dry, cold-temperature-boreal climate (Trewartha 1968). This climate is primarily characterized by a deficiency of precipitation (i.e., evaporation exceeds precipitation). Climatological data from the Baggs Station (No. 480484) is most relevant to the characterization of water resources in the BCPA. A brief description of the climatic conditions in the project area is presented below.

Temperature: The area generally has cold temperatures where fewer than eight months have an average temperature greater than 50°F, with hot summer days and cool summer nights, but bitterly cold winters. The average annual temperature is 42°F (WRCC 2000). The average daily low and high temperatures in January are 5°F and 33°F, respectively. In contrast, the average daily low and high temperatures in July are 48°F and 86°F, respectively. Data from the nearby Dixon recording weather station indicates that the average number of days per year with a minimum temperature at or below 32°F is 222, and the average number of days per year with a maximum temperature at or above 90°F is 3 (Martner 1986).

Precipitation: Mean annual precipitation is approximately 11 inches. Precipitation occurs throughout the year with a peak in May. The majority of precipitation falls as rain from frontal systems and thunderstorms. In regard to intensity of rainfall events, the estimated 50-year, 24-hour maximum precipitation event is 2.3 inches (Miller et al. 1973). Average annual snowfall depth is approximately 41 inches. Greatest snowfall usually occurs in December and January. Due to the effects of ablation and snow drifting, a discontinuous snow cover is usually present during the winter.

Other Climate Characteristics: Mean annual evaporation ranges from 55 inches (lake) to 75 inches (pan) and potential annual evapotranspiration is 20 inches (Martner 1986). Compared to the average annual precipitation of 11 inches, this gives an average annual deficit of approximately 9 inches. These meteorological and Climatological-*/ characteristics of the project area combine to produce a predominantly dry climate where evaporation exceeds precipitation.

3.4.2 Surface Water

3.4.2.1 Quantity

The project area is located within the Little Snake River drainage basin. Smiley Draw, an ephemeral tributary to Muddy Creek, is found within the project area. Muddy Creek is an intermittent to perennial stream that carries water most of the year to its confluence with the Little Snake River near Baggs.

The Little Snake River drains the largest basin in the Yampa River basin (Driver et al. 1984). It joins the Yampa River in northwest Colorado. The Yampa River flows southwest to its confluence with the Green River in Utah. The Green River drains to the Colorado River, which drains to the Pacific Ocean.

Annual peak flows for all streams within the project area generally occur in late May through early June in response to snowmelt. Baseflows are reached in the fall and continue through March until low elevation snowmelt initiates the rising limb of the hydrograph. A United States Geological Survey (USGS) continuous gaging station on the Little Snake River near Dixon recorded a maximum peak discharge of approximately 13,000 cfs on May 16, 1984, while minimum flows of near 0 cfs occur in late summer and early fall at the end of the irrigation season (Druse et al. 1993).

3.4.2.2 Quality

There are six USGS surface water quality stations in and around the project area, including two on the Little Snake River, two on Muddy Creek, and one each on Cow Creek and Dry Cow Creek. Average sample data from each of the stations are shown on Table 3-7. The data

suggest that surface waters in the project area are of moderately high pH (8.1 to 9.2) and moderate dissolved oxygen (9 to 11 mg/l).

Generalizations among other sample parameters are made difficult by high variability between stations. Trends become apparent, however, when the stations are divided according to the surface water designation. Table 3-8 averages select parameters from Table 3-7 into ephemeral, intermittent, and perennial classes.

Water quality in ephemeral streams is represented by the Smiley Draw monitoring station. The ephemeral quality is characterized by high TDS (1,620 mg/l) and sodium and bicarbonate dominance as the major dissolved ions. Sodium dominance is reflected in the relatively high sodium adsorption ratio (SAR) of 14.1.

Table 3-7. Surface Water Quality in the Project Area

	ce Water Quality Station[1]				
	Smiley Draw	**Muddy Creek**	**Muddy Creek**	**Little Snake River**	**Little Snake River**
Station Number	**1409018F**	**09258900**	**09259000**	**09257000**	**09259050**
Sample Period	**1988-1989**	**1976-1978**	**1957-1991**	**1957-1988**	**1980-1997**
Number of Samples[2]	2	3	41	107	100
pH, standard units	8.24	8.6	8.2	8.1	8.1
Conductance, mmhos/cm	1005	1350	966	259	366
Total Dissolved Solids[3]	598	913	630[4]	158	243
Suspended Solids	61	6198	3191	154	228
Turbidity	NM	1260 NTU	NM[5]	13 JTU	167 NTU
Hardness as $CaCO_3$	0	315	270	111	151
Oxygen	NM	11	10	9	10
Sodium	1416	200	286	11	26
Calcium	0.9	54	42	30	34
Magnesium	0.5	44	40	8	12
Potassium	2.4	7	9	2	2
Bicarbonate	3698	373	308	159	190
Carbonate	11.3	0.5	NM	0	1
Sulfate	1.05	380	320	25	54
Chloride	5.9	65	32	3	2
Fecal coliform, #/100 ml	NM	NM	8	NM	351

[1] Data available on the Internet at http://www.wrds.uwyo.edu
[2] Total number of grab samples analyzed; not every parameter was analyzed in every sample
[3] All units are mg/l except as noted
[4] TDS calculated from specific conductance due to lack of sample data
[5] NM = not measured

Table 3-8. Surface Water Quality Comparison

	Stream Class		
	Ephemeral	**Intermittent**	**Perennial**
Representative Surface Waters	Smiley Draw	Muddy Creek	Little Snake River
Total Dissolved Solids[1]	598	772	201
Sodium	1,416	243	19
Calcium	0.9	42	10
Magnesium	0.5	48	32
Potassium	2.4	8	2
Bicarbonate	3,698	341	175
Carbonate	11.3	0.5	0.5
Sulfate	1.05	350	40
Chloride	5.9	49	3
SAR	14.1	6.1	0.7

[1] All units are mg/l except SAR, which is unitless

The Wyoming Department of Environmental Quality (WDEQ) classifies Wyoming streams according to quality and degree of protection. Four classes have been identified as follows (WDEQ 2000):

Class 1: Those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. Considerations employed during the designation of these waters include water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish and wildlife, the presence of significant quantities of developable water and other values of present and future benefit to the people.

The two Muddy Creek monitoring stations represent intermittent surface water quality. Muddy Creek has actually been classified as an intermittent to perennial stream (Higley 1996), but its classification has been simplified for Table 3-8. Intermittent streams in the project area are characterized by moderate TDS (772 mg/l) and the replacement of bicarbonate by sulfate as the major anionic species. Sodium dominance is reflected in the SAR of 6.1, but is less marked than in ephemeral flows.

Two Little Snake River stations monitor perennial water quality in the project area. Perennial quality is characterized by a significantly reduced TDS (201 mg/l) from intermittent and ephemeral streams. Sodium is also displaced by calcium as the major cationic species. This is reflected in the low SAR (0.7 mg/l).

Class 2: Surface water other than Class 1 determined to be presently supporting game fish, have the hydrologic and natural water quality potential to support game fish, or include nursery areas or food sources for game fish.

Class 3: Those surface waters, other than those classified as Class 1, which are determined to be presently supporting nongame fish only, have the hydrologic and natural water quality potential to support nongame fish only, or include nursery areas or food sources for nongame

fish only.

Class 4: Those surface waters, other than those classified as Class 1, which are determined to not have the hydrologic or natural water quality potential to support fish and include all intermittent and ephemeral streams.

Smiley Draw is classified as a Class 3 stream. The Little Snake River and Muddy Creek are designated Class 2. The portion of the Little Snake River below Baggs has been further classified as a secondary body contact recreation water. This classification adds fecal coliform restrictions normally reserved for Class 1 water bodies.

3.4.2.3 Waters of the U.S.

Most of the surface water features in the project area qualify as Waters of the United States. Waters of the U.S. include territorial seas; interstate waters; navigable waterways (such as lakes, rivers, and streams) special aquatic sites and wetlands that are, have been, or could be used for travel, commerce, or industrial purposes; tributaries; and impoundments of such waters. All channels that carry surface flows and that show signs of active water movement are waters of the U.S. Similarly, all open bodies of water (except ponds and lakes created on upland sites and used exclusively for agricultural and industrial activities or aesthetic amenities) are waters of the U.S. (EPA 33 CFR § 328.3(a)). Such areas are regulated by the EPA and Department of Army Corps of Engineers (COE). As described previously, many of the drainage channels identified on the USGS topographic maps are vegetated swales which are not considered to be waters of the U.S. by the COE. Any activity that involves discharge of dredge or fill material into or excavation of such areas is subject to regulation by the COE pursuant to Section 404 of the CWA. Activities that modify the morphology of stream channels are also subject to regulation by the State Engineer's Office (SEO) of Wyoming. Special aquatic sites and wetlands are discussed in greater detail in the Vegetation Section 3.5.

3.4.3 Groundwater

The project area occurs in the Colorado Plateau and Wyoming Basin groundwater regions described by Heath (1984); the Upper Colorado River Basin groundwater region described by Freethey (1987); or Washakie Basin described by Collentine et al. (1981) and Welder and McGreevy (1966). Groundwater resources include deep and shallow, confined and unconfined aquifers. Site-specific groundwater data for the project area are limited. Existing information comes primarily from oil and gas well records from the Wyoming Oil and Gas Conservation Commission, water-well records from the Wyoming SEO, and from the USGS (Weigel 1987). Regional aquifer systems pertinent to the project area are discussed by Heath (1984), Freethey (1987), and Driver et al. (1984). Basin-wide evaluations of hydrogeology specific to the project area have been investigated by Collentine et al. (1981). The most relevant hydrogeologic study specific to the project are is by Welder and McGreevy (1966).

3.4.3.1 Location and Quantity

Groundwater in the Washakie Basin is generally found in artesian aquifers, although it is also present in unconfined alluvial valleys and in isolated, saturated outcrops (Welder and McGreevy, 1966). Table 3-9 summarizes the water-bearing characteristics of the geologic formations present in the project vicinity. Of the geologic units listed in the table, Welder and McGreevy (1966) suggest that those capable of producing the greatest quantity of water include the following: Quaternary alluvium; Tertiary deposits in the Browns Park, Wasatch, and Fort

Union Formations; Cretaceous formations, including Mesaverde, Frontier, and Cloverly; the Sundance-Nugget Sandstone of the Jurassic Age; and the Tensleep and Madison Formations of the Paleozoic Era. Following is a brief description of the major aquifers of the project area.

Table 3-9. Water-Bearing Characteristics of Geologic Formations in the Washakie Basin[1]

Era	Period	Geologic Unit	Thickness	Hydrologic Properties		
				Well Yield (gpm)	Transmissivity (gpd/ft)	Permeability (gpd/ft^2)
Cenzoic	Quaternary		0-70	<30	168-560	21-62
	Tertiary	Browns Park Fm.	0-1,200	3-30	100-10,000	NM
		Wasatch Fm.	0-4,000+	30-50	150-10,000	0.04-18.2
		Fort Union Fm.	0-2,700+	3-300	<2,500	<1
Mesozoic	Upper Cretaceous	Lance Fm.	0-4,500+	<25	<20	0.007-8.2
		Fox Hill Sandstone	0-400	NM	10-20	0.9
		Lewis Shale	0-2,700+	2-25[2]	0.03-50	0.002-0.9
		Almond Fm.[3] (Mesaverde Group)	0-600	NM	2,000-8,000	100-800
		Mesaverde Group (excl. Almond Fm.)	300-2,800	<100	<3,000	NM
		Baxter Shale (incl. Steele Shale and Niobrara Fm.)	2,000-5,000+	Major regional aquitard between Mesaverde and Frontier aquifers. Hydrologic data unavailable.		
		Frontier Fm.	190-1,1900+	1-100+	<100-6,500	NM
	Lower Cretaceous	Mowry Shale	150-525	Regional aquitard. Hydrologic data unavailable.		
		Thermopolis Shale (incl. Muddy Sandstone)	20-235	Considered a leaking confining unit. Hydrologic data unavailable.		
		Cloverly Fm.	45-240	25-120	340-1,700	1-177
	Upper Jurassic	Morrison Fm.	170-450+	Confining unit between Cloverly and Sundance-Nugget aquifers. Hydrologic data unavailable.		
		Sundance Fm.	130-450+	27-35	12-3,500	NM
	Lower Jurassic-Upper Triassic	Nugget Sandstone	0-650+	35-200	<2,166	NM
	Triassic	Chugwater Fm.	900-1,500+	Confining unit between Sundance-Nugget and Paleozoic aquifers. Hydrologic data unavailable.		
Mesozoic-Paleozoic	Lower Trassic Permian	Phosphoria Fm. (incl. Goose Egg Fm.)	170-460	Probable poor water-bearing capabilities due to low permeability. Hydrologic data unavailable.		
Paleozoic	Permian-Pennsylvanian	Tensleep Fm.	0-840+	24-400	1-374	NM
	Lower and Middle Pennsylvanian	Amsden Fm.	2-260+	Probable poor water-bearing capabilities due to predominance of fine-grained sediments.		
	Mississippian	Madison Limestone	5-325+	<400	Variable	NM
Paleozoic	Cambrian	Indef. rocks	0-800+	4-250	NM	NM
Precam-brian	N/A	Igneous and metamorphic rocks	Unknown	10-20	1<1,000	Generally high in upper 200 ft of unit

[1] Adapted from Table V-1 in Collentine et al. (1981). Formations not encountered in project area have been omitted.
[2] From well completion records on file with SEO
[3] From Atlantic Rim CBM well test data

Quaternary aquifers in the Washakie Basin are comprised of alluvial deposits along major floodplains and isolated windblown and lake sediments. The major Quaternary aquifers in the

vicinity of the project area occur in alluvial deposits along the Little Snake River and Muddy Creek, and in windblown segments along the Sand Hills. Groundwater flow within the sandy Quaternary aquifers is typically downward toward permeable underlying formations (Collentine et al. 1981).

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

Cretaceous aquifers in the project area occur in three major geologic formations. From youngest to oldest they are the Almond Formation of the Mesaverde Group, the Frontier Formation, and the Cloverly Formation. The Mesaverde is exposed along the eastern slopes of the project area, although a mantle of Tertiary deposits unconformably overlies large areas of the Late Cretaceous strata. No outcrops of the Frontier or Cloverly Formations are present within the project area. The Cretaceous aquifers are composed of interbedded sandstone, shale, and coal and have demonstrated considerable yields in existing wells (Collentine et al. 1981). Recharge to these water-bearing strata is principally from precipitation infiltration and the movement of groundwater from the overlying Tertiary sediments at their outcrops and subcrops along the elevated eastern margin of the Washakie Basin. Regional groundwater flow direction is toward the west in response to the structural dip and surface topography. The Almond Formation coal seams, which are the targeted reservoir for the Brown Cow project, are classified as confined to semi-confined aquifers because they are bound by impervious to semi-pervious layers of shale and siltstone. CBM test wells completed in the Almond Formation coal seams located within the project area exhibit shut-in hydrostatic pressures indicative of flowing artesian conditions. This supports the potential for groundwater discharge in the form of springs along the eastern margin of the Washakie Basin. In fact, the Mesaverde Group is a source of many springs along the Atlantic Rim and flowing wells can probably be obtained by completing wells in the Mesaverde (USGS 1981).

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

The final two major aquifers occur in Paleozoic Era rocks. The Tensleep Formation from the Pennsylvania Age consists of fine- to medium-grained sandstone between confining layers of the Chugwater Formation (Triassic) and the Amsden Formation (Pennsylvanian) (Collentine et al. 1981). The Madison aquifer is comprised of limestone and dolomite bordered on the top by the fine-grained Amsden sediments and on the bottom by Cambrian rocks. Wells completed within both of these Paleozoic aquifers have demonstrated yields up to 400 gpm. Groundwater flow is west-southwest in the project area.

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

An SEO records review revealed 13 permitted wells in the project area. They are apportioned

as follows: 4 stock, 1 industrial, and 8 miscellaneous. Of the 13 permitted wells, 12 reported positive yields. Geologic units and yields of the 30 wells are listed in Table 3-10. The majority of these wells were developed in the Upper Cretaceous age Lance Formation, Lewis Shale and Mesaverde Group, and the Quaternary age Alluvium.

3.4.3.2 Quality

Groundwater quality is related to the depth of the aquifers, flow between aquifers, and the rock type. Groundwater quality is variable in the BCPA. TDS, an indicator of salinity, is generally less than 2,000 mg/l (slightly saline to saline) in the project area, with local concentrations of less than 500 mg/l (considered fresh).

Because most existing groundwater wells and the proposed CBM wells of the Brown Cow project occur in Mesaverde aquifers, a detailed Mesaverde groundwater quality analysis has been included. Table 3-11 lists the major cation and anion composition of Mesaverde groundwater in the project area. Sodium and bicarbonate dominate as the major ionic species. Collentine et al. (1981) offer three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction resulting in bicarbonate generation; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde or adjacent aquifers.

Table 3-10. Existing Groundwater Wells in Project Vicinity

Formation	Number of Wells	Yield[1] (gpm)
Alluvium	5	1.5-20
Browns Park Formation	2	8-25
North Park Formation	2	2-25
Wasatch Formation	2	5-10
Fort Union Formation	2	11.5-20
Lance Formation	4	2-7.5
Lewis Shale	7	1–25
Mesaverde Group	5	2-20
Unknown	1	2

[1] obtained from SEO well completion permits

Table 3-11. Major Ion Composition of Mesaverde Groundwater

Cation	Concentration (mg/l)	Anion	Concentration (mg/l)
Sodium	513	Bicarbonate[2]	1,284
Calcium	7	Carbonate[1]	9
Magnesium	3	Chloride	56
Potassium[1]	5	Sulfate	11

[1] potassium and carbonate concentrations were not measured in CBM samples; values represent composite of USGS data for Mesaverde wells in project vicinity (USGS, 1980)
[2] bicarbonate was not measured; value shown was calculated from ion balance

Table 3-12 presents a comparison of Mesaverde groundwater with WDEQ suitability standards. The composite results of the three CBM wells analyzed indicate water that is generally suitable for livestock use, but is unsuitable for domestic supply or irrigation without treatment or dilution. Parameters with measured concentrations in excess of Wyoming drinking water standards

include iron, manganese, and TDS. Calculated SAR (47.3) and residual sodium carbonate (41 meq/l) exceed the agriculture suitability limits of 8 and 1.25, respectively. Unless the water were mixed with an existing water source of lower sodium and bicarbonate and lower total salinity, irrigation would result in reduction in infiltration in the affected soil.

Table 3-12. Groundwater Quality for Mesaverde Wells in Project Area

Parameter	Concentration[1]	Unit	Groundwater Suitability Standards[2]		
			Domestic	Agriculture	Livestock
Aluminum	0.045	mg/l	---	5	5
Ammonia	0.9	mg/l	0.5	---	---
Arsenic	0.0006	mg/l	0.05	0.1	0.2
Barium	0.36	mg/l	1	---	---
Beryllium	<0.002	mg/l	---	0.1	---
Boron	0.25	mg/l	0.75	0.75	5
Cadmium	<0.0002	mg/l	0.01	0.01	0.05
Chloride	56	mg/l	250	100	2000
Chromium	0.002	mg/l	0.05	0.1	0.05
Cobalt	NM	mg/l	---	0.05	1
Copper	0.03	mg/l	1	0.2	0.5
Cyanide	<5	mg/l	0.2	---	---
Fluoride	1.0	mg/l	1.4 - 2.4	---	---
Hydrogen Sulfide	NM	mg/l	0.05	---	---
Iron	3.06	mg/l	0.3	5	---
Lead	0.004	mg/l	0.05	5	0.1
Lithium	NM	mg/l	---	2.5	---
Manganese	0.102	mg/l	0.05	0.2	---
Mercury	<0.0004	mg/l	0.002	---	0.00005
Nickel	0.041	mg/l	---	0.2	---
Nitrate	<0.03	mg/l	10	---	---
Nitrite	<0.03	mg/l	1	---	10
Oil & Grease[3]	<1	mg/l	Virtually Free	10	10
Phenol	65	mg/l	0.001	---	---
Selenium	<0.005	mg/l	0.01	0.02	0.05
Silver	<0.003	mg/l	0.05	---	---
Sulfate	11	mg/l	250	200	3000
TDS	1,322	mg/l	500	2000	5000
Uranium	NM	mg/l	5	5	5
Vanadium	NM	mg/l	---	0.1	0.1
Zinc	0.3	mg/l	5	2	25
pH	8.2	s.u.	6.5 - 9.0	4.5 - 9.0	6.5 - 8.5
SAR	47.3	<none>	---	8	---
RSC[4]	41	meq/l	---	1.25	---
Radium 226 + Radium 228	0.9	pCi/l	5	5	5
Strontium 90	NM	pCi/l	8	8	8
Gross alpha	NM	pCi/l	15	15	15

[1] boron, ammonia, fluoride, and nitrate/nitrite concentrations from 11 Mesaverde groundwater wells (USGS, 1980); remaining concentrations from three Mesaverde CBM wells in project area

[2] from WDEQ Water Quality Rules and Regulations, Chapter VIII

[3] reported as total petroleum hydrocarbons

[4] residual sodium carbonate calculated from measured calcium and magnesium concentrations and calculated bicarbonate concentration

The confining beds slow the movement of water, and hence, movement of potential contaminants between aquifers. Although there is some downward movement of the water from the surface units, most of the groundwater movement, if any, is upward from the deeper aquifers to the shallower aquifers. Concerns have been raised for several gas field projects in southwest Wyoming regarding groundwater quality degradation due to the piercing of confining layers and vertical and horizontal migration and mixing of water of variable qualities. Data suggesting this is a current problem in the project area are not available. Improperly completed injection wells could be a potential source of contamination.

3.5 VEGETATION, WETLANDS, and NOXIOUS WEEDS

3.5.1 Introduction

The BCPA is located in Sections 1, 2, 12 and 13, T14N:R91W of the BLM-Rawlins Field Office Resource Area and encompasses about 1,570 acres. A total of 12 CBM wells are proposed for development on the BCPA. Ancillary facilities proposed for development within the BCPA include access roads, gas and water pipelines, two injection wells, and two pumping stations.

3.5.2 Vegetation Cover Types

The BCPA is generally located on the north and east flank of Wild Horse Butte and within the area commonly known as Wild Horse Basin. Topography of the area is highly variable with numerous hillsides, gullies and draws which have produced a diverse mix of vegetation cover types. A vegetation cover-type map of the project area was obtained from the Wyoming Natural Resources [WNR] Clearinghouse (2003) and used to delineate primary and secondary land cover type boundaries. Information for secondary vegetation types and plant species of concern was also provided by the Wyoming Natural Diversity Database (WYNDD 2003). The relevant portion of the land cover-type layer from the Wyoming Gap Analysis Project (Merrill et al. 1996) was downloaded as an ArcView shapefile from the University of Wyoming's Geographic Information Science Center.

The primary plant cover types mapped by GAP are Wyoming big sagebrush (*Artemesia tridendata* ssp. *wyomingensis*) which covers about 1,245 acres (about 80% of the 1,570 acre BCPA), and Juniper woodland (Utah juniper, *Juniperus osteosperma*) which was mapped at 326 acres and represents about 20% of the total project land area. Secondary vegetation cover types were mapped as Wyoming big sagebrush at 326 acres (20%) and Juniper woodland at 1245 acres (80%).

The GAP cover-type layer was derived from Landsat satellite imagery. Resolution of the layer is 100 hectares (248 acres) for uplands and 40 hectares (100 acres) in riparian areas and wetlands (Merrill et al. 1996). Given the resolution of the GAP layer, small stands of some cover-types may fail to appear on the map. For example, small linear stands of basin big sagebrush commonly associated with ephemeral draws as well as small cushion plant communities are too small to register at this resolution.

In addition to Wyoming big sagebrush, an August, 2003, on-site inspection revealed that varying densities of other species and subspecies of sagebrush are also present on the BCPA, including small stands of mountain big sagebrush (*Artemesia tridendata* var. *pauciflora*), Vasey big sagebrush (*A. tridendata* var. *vaseyana*), black sagebrush *(A. nova*), basin big sagebrush (*A. t*. ssp. *tridentada*) and plains silver sagebrush (*A. cana* ssp. *cana*). Much of the big

sagebrush habitat in the BCPA is moderately old and exhibits decadence inherent with age. The understory of these older vegetation areas is showing moderate to severe decline.

The BCPA encompasses the northern portion of a very unique and large alkali sagebrush (*Artemesia longiloba*) community beginning in Section 1 (UTM coordinates E283735 N4564317 NAD27) and extending south to the eastern flank of Muddy Mountain where the community becomes nearly a pure stand and occupies several thousand acres. The species is sometimes referred to as "early sagebrush" because of its early seasonal development. The majority of these plants had produced seeds and were senescent by late July of the 2003 growing season. This taxa was found in suitable habitats (clay soils with high cation exchange capacity below 7,500 feet) throughout the entire Atlantic Rim Project Area in various densities during the 2003 field investigation.

Greasewood (*Sarcobatus vermiculatus*) is the dominant shrub along several draw bottoms on the BCPA and becomes intermixed with sagebrush in various densities up to about 7,100 ft. elevation demonstrating its unique ability to grow on different sites. Both the native rabbitbrush species (*Chrysothamnus nauseosus and C. viscidiflorus)* are present on the BCPA and can be found at all elevations, including the summit of Wild Horse Butte (7255 ft.). Several small saltbush (*Atriplex gardneri*) dominated communities also occur on the BCPA and these sites are characterized by an accumulation of salt in poorly developed soils with a pH of 7.8 to 9. Grass cover is negligible and bare ground usually exceeds 50%. Birdsfoot sagebrush (*Artemesia pedifida*) also occurs in alkaline soils with pH levels of 8.5 to 11. At the lower pH levels, birdsfoot sagebrush can occur with Gardner saltbush in varying densities. At the higher pH levels, birdsfoot sagebrush usually occurs as a monoculture.

Dominant grass species on the BCPA include Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), king spike fescue (*Leucopoa kingii*), western wheatgrass (*Agropyron smithii*), Basin wildrye (*Elymus cinereus*), Columbian needlegrass (*Stipa columbiana*), Sandberg bluegrass (*Poa secunda*), wild oat (*Avena fatua*), Indian ricegrass (*Oryzopsis hymenoides*), sand dropseed (*Sporobolus cryptandrus*), bottlebrush squirreltail (*Sitanion hystrix*), and needle-and-thread (*Stipa comata)*. Commonly observed forb species include the phloxs, buckwheats, penstemons, Plains prickly-pear cactus (*Opuntia* sp.), scurfpea (*Psoralea tenuiflora*), Indian paintbrush (*Castilleja* sp.), and arrowleaf balsamroot (*Balsamorhiza sagittata*). Lupine (*Lupinus* sp.) is commonly observed on sites that have recently burned.

3.5.3 Wetlands and Waters of the U.S.

Location and classification of potential wetlands on the BCPA was determined from a USFWS National Wetlands Inventory (NWI) map obtained from the Wyoming Geographic Information Science Center (WYGISC 2003). No jurisdictional wetlands exist on the BCPA and the nearest perennial/intermittent streams are Cherokee Creek about 3/4 mile north and Deep Creek about 1 mile east of the project area. Both of these creeks are considered Waters of the U.S. and are subject to Section 404 of the Clean Water Act (CWA) under the jurisdiction of the Army Corps of Engineers (ACOE) and EPA. Any activity that involves fill or dredging to these waters would need to be permitted under current BLM, Wyoming DEQ, and ACOE regulations. Several flowing wells and springs on the BCPA are also considered Waters of the U.S. and are regulated in the same manner as perennial/intermittent streams.

Several ponds/reservoirs are located within the BCPA, however, on 9 January 2001, the U.S. Supreme Court, in a 5-4 ruling, ruled that isolated wetlands and ponds that are used by

migratory birds do not satisfy the "interstate commerce" clause and are not Waters of the U.S. and therefore are not subject to Section 404 of the Clean Water Act jurisdiction (SWANCC vs. Supreme Court). The numerous ephemeral draws common to the area are not considered Waters of the U.S. (ACOE 1987).

3.5.4 Invasive/Noxious Weeds

The BCPA is vulnerable to infestations of invasive/noxious weeds, especially Russian thistle (*Salsosa iberica)*, Canada thistle (*Cirsium arvense)*, common cocklebur (*Xanthium strumarium*), and musk thistle (*Carduus nutans*). All of these species were observed on the BCPA and adjoining areas during the 2003 field investigation. The most common invasive species observed throughout south-central Wyoming during the 2003 growing season were halogeton (*Halogeton glomeratus*), desert alyssum (*Alyssum desertorum* var. *desertorum)*, curlycup gumweed (*Grindelia squarrosa*), whitetop (Cardaria draba, Russian knapweed (Centaurea repens L.), bull thistle (Cirsium vulgare), and perennial pepperweed (*Lepidium latifolium*). Any newly disturbed surface (e.g., well pads, pipeline and road ROW's) within the BCPA would be highly susceptible to invasive/noxious weed infestations, especially after the heavy 2003 weed seed production season. Close monitoring and the development/implementation of an effective management program coordinated by Merit Energy, the BLM, and the Carbon County Weed and Pest District will be required to prevent establishment and spread of these species.

3.6 RANGE RESOURCES AND OTHER LAND USES

3.6.1 Range Resources

The BCPA lies within a portion of the Cherokee Grazing Allotment which encompasses about 73,966 acres, most of which is public land. The Cherokee Allotment supports a total of 9,508 AUM's, of which, 7,920 are allocated to cattle and 1,588 for sheep. The average stocking rate is approximately 10 acres per AUM. The season of use varies from late spring to late summer (June 15 to August 15), however, recent fencing by the BLM has placed a portion of the allotment into the Deep Creek Pasture which is grazed in the early spring and early summer on a two-year alternating rotation (Warren 2003).

3.6.2 Other Land Uses

The BCPA contains approximately 1,570 federally owned acres. There are no State of Wyoming or privately owned acres within the BCPA. The Proposed Action is located on federal lands administered by the BLM Rawlins Field Office in accordance with the Great Divide RMP.
Other land uses within and adjacent to the BCPA are agriculture (primarily cattle and sheep grazing), wildlife habitat, oil and natural gas exploration, development, and transmission, and dispersed outdoor recreation (primarily hunting in the fall). No developed recreation facilities exist within or adjacent to the project area. For more information on recreational resources in the project area (see Section 3.8).

3.7 WILDLIFE

Wildlife surveys discussed and summarized herein were conducted as part of larger scale surveys being performed in preparation of the Atlantic Rim Coalbed Methane EIS. The Brown

Cow Pod lies within the Great Divide Resource Area and management decisions are guided by the Resource Management Plan (RMP; USDI-BLM 1990) for that resource area.

3.7.1 General Wildlife

The BCPA includes approximately 1,570 acres with Wyoming big sagebrush, alkali sagebrush, and juniper woodland as the two primary cover types intermixed with other sub-dominant shrub, forb, and grass species. Many common species of birds, mammals, amphibians, and reptiles may be found within the pod area. The proposed development is not expected to significantly impact the common species found in the BCPA, therefore they are not considered in this analysis. Those species being considered for threatened or endangered status, BLM state sensitive species, big game species, raptors, and greater sage-grouse are considered in this analysis. The area of analysis for wildlife concerns consists of the area of the BCPA plus a two-mile buffer for sage-grouse leks, and a one-mile buffer for raptor nests. Wildlife surveys discussed and summarized herein were conducted as part of larger scale surveys being performed in preparation of the Atlantic Rim Project Area EIS.

Information regarding the occurrence of species being considered for threatened or endangered status, big game species, and raptors, and sage-grouse near the BCPA was obtained from several sources. Sage-grouse lek locations, seasonal big game range designations, raptor nest locations, and locations for threatened and endangered species were obtained from the Wyoming Game and Fish Department's (WGFD) Wildlife Observation System (WOS) and BLM. WGFD big game herd unit annual reports were used for herd unit population statistics. This existing wildlife information for the BCPA was supplemented through survey data collected by Hayden-Wing Associates (HWA) biologists primarily during 2000 and 2001. These data collections consisted of aerial and ground surveys to: (1) determine occurrence of threatened, endangered, proposed, or candidate species for listing on the pod area; (2) determine the occurrence, location, size, and burrow density of white-tailed prairie dog colonies; (3) determine the location and activity status of raptor nests; (4) search for previously undocumented sage-grouse leks and determine the activity status of all leks in the area; (5) locate winter sage-grouse concentration areas; and (6) determine the occurrence, location, and size of mountain plover habitat and conduct a preliminary presence/absence survey for the species.

3.7.2 Big Game

Three big game species: pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and elk (*Cervus elaphus*) occur on or may utilize the BCPA during the course of a year. The types of big game seasonal ranges designated by WGFD which are discussed are winter, winter/yearlong, and crucial winter/yearlong. Winter ranges are used by substantial numbers of animals only during the winter months (December through April). Winter/yearlong ranges are occupied throughout the year but during winter they are used by additional animals that migrate from other seasonal ranges. Crucial big game range (e.g. crucial winter/yearlong range) describes any seasonal range or habitat component that has been documented as a determining factor in a population's ability to maintain itself at a specified level over the long term. Crucial winter ranges are typically used 8 out of 10 winters.

Pronghorn Antelope. The BCPA is located within the 1,394-square-mile Baggs Herd Unit. The BCPA is all designated as pronghorn winter/yearlong range (1,570 acres). Crucial pronghorn range is present two to three miles west of the BCPA (Figure 4-1). The project area lies within the transition area between crucial winter range and slopes to the east which are often unusable in winter. During years with higher snowfall across the winter range, pronghorn

congregate on the crucial winter range, resulting in heavy browse use here and only light use of the transition area in the fall and spring. In years with low amounts of snow, the pronghorn are not forced to spend as much time on the crucial winter range. Utilization of important shrub species is then more evenly distributed across this transition area with less use on the plants in the crucial winter range. The population objective was increased 25 percent in 1994, from 7,200 to 9,000. The 2001 post hunt season population estimate for the Baggs Herd Unit of 7,000 animals is 12.0 percent higher than the 1996-2000 estimated population average of 6,240. The population during the 2000 post season population was approximately 7,800; however, with the higher than normal winter mortality, the 2001 post season decreased approximately 15 percent. Therefore, the current population estimate remains well below the WGFD management objective. The BCPA is located within Hunt Area 53, where the hunter success rate for 2001 was 98.1%.

Mule Deer. The BCPA is located within the Baggs Herd Unit. The Baggs Herd Unit is very large (3,440 square miles) and contains habitats ranging from subalpine and montane coniferous forests to desert scrub. The BCPA is designated as winter/yearlong mule deer range (1,052 acres) and crucial winter/yearlong range (518 acres). No major mule deer migration routes pass through the BCPA (WGFD 2002a). The 2001 post-hunt population estimate for the Baggs Herd Unit was 18,000. This estimate is slightly below the (3.7%) WGFD management objective of 18,700. The BCPA is located within Hunt Area 82, where the hunter success rate for 2001 was 42.6%.

Elk. The BCPA is located within the Sierra Madre Herd Unit (2,425 square miles). Most elk in the herd unit utilize spring/summer/fall ranges in the Sierra Madre Mountains, although there are groups using habitats on Atlantic Rim and around McCarty Canyon. During winter, the elk migrate to lower elevation winter range habitats on the west side of the Sierra Madre Mountains and into the Atlantic Rim/Sand Hills areas. Some animals may migrate as far west as the Powder Rim (~ 40 miles west of Baggs; Porter 1999). However, no major elk migration routes pass through the BCPA (WGFD 2002a). The habitat in the BCPA is designated as elk winter range (1,570 acres). The 2001 post hunt season population estimate for the Sierra Madre Herd Unit of 5,500 animals is 31.0 percent above the WGFD management objective of 4,200. The BCPA is located within Hunt Area 21, where the hunter success rate for 2001 was 36.5%.

3.7.3 Wild Horse Management

The Rawlins Field Office is home to approximately 1,650 wild horses, the largest population of wild, free-roaming horses outside of Nevada (USDI-BLM 2003). BLM has the responsibility to protect, manage, and control wild horses pursuant to the Wild Free Roaming Horse and Burro Act of 1971. The wild horse program is responsible for monitoring both the land and the herds, removing excess animals, and preparing animals for adoption. In Wyoming, BLM maintains and manages about 3,000 wild horses in sixteen herd management areas (HMA's). The BLM establishes an appropriate management level (AML) for each HMA. The AML is the population objective for the HMA that will ensure a thriving ecological balance among all the users and resources of the HMA.

Three wild horse HMA's (Adobe Town, Lost Creek, and Stewart Creek) are within the RFO jurisdiction. However, none of the three HMA's are within the boundaries of the proposed BCPA. The Stewart Creek HMA (AML = 150 horses) is generally located northwest of Rawlins, with its southeast boundary beginning near the intersection of U.S. Hwy. 287 and Carbon County Road 63 (about 14 miles northwest of Rawlins). The Lost Creek HMA (AML = 70

horses) lies within the Great Divide Basin to the west of the Stewart Creek HMA with both HMA's sharing a common, fenced border.

The largest and nearest of the three HMA's to the BCPA is the Adobe Town HMA (AML = 700 horses) located in the extreme southwest portion of Carbon County, Wyoming and southeast portion of Sweetwater County, Wyoming. Daily or seasonal movement of wild horses from the Adobe Town HMA to the BCPA is highly unlikely due to the state-maintained, limited access fencing along Hwy. 789. Horses (some wild-appearing) may commonly be observed east of Hwy. 789 but they are privately owned (Newberry, Pers. Comm. 2003).

3.7.4 Upland Game Birds

Greater Sage-grouse. The BCPA is located within the extensive sagebrush/grassland habitat of southcentral Wyoming where sage grouse are common inhabitants. Important habitats for these birds include strutting (leks), nesting, brood-rearing, and wintering areas, all of which occur on the project area both in contiguous blocks and in isolated patches. During their spring mating season, greater sage-grouse gather on strutting grounds (leks) that typically occur in open or barren areas within a sagebrush matrix. Females usually nest within mature stands of sagebrush that provide adequate cover and protection from predators. Density of nesting greater sage-grouse tends to decrease with distance from the lek, with the majority of females nesting within two miles of leks (Braun et al. 1977, Hayden-Wing et al. 1986). The Greater-sage grouse is listed as a sensitive species by the BLM. In addition the sage grouse receives special consideration because of population declines over much of its range and its importance as an upland game bird in the state of Wyoming.

The BCPA is located within the Sierra Madre upland game management unit area (Area 25). According to the Annual Report of Upland Game and Furbearer Harvest for 2001, 761 sage-grouse were harvested in Area 25 providing 724 hunter recreation days (WGFD 2002b). The Sierra Madre Upland Game Management Area accounted for approximately 6.0 percent (761 birds out of 12,742) of the state-wide harvest of sage grouse in 2001.

The primary vegetation cover type on the Brown Cow Pod is Wyoming big sagebrush. Because sage grouse utilize sagebrush habitats all year, the area provides excellent year-round range. Aerial surveys were conducted by HWA biologists during the winter of 2001 to identify and define sage grouse concentration areas during winter. Transects were flown at ½-mile spacing using a Bell Jet Ranger helicopter at speeds between 60 and 80 MPH approximately 100-150 feet above the ground. The pilot and two observers visually searched for sage grouse and when sage grouse were spotted or flushed the helicopter circled the location and UTM coordinates were recorded using a hand-held GPS. Concentric circles were flown around each location (within 1/4 mile) where sage grouse were initially observed and the area was searched for additional sage grouse. The entire Atlantic Rim Coalbed Methane Project Area was surveyed in this manner on February 17-18, 2001. Snow cover during the winter 2000-2001 was much deeper than normal. Deep snow cover forced sage grouse to seek out habitat with tall sagebrush that remained above the snow. During the spring and summer of 2001 each sage grouse winter aerial location was visited on the ground and the habitat that was used by the sage grouse was mapped. Habitat patches located from the air were mapped by walking the perimeter of the patch and recording UTM coordinates with a hand-held GPS. Sagebrush in the sage grouse winter use areas was usually located in long linear patches in drainage bottoms and was between 2 and 4 feet tall. Those areas of habitat where sage grouse were located

during the winter aerial survey could be termed severe winter relief habitat. No sage grouse severe winter relief habitat was located on the Brown Cow Pod (Figure 4-1).

Aerial surveys were also conducted by HWA biologists in late March and early April, 2001 to check the status of known sage grouse leks and document new leks. Linear transects were flown at 1/4-mile spacing intervals at an average altitude of 300 feet using a slow moving fixed-wing aircraft. Lek locations were recorded with a handheld GPS receiver. No active sage grouse leks were located within the pod boundary, however, four were documented within two miles of the pod (Figure 4-1). A 2-mile buffer around these four leks includes all of the pod. None of the leks are within 1/4-mile of the pod. One lek lies within the pod, but it has been inactive for some time (WGFD, 2003).

3.7.5 Raptors

Raptor species that may occur on the BCPA include golden eagle, bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, American kestrel, merlin, prairie falcon, peregrine falcon, short-eared owl, long-eared owl, great-horned owl, and burrowing owl. Helicopter surveys of raptor nests on and around the BCPA were conducted by HWA biologists during late May 2001. The helicopter survey protocol consisted of flying low-level, ½ mile interval transects within a one-mile buffer zone of the pod. Areas of potential raptor nest habitat (cliffs, rock outcrops, etc.) were surveyed more intensively. Nest locations were recorded with a GPS unit. No active raptor nests were located within one mile of the BCPA in 2001. Four inactive ferruginous hawk nests, one inactive golden eagle nest, and one inactive red-tailed hawk nest were located within one mile of the pod boundary (Figure 4-1). One artificial ferruginous hawk nest is located within the pod boundaries.

3.8 SPECIAL STATUS PLANT, WILDLIFE, AND FISH SPECIES

Special status species include: (1) threatened, endangered, and species proposed for listing by the FWS (Under the ESA of 1973 as amended); (2) sensitive species identified by the BLM Wyoming State Sensitive Species List.

3.8.1 Threatened, Endangered, or Proposed for Listing Species of Plants, Wildlife, and Fish

The U.S. Fish and Wildlife Service (FWS) has determined that two plant species, four wildlife species, and four fish species listed as either threatened, endangered or proposed under the ESA may potentially be found in the Atlantic Rim EIS Project Area or be affected by activities conducted on the project area (USDI-FWS 2003). The Brown Cow Pod is a portion of the Atlantic Rim EIS Project area consisting of approximately 1,600 acres out of the total of over 310,000 acres comprising the Atlantic Rim project. These species and their federal status under the ESA are listed in Table 3-13.

3.8.1.1 Plant Species

One federally endangered plant species, blowout penstemon (*Penstemon haydenii*), and one threatened plant species, Ute ladies'-tresses (*Spiranthes diluvialis*), have the potential to occur within the Atlantic Rim EIS area of which the the BCPA is a portion, according to the USFWS (2003) and the Wyoming Natural Diversity Database (WYNDD 2003). No other threatened or

endangered plant species are known or expected to occur on the BCPA.

Blowout Penstemon. Blowout penstemon is a member of the snapdragon family. The species is most commonly found in the bowls and along the rims of sandy blowouts (Fertig 2000). In Wyoming, the species has been documented on very steep, unstable sand dunes (Fertig 2001). Within these limited habitats, blowout penstemon typically occurs in large, multi-stemmed clumps. When in bloom, its lavender-purple flowers stand out against other sparse vegetation found in and around sandy blowouts. In addition to features of its leaves and flowers, blowout penstemon's lavender or vanilla-like fragrance is a characteristic that distinguishes it from other *Penstemon* species. Blowout penstemon typically blooms between late May and late June. This short flowering period is the best time of year to survey for the species.

Table 3-13. Threatened, Endangered, and Proposed Plant, Wildlife and Fish Species Potentially Present or Affected by Development on the Atlantic Rim EIS Project Area.

Species	Scientific Name	Status
Plants		
Blowout penstemon	*Penstemon haydenii*	Endangered
Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
Mammals		
Black-footed ferret	*Mustela nigripes*	Endangered
Canada lynx	*Lynx canadensis*	Threatened
Birds		
Bald eagle	*Haliaeetus leucocephalus*	Threatened
Mountain plover	*Charadrius montanus*	Proposed Threatened
Fish		
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered
Bonytail	*Gila elegans*	Endangered
Humpback chub	*Gila cypha*	Endangered
Razorback sucker	*Xyrauchen texanus*	Endangered

An area of vegetated sand dunes, referred to as the "Sand Hills", occurs about 12 miles north of the proposed BCPA. The Sand Hills area has the potential to provide habitat for blowout penstemon, however, vegetation has stabilized the dunes, thus eliminating potential sites required by blowout penstemon for establishment and growth. The species was not found during field surveys of this area conducted by the Wyoming Natural Diversity Database in June, 2000 (Fertig 2001) or the current 2003 growing season (Blomquist 2003). The closest known populations of blowout penstemon are located south of the Ferris Mountains (Blomquist 2003). Given the absence of suitable habitat (sandunes with active blowouts) in the BCPA, blowout penstemon is highly unlikely to occur within the BCPA.

Ute ladies'-tresses. The Ute ladies'-tresses (*Spiranthes diluvialis*), a threatened species, is a perennial, terrestrial orchid, endemic to moist soils near wetland meadows, springs, lakes, and perennial streams. It occurs generally in alluvial substrates along riparian edges, gravel bars, old oxbows, and moist to wet meadows at elevations from 4,200 to 7,000 feet. The orchid colonizes early successional riparian habitats such as point bars, sand bars, and low lying gravelly, sandy, or cobbly edges, persisting in those areas where the hydrology provides continual dampness in the root zone through the growing season. This species has been located in Converse, Goshen, Laramie, and Niobrara counties in Wyoming (Fertig 2000). Ute ladies'-tresses typically blooms from late July through August, however, it has been known to bloom in early July and as late as early October (USDI-FWS 2003).

3.8.1.2 Wildlife Species

Black-footed Ferret and Associated White-tailed Prairie Dog Colonies. The black-footed ferret's original distribution in North America closely corresponded to that of prairie dogs (Hall and Kelson 1959, Fagerstone 1987). In Wyoming, white-tailed prairie dog (*Cynomys leucurus*) colonies provide potential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food and they also use prairie dog burrows for shelter, parturition, and raising their young (Fagerstone 1987).

Prairie dog colonies on the BCPA were mapped on the ground during the summers of 2000 and 2001 by HWA. The edges of the prairie dog towns were mapped using a handheld GPS receiver and an ATV. One small prairie dog town occurs on the pod, covering approximately 24.9 acres (1.6% of the pod; Figure 4-1). A black-footed ferret survey has not been conducted within the town.

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

Due to the facts that: (1) the BCPA does not include high elevation lodgepole pine/spruce-fir habitat types preferred by this species, (2) the BCPA does not support a population of snowshoe hares (preferred prey item), (3) there are no recorded lynx sightings near the BCPA (WGFD 2000, WYNDD 2003), and (4) the closest potential habitat is more than ten miles away in the Sierra Madre Mountains, it is unlikely that lynx occur on or near the BCPA.

Bald Eagle. Primary bald eagle wintering areas are typically associated with concentrations of food sources along major rivers that remain unfrozen where fish and waterfowl are available, and near ungulate winter ranges that provide carrion (Steenhof et al. 1980). Wintering bald eagles are also known to roost in forests with large, open conifers and snags protected from winds by ridges, often near concentrations of domestic sheep and big game (Anderson and Patterson 1988).

Incidental sightings of bald eagles have been recorded in the vicinity of the BCPA (WGFD 2000). Most observations were documented between November and March, indicating that the area is commonly used by bald eagles during the winter months. No communal winter roosts are known to exist on or near the BCPA. Inspection of BLM and WGFD raptor nest records,

and results of aerial and ground raptor nest surveys conducted by HWA reveal that no bald eagle nests occur within a two-mile buffer of the BCPA. The closest known nest is located in Section 11, T12N:R93W (Cerovski 2000), approximately 18 miles southwest of the project area.

Mountain Plover. The mountain plover nests over much of Wyoming and is typically found in areas of short (less than four inches) vegetation on slopes of less than five percent. Any short grass, very short shrub, or cushion plant community could be considered plover nesting habitat (Parrish et al. 1993), however, mountain plovers prefer shortgrass prairie with open, level or slightly rolling areas dominated by blue grama and buffalograss (Graul 1975, Dinsmore 1981, Dinsmore 1983, Kantrud and Kologiski 1982).

The BCPA was surveyed for mountain plover habitat in May, 2001 by HWA biologists. Areas with habitat that approximated the habitat requirements for mountain plovers discussed above were identified on the ground and mapped on 1:24,000 scale topographic maps. In order to not overlook any potential mountain plover habitat, we conservatively classified habitat and included some areas with slopes greater than 5% and vegetation taller than four inches. These areas were termed potential mountain plover habitat. Mountain plover surveys were conducted between April 29 - May 8, 2001 on all areas determined to provide potential habitat on the Atlantic Rim Coalbed Methane Project Area, and followed the 2001 Mountain Plover Survey Protocol developed by the Rawlins Field Office and the FWS. Four patches, totaling 97.5 acres, of potential mountain plover habitat were located within the pod boundary (Figure 4-1). Potential plover habitats defined during 2001 were again surveyed for plovers in April 2002 and 2003. No plovers were sighted during any of the three years' surveys of the Atlantic Rim Project Area. It is unlikely that plovers would nest in the pod due to a lack of habitat.

3.8.1.3 Fish Species

Four federally endangered fish species may occur as downstream residents of the Little Snake River system: Colorado pikeminnow *(Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker *(Xyrauchen texanus*) (USDI-FWS 2003). The last sighting of any of these fish in the Little Snake River was of a single Colorado pikeminnow in 1990. Currently, these fish species are not likely to be found in the mainstem of the Little Snake River or Muddy Creek, and critical habitat for these species has not been designated in Wyoming (Upper Colorado River Endangered Fish Recovery Program 1999).

The Colorado pikeminnow, bonytail, and humpback chub are all members of the minnow family. The razorback sucker is a member of the sucker family. All four of these fish species share similar habitat requirements and historically occupied the same river systems. Declines in populations of these species are mainly attributed to impacts of water development on natural temperature and flow regimes, creation of migration barriers, habitat fragmentation, the introduction of competitive and predatory non-native fishes, and the loss of inundated bottom lands and backwater areas (Minckley and Deacon 1991, USDI-FWS 1993).

3.8.2 Sensitive Plant, Wildlife, and Fish Species

The BLM has developed a sensitive species list for public lands in Wyoming. The objective of the sensitive species designation is to ensure the overall welfare of these species is considered when undertaking actions on public lands, and that they do not contribute to the need to list the species under the provisions of the Endangered Species Act (ESA). It is the intent of this policy to emphasize the inventory, planning consideration, management implementation, monitoring,

and information exchange for the sensitive species on the list. The BLM Sensitive Species List is meant to be dynamic and will be reviewed annually with recommendations from BLM and appropriate non-BLM authorities for additions and deletions (USDI-BLM 2002). The following 32 species (7 plants, 7 mammals, 15 birds, and 3 amphibians) occur on the BLM Sensitive Species List in the RFO management area and may occur on or near the Brown Cow Pod (Table 3-14).

3.8.2.1 Plant Species

Seven plant species of concern may potentially occur on or near the BCPA. Of these, Gibben's beardstongue has the highest conservation priority (WYNDD 2003). Table 3-14 provides information on the names, sensitivity status, habitat requirements, and probability of occurrence on the BCPA. Four of the species are unlikely to occur on or near the BCPA because suitable habitats are not present. The remaining three plant species of concern may possibly occur on or near the BCPA but have not been recorded there (WYNDD 2003).

3.8.2.2 Wildlife Species

Mammals. Seven sensitive mammal species may potentially be found on the Brown Cow Pod. These include: dwarf shrew, Wyoming pocket gopher, white-tailed prairie dog, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat. Only one of these species, the white-tailed prairie dog is known to occur on the Brown Cow Pod; one small town (24.9 acres) exists in the southeast quarter of Section 12. The dwarf shrew is likely to occur on the Brown Cow Pod. The remaining species: Wyoming pocket gopher, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat have a slight potential to occur on the pod.

Birds. Fifteen sensitive bird species may potentially be found on the Brown Cow Pod. These include: Baird's sparrow, sage sparrow, Brewer's sparrow, long-billed curlew, sage thrasher, western burrowing owl, yellow-billed cuckoo, loggerhead shrike, Columbian sharp-tailed grouse, greater sage-grouse, white-faced ibis, trumpeter swan, peregrine falcon, ferruginous hawk, and northern goshawk. The western subspecies of yellow-billed cuckoo is considered a FWS candidate for listing as endangered. Two of these species are known to be present in the area of the Brown Cow Pod and include: greater sage-grouse (see Section 3.7.4), and ferruginous hawk. Five species: Baird's sparrow, long-billed curlew, yellow-billed cuckoo, white-faced ibis, and trumpeter swan are unlikely to occur. The Columbian sharp-tailed grouse, sage sparrow, Brewer's sparrow, sage thrasher, western burrowing owl, loggerhead shrike, northern goshawk (not likely to nest on the Brown Cow Pod, though), and peregrine falcon have a slight potential to occur in the Brown Cow Pod.

Amphibians. Three sensitive amphibian species may potentially be found on the Brown Cow Pod. These include: boreal toad, Great Basin spadefoot toad, and northern leopard frog. The boreal toad and the Great Basin spadefoot toad have a slight potential to occur, and the northern leopard frog is likely to occur on the Brown Cow Pod.

3.8.2.3 Fish Species

Fish species that are not listed as endangered or threatened by the FWS, but have been identified for possible listing in the future, are classified as "species at risk" and are also included on the Wyoming BLM Sensitive Species List. Three fish species that have the potential to occur, or are known to occur within the specific project area, are designated as "species at risk" by the FWS and are considered sensitive by the Wyoming BLM. These

species are described below.

The three Wyoming BLM sensitive fish species that occur within or downstream from the project area are the roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), and flannelmouth sucker (*Catostomus latipinnis*) (WYNDD 2003, USDI-BLM 2002). All three of these species can be found downstream of the project area within the Muddy Creek drainage or immediately downstream from its confluence with the Little Snake River. The potential for project-related impacts to water that contributes to downstream quality and flow and direct impacts to instream habitat quality or fish passage necessitates their inclusion in this NEPA document. Similar to the endangered fish species discussed previously in this document, original numbers and distribution of these special concern fishes have been reduced through the introduction of competitive and predatory non-native fish, and habitat alterations that reduce or impair fish habitat and migration abilities.

Table 3-14. Sensitive Plant, Wildlife, and Fish Species Potentially Present in the Brown Cow Pod.[1]

Plant Species				
Common Name	**Scientific Name**	**Sensitivity Status[2]**	**Habitat**	**Occurrence Potential[3]**
Laramie columbine	*Aquilegia laramiensis*	G2/S2, FSR2	Crevices of granite boulders and cliffs, 6,400-8,000'	unlikely
Nelson's milkvetch	*Astragalus nelsonianus*	G2/S2 CO	Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, and cushion plant communities at 5,200-7,600'	possible
Cedar Rim thistle	*Cirsium aridum*	G2Q/S2	Barren, chalky hills, gravelly slopes and fine textured, sandy-shaley draws 6,700-7.200'	possible
Weber's scarlet gilia	*Ipomopsis aggregata ssp. weberi*	G5T1T2Q/S1,FSR2	Openings in coniferous forests and scrub oak woodlands 8,500-9,600'	unlikely
Gibbens' beardtongue	*Penstemon gibbensii*	G1, S1, BLM	Sandy or shaley (often Green River Shale) bluffs and slopes, 5,500-7,500 ft. Associated vegetation: *Juniperus* spp., *Cirsium* spp., *Eriogonum* spp., *Elymus* spp., *Amelanchier alnifolia*, *Chrysothamnus* spp., *Thermopsis* spp., *Arenaria* spp., and *Astragalus* spp.	certain, within eastern portion of project
Persistent sepal yellowcress	*Rorippa calycina*	G3/S2S3	Riverbanks and shorelines, usually on sand soils near high water line	unlikely
Laramie false sagebrush	*Sphaeromeria simplex*	G2/S2	Cushion plant communities on rocky limestone ridges and gentle slopes 7,500 - 8600'	unlikely

Wildlife Species			
Common Name	**Scientific Name**	**Sensitivity Status[2]**	**Occurrence Potential[3]**
Mammals			
Dwarf shrew	*Sorex nanus*	G4/S2S3, R2, NSS3	Likely
Wyoming pocket gopher	*Thomomys clusius*	R2, G2/S1S2, NSS4	Possible
White-tailed prairie dog	*Cynomys leucurus*	G4/S2S3, NSS7	Present
Swift fox	*Vulpes velox*	R2, G2/S2S3, NSS3	Possible
Fringed myotis	*Myotis thysanodes*	R2, G5/S1B, S1N, NSS2	Possible
Long-eared myotis	*Myotis evotis*	G5/S1B, S1?N, NSS2	Possible

Townsend's big-eared bat	*Corynorhinus townsendii*	R2/R4, G4/S1B, S2N, NSS2	Possible
Birds			
Baird's sparrow	*Ammodramus bairdii*	G4/S1B, SZN, R2, NSS4	Unlikely
Sage sparrow	*Amphispiza belli*	G5/S3B, SZN	Likely
Brewer's sparrow	*Spizella breweri*	G5/S3B, SZN	Likely
Long-billed curlew	*Numenius americanus*	G5/S3B, SZNR2, NSS3	Unlikely
Sage thrasher	*Oreoscoptes montanus*	G5/S3B, SZN	Likely
Western burrowing owl	*Athene cunicularia*	R2, G4/S3B, SZN, NSS4	Likely
Yellow-billed cuckoo	*Coccyzus americanus*	G5/S2B, SZN, R2, NSS2	Unlikely
Loggerhead shrike	*Lanius ludovicianus*	G5/S4B, SZN, R2	Likely
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*	R2/R4, G4T3/S1	Possible
Greater sage-grouse	*Centrocercus urophasianus*	G5/S3	Present
White-faced ibis	*Plegadis chihi*	G5/S1B, SZN, R2, NSS3	Unlikely
Trumpeter swan	*Cygnus buccinator*	R2/R4, G4/S1B, S2N, NSS2	Unlikely
Peregrine falcon	*Falco peregrinus*	G4/T3/S1B, S2N, R2, NSS3	Possible
Ferruginous hawk	*Buteo regalis*	R2, G5/S23B, S4N, NSS3	Present
Northern goshawk	*Accipiter gentilis*	R2/R4, G5/S23B, S4N, NSS4	Possible
Amphibians			
Boreal toad	*Bufo boreas boreas*	G4T4/S2, R2, R4, NSS1	Possible
Great Basin spadefoot toad	*Spea intermontanus*	G5/S4, NSS4	Possible
Northern leopard frog	*Rana pipiens*	G5/S3, R2, NSS4	Likely
Fish			
Roundtail chub	*Gila robusta*	G3G4/S2?, NSS1	Unlikely
Bluehead sucker	*Catostomus discobolus*	G4/S2S3, NSS1	Unlikely
Flannelmouth sucker	*Catostomus latipinnis*	G3G4/S3, NSS1	Unlikely

[1] - Source: USDI-BLM (2002).
[2] - Definition of status

G Global rank: Rank refers to the range-wide status of a species.
T Trinomial rank: Rank refers to the range-wide status of a subspecies or variety.
S State rank: Rank refers to the status of the taxon (species or subspecies) in Wyoming. State ranks differ from state to state.
1 Critically imperiled because of extreme rarity (often known from 5 or fewer extant occurrences or very few remaining individuals) or because some factor of a species' life history makes it vulnerable to extinction.
2 Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction.
3 Rare or local throughout its range or found locally in a restricted range (usually known from 21-100 occurrences).
4 Apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
5 Demonstrably secure, although the species may be rare in parts of its range, especially at the periphery.
H Known only from historical records. 1950 is the cutoff for plants; 1970 is the cutoff date for animals.
X Believed to be extinct.
A Accidental or vagrant: A taxon that is not known to regularly breed in the state or which appears very infrequently (typically refers to birds and bats).
B Breeding rank: A state rank modifier indicating the status of a migratory species during the breeding season (used mostly for migratory birds and bats)
N Nonbreeding rank: A state rank modifier indicating the status of a migratory species during the non-breeding season (used mostly for migratory birds and bats)
ZN or ZB Taxa that are not of significant concern in Wyoming during breeding (ZB) or non-breeding (ZN) seasons. Such taxa often are not encountered in the same locations from year to year.
U Possibly in peril, but status uncertain; more information is needed.
Q Questions exist regarding the taxonomic validity of a species, subspecies, or variety.
? Questions exist regarding the assigned G, T, or S rank of a taxon.

WGFD Native Species Status Codes - Fish and Amphibians

NSS1 - Populations are physically isolated and/or exist at extremely low densities throughout range. Habitats are declining or vulnerable. Extirpation appears possible. The Wyoming Game and Fish Commission mitigation category for Status 1 species is "Vital". The mitigation objective for this resource category is to realize "no loss of habitat function". Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.
NSS2 - Populations are physically isolated and/or exist at extremely low densities throughout range. Habitat conditions appear to be stable. The Wyoming Game and Fish Commission mitigation category for Status 2 species is also "Vital". The mitigation objective for this resource category is to realize "no loss of habitat function". Under these guidelines, it will be very important that the project be conducted in a manner that avoids alteration of habitat function.
NSS3 - Populations are widely distributed throughout its native range and appear stable. However, habitats are declining or

vulnerable. The Wyoming Game and Fish Commission mitigation category for Status 3 species is "High". The mitigation objective for this resource category is to realize "no net loss of habitat function within the biological community which encompasses the project site". Under these guidelines, it will be important that the project be conducted in a manner that either avoids the impact, enhances similar habitat or results in the creation of an equal amount of similarly valued fishery habitat.

NSS4-7 - Populations are widely distributed throughout native range and are stable or expanding. Habitats are also stable. There is no special concern for these species.

WGFD Native Species Status Codes - Birds and Mammals

NSS1 - Populations are greatly restricted or declining, extirpation appears possible. AND On-going significant loss of habitat.

NSS2 - Populations are declining, extirpation appears possible; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; ongoing significant loss of habitat.

NSS3 - Populations are greatly restricted or declining, extirpation appears possible; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance. OR Species is widely distributed; population status or trends are unknown but are suspected to be stable; on-going significant loss of habitat.

NSS4 - Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is restricted or vulnerable but no recent or on-going significant loss; species may be sensitive to human disturbance.

NSS5 - Populations are declining or restricted in numbers and/or distribution, extirpation is not imminent; habitat is stable and not restricted. OR Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is not restricted, vulnerable but no loss; species is not sensitive to human disturbance.

NSS6 - Species is widely distributed, population status or trends are unknown but are suspected to be stable; habitat is stable and not restricted.

NSS7 - Populations are stable or increasing and not restricted in numbers and/or distribution; habitat is stable and not restricted.

[3] - Occurrence potential based upon presence of habitat and known distribution.

The roundtail chub is a close relative of the federally endangered humpback chub and bonytail and is common within the Little Snake River drainage and can also be found in Muddy Creek (Carbon County, Wyoming), a small perennial stream located downstream of the project area (Baxter and Stone 1995). The bluehead sucker is restricted to the Little Snake and Green River basins in Wyoming (Baxter and Stone 1995) and occupies habitat similar to that of the roundtail chub. The species is known to occur in the Little Snake River and was considered to occur in large numbers in Muddy Creek by Baxter and Stone (1995). Fish populations sampling conducted in Muddy Creek during 2000 and 2001 by Rawlins, BLM field office personnel indicated that there are far fewer bluehead sucker in this drainage than reported by Baxter and Stone (1995). Populations of bluehead sucker are considered rare in Wyoming, in comparison to other sucker species. Although the flannelmouth sucker has been considered one of the most abundant and widely distributed fish species of the tributaries and mainstream portions of the Upper Colorado River Basin (Tyus et al. 1982) and was considered a common resident of Muddy Creek by Baxter and Stone (1995), the additional sampling of BLM during 2000-2001 suggests that even fewer flannelmouth sucker exist in the Muddy Creek drainage than bluehead sucker.

3.9 RECREATION

Recreation resources in the BCPA are typical of those found in the Red Desert Region of Wyoming. Recreation use of BLM and private lands within the project area are best characterized as dispersed; there are no developed recreation sites or facilities. Most recreation activities occur during the fall hunting seasons. The area attracts small game hunters in September and October during the sage grouse season. Pronghorn hunting also occurs in September. Other hunting use occurs during the mule deer season in mid to late October and hunting for rabbits and predators later in the fall and winter. During other seasons, the area attracts small numbers of recreationists engaged in rock collecting, camping and hiking, wild horse and wildlife observation, outdoor photography and picnicking. The area also has a limited

amount of use by off-road vehicle enthusiasts. Although data on non-consumptive recreational visitation are not available, overall use levels are generally low (BLM 2000). Low visitation is a function of the small number of local residents, long drives from major population centers, lack of publicized natural attractions, and road conditions that limit vehicle access into many back country areas.

3.10 VISUAL RESOURCES

The BCPA is typical of the more rugged sections of Wyoming Red Desert Region. The characteristic landscape is moderately undulating with occasional areas of steep topography (badland breaks and buttes) which stand out as contrasting forms across most of the rest of the area. Numerous small drainages dissect the landscape adding diversity. The combination of topography, buttes and badland breaks subdivide the area into a number of small viewsheds. Larger views that encompass several viewsheds are available from high points. The sky/land interface is a significant aspect of all distant views. The predominant vegetation, typical of cold desert steppe, is alkali and low sage brush, mixed desert scrub, grasses and forbs with scattered patches of big sage/rabbit brush on flatter north and east facing slopes, along drainage ways and in large depressions. Small established stands of juniper exist within the study area. The combination of plant communities creates a subtle mosaic of textures and colors. Predominant vegetation colors in early spring are green and gray green changing to gray green and buff/ochre as grasses and forbs cure in the summer and fall. Reddish brown and buff colors of the badland formations add contrast and dominate in areas of steep topography. Evidence of cultural modification in and near the BCPA includes improved and unimproved roads, power lines and some oil and gas production facilities. Motorists traveling Wyoming Highway 789 would have limited views of the project area because of viewing distance (3 to 6 miles) and intervening elevated topography. However, facilities and activities located on ridge lines or buttes are visible over longer viewing distances. The area receives moderate use by recreationists including big and small game hunters, rock collectors, wild horse and wildlife watchers, backpackers and ATV operators. The quality of the visual resource is an important part of the recreational experience for many of these users. Other non-recreational users of the area, including grazing permit holders and those working in the oil and gas industry, would also be affected by changes to the visual resources.

The intent of the BLM VRM program is to preserve scenic values in concert with resource development. BLM personnel responsible for visual resource management have classified the BCPA as Class 3. The VRM describes the levels of change to the visual resource permitted in Class 3 landscapes as:
Class 3: *Contrasts to the basic elements caused by a management activity are evident but should remain subordinate to the existing landscape.*

Thus for projects in Class 3 areas, project facilities, activities and site disturbance that contrast enough to attract viewer attention and are evident in the landscape are allowed, but they should be constructed in a manner that reflects the lines, forms, colors and textures of the characteristic landscape.

3.11 CULTURAL RESOURCES

3.11.1 Culture Chronology of the Project Area

Archaeological investigations in the Washakie Basin indicate the area has been inhabited by prehistoric people for at least 10,000 years from Paleoindian occupation to the present. The accepted cultural chronology of the Washakie Basin is based on a model for the Wyoming Basin by Metcalf (1987) and revised by Thompson and Pastor (1995). The Wyoming Basin prehistoric chronology is documented in Table 3-15.

Paleoindian Period - The oldest period for which there is archaeological evidence is the Paleoindian, beginning ca. 12,000 years B.P. and ending around 8500 B.P. This is the transition period from the periglacial conditions of the Wisconsin ice advance during the terminal Pleistocene to the warmer and drier climatic conditions of the Holocene. A savanna-like environment with higher precipitation than occurs today was prevalent in southwest Wyoming. Understanding paleoenvironmental conditions operating at the end of the Pleistocene and into the Holocene will provide insights into the articulation between human populations and the environment (Thompson and Pastor 1995). Paleoindian sites are rare in southwest Wyoming. However, isolated surface finds of Paleoindian projectile points are not uncommon and suggest that site preservation may be a major factor affecting the number of known sites. The Paleoindian tool assemblage includes lanceolate points, gravers, and end-scrapers.

Table 3-15. Prehistoric Chronology of the Wyoming Basin.

Period	Phase	Age (B.P.)
Paleoindian		12,000 - 8500
Early Archaic	Great Divide	8500 - 6500
	Opal	6500 - 4300
Late Archaic	Pine Spring	4300 - 2800
	Deadman Wash	2800-2000/1800
Late Prehistoric	Uinta	2000/1800 - 650
	Firehole	650 - 300/250
Protohistoric		300/250 - 150

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

Archaic Period - Settlement and subsistence practices, in southwest Wyoming, remained largely unchanged from the end of the Paleoindian period through the Archaic and continued until at least the introduction of the horse, or even until Historic Contact. Reduced precipitation and warmer temperatures occurred ca. 8500 B.P. The environmental change at the end of the Paleoindian period led to a pattern of broad spectrum resource exploitation which is reflected in the subsistence and settlement practices of the Archaic period which became more diverse. The Archaic period is divided into the Early and the Late periods and subdivided in the Great Divide and Opal and the Pine Spring and Deadman Wash phases, respectively. Large side- and corner-notched dart points and housepits are found during the Archaic period. The presence of ground stone implements suggests a greater use of plant resources during the Archaic period. Faunal assemblages from Archaic components document increased use of small animals (Thompson and Pastor 1995). At the Yarmony site in Colorado, at least one

housepit has been investigated which produced radiocarbon dates of ca. 6300 B.P. (Metcalf and Black 1991). The housepit is a large, semi-subterranean, two-room dwelling containing four slab-lined storage bins, interior hearths and other floor features. Large side-notched points have not been recovered from components dated to the Great Divide phase in the Wyoming Basin. The earliest dated context for side-notched points are Component I at Maxon Ranch (6400-6000 B.P.), west of the project area. Large side-notched points from the Great Basin and Colorado Plateau occur as early as 7000 years B.P.

Late Prehistoric Period - The Late Prehistoric period 2000/1800 B.P. is subdivided into the Uinta and the Firehole phases. Large-scale seed processing and an increase in the number of features including roasting pits is noted in the Late Prehistoric period as is the presence of pottery and the introduction of bow and arrow technology. A characteristic of the Uinta phase is clusters of semi-subterranean structures dating to ca. 1500 B.P. At least two different types of structures have been identified: a more substantial, cold weather habitation is present at the Nova site (Thompson 1989) and a less substantial, warm weather structure serving more as a windbreak is present at the Buffalo Hump site (Harrell 1989).

The Firehole phase is distinguished from the preceding Uinta phase by a dramatic decline in radiocarbon dates possibly related to a decline in population density. The South Baxter Brush Shelter site (Hoefer et al. 1992) and Firehole Basin 11 site (Metcalf and Treat 1979) are sites located west of the project area attributed to the Firehole phase.

Protohistoric Period - The Protohistoric period begins sometime after 300 years B. P. with the first European trade goods to reach the area, and ends with the development of the Rocky Mountain fur trade 150 years ago. The Wyoming Basin was the heart of Shoshone territory during this period, with occasional forays into the area by other groups such as the Crow and Ute (Smith 1974). The most profound influence on native cultures during this time was the introduction of the horse enabling Native Americans to expand their range. All forms of rock art denoting horses, metal implements, and other Euro-American goods are associated with the Protohistoric period. These include the Upper Powder Spring Hunting Complex site immediately west of the project area (Murcray 1993). Metal projectile points have been recovered from both surface and subsurface contexts in southwest Wyoming.

Historic use of the area is limited by the formidable topographic relief. Steep canyons, inadequate water supply, badlands, and escarpments make the area inhospitable for settlement with only limited ranching activities present. Previously recorded historic sites are represented by a ranching/stock herding site, three historic debris sites, one historic cairn, and the Rawlins-Baggs freight/stage road. In addition, the Cherokee Trail, stage stations, and trash scatters all exist near the project area. Table 3-16 displays the historic chronology of the Washakie Basin.

Table 3-16. Historic chronology of the Washakie Basin.

Phase	Age A.D.
Pre-Territorial	1842 - 1868
Territorial	1868 - 1890
Expansion	1890 - 1920
Depression	1920 - 1939

Modern	1939 - Present

from Massey 1989

3.11.2 Summary of Extant Cultural Resources

The Cultural Records Office in Laramie provided information on the previous work conducted and sites recorded in the project area. Thirty-two Class III cultural resource projects have been previously conducted and 3 sites recorded in the project area. Limited amounts of field work have resulted in the documentation of cultural resources through survey, test excavations, examination of ethnographic records, and historic record research. No excavations have been conducted in the project area.

Of the 32 projects conducted in the area of the Brown Cow locations, 23 were block/linear surveys and 9 were linear surveys. Of the three previously recorded sites, two are recommended not eligible for the National Register, and one is recommended eligible.

In southwest Wyoming, sand deposits (dunes, shadows, and sheets) are recognized as highly likely to contain cultural material. The topographic setting of the Brown Cow locations could be conducive to prehistoric occupation. The area is bisected by Cherokee Creek. The topography gently slopes to the west and the south toward Cherokee Creek.

3.11.3 Site Types

Site types previously identified, recently located, or predicted to be in the Brown Cow study area are discussed below.

Prehistoric open camps (n=3) contain evidence of a broad range of activities including subsistence-related activities. Cultural remains include formal features, lithic debris, chipped stone tools, evidence of milling/vegetable processing activities including ground stone, and pottery. Single as well as long-term occupation may be represented.

Lithic scatters consist of sites containing lithic debris such as debitage or stone tools. No features or feature remnants are found at the site. The sites are interpreted as representing short-term activities.

Quarries are sites where lithic raw material was obtained and initially processed. Primary and secondary lithic procurement areas are geologic locations where chert and quartzite cobbles have been redeposited and later used by prehistoric inhabitants for tool manufacture.

Human burials, rock art, both pictographs and petroglyphs, and rock alignment sites, are unknown in the analysis area, but have been identified as sensitive or sacred to Native Americans. Few of these types of sites have been located in all of southwestern Wyoming.

Pottery/ceramics are as yet undocumented in the study area. Pottery is associated with the Uinta phase of the Late Prehistoric period. There are numerous pottery sites in southwestern Wyoming and northwestern Colorado.

3.11.4 Excavation Data

No sites have been extensively tested or excavated in the Brown Cow analysis area. However, several excavations have been conducted in the surrounding area contributing data about the prehistory of the area.

The Sheehan site is a multi-component prehistoric site (Bower et al.1984) located in the Washakie Basin, west of the analysis area. Component I dates to the Archaic period and Component II dates to the Late Prehistoric period. Data suggests both components reflect short-term winter camps with meat processing activities identified and locally available lithic materials exploited. The Nova Site (48CR4419) is located ca. 4 miles northwest of the SDPA block. The site is a Uinta phase housepit dating from 1098 to 1285 B.P. represents Component I as a short-term spring/late summer occupation. Component II was not dated but is believed to occur as the reuse of the Component I housepit.

3.11.5 Summary

The Class III intensive survey of ten well locations within the Brown Cow Unit produced only one prehistoric open camp, which could indicate a low site density within the survey area. Out of 32 inventories within the area, only three prehistoric sites have been reported. There were no historic sites identified within the immediate area of the Brown Cow Unit.

3.12 SOCIOECONOMICS

The primary geographic area of analysis for potential socioeconomic effects of the Proposed and No Action alternatives is Carbon County, Wyoming and the communities of Baggs, Dixon and Rawlins. Temporary housing availability is also described for the Moffat County, Colorado community of Craig, and the Sweetwater County, Wyoming community of Wamsutter. Carbon County socioeconomic conditions characterized for the assessment include economic and population conditions, temporary housing resources, law enforcement and emergency management services, certain local and state government revenues and local attitudes and opinions.

3.12.1 Economic Conditions

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

Employment and earnings are two common measures of economic activity. The mining sector, which includes oil and gas employment, would be the primary sector affected by the Proposed and No Action alternatives.

In 2000 Carbon County employment totaled 9,804 full and part-time jobs, which was a little less than one percent lower than the 1990 level (WDAI 2003a) and about 28 percent lower than the1980 level of 13,560 jobs. Mining sector employment, which includes oil and gas jobs, decreased 66 percent from 1990 to 2000, from 934 to 318 jobs. The 2000 level was 91 percent lower than the 1980 level of 3,563 jobs mining jobs. The mining sector losses and the volatility in total employment are attributed to the shutdown of the Rosebud and Seminoe # 2 mines (USDI-BLM 1999) and more recently closure of the RAG Shoshone mine near Hanna (Rawlins

Daily Times 2000a). However, in recent years increased natural gas drilling has resulted in employment increases in support sectors such as construction and specialized services (Schnal 2000).

In Carbon County, ten-year annual unemployment averages ranged from a low of 4 percent (2000) to a high of 6.1 percent (1993). The 2002 Carbon County annual unemployment rate was 5.3, based on 306 unemployed persons out of a total labor force of 7,672. The Carbon County labor force declined 9 percent between 1990 and 2002 (Wyoming Department of Employment 2003).

Carbon County earnings increased from $202 million to $225 million between 1990 and 2000, an 11 percent increase. However, when adjusted for inflation, Carbon County earnings decreased by 15 percent during the decade.

3.12.1.1 Oil and Gas Activity

Carbon County natural gas production increased, from 76 million MCF in 1995 to about 98 million MCF during 2002, an increase of 29 percent. Carbon County oil production in 2002 was 1.7 million barrels or about 30 percent higher than the 995 level of 1.3 million barrels. In 2002, During 2002, there were a total of 1,191 producing oil and gas wells in Carbon County, and the County produced 5.6 percent of all gas produced in Wyoming and 3.1 percent of all oil.

One indicator of future production, approved applications for drilling permits (APD), increased steadily in Carbon County in recent years, from 50 in 1995 to 199 in 2002. Increased drilling may result in increased production in the county if drilling efforts are successful and commodity prices increase or stabilize at economic levels (WOGCC 1995-2002).

3.12.1.2 Economic Activities in the Vicinity of the Proposed Action

Other economic activities occurring on and near the BCPA include oil and gas exploration (Vosika Neuman 2000), cattle grazing (Warren 2000) and outdoor recreation activities such as hunting (pronghorn antelope, mule deer, elk and upland birds), hiking, off road vehicle use, camping and sightseeing. Currently 35 commercial hunting outfitters hold permits for the hunt areas for the portion of Carbon County that contains the BCPA (Clair 2000).

3.12.2 Population

Carbon County population growth and decline parallels the employment boom and bust cycle outlined at the beginning of this section. For example, the 2000 Carbon County population (15,639) was 29 percent lower than its 1980 level of 21,896 (WDAI 2001). Between 1990 and 2000, the City of Rawlins, the largest community in Carbon County, lost an estimated 842 persons to end the period at 8,538. The Town of Baggs, the closest community to the Brown Cow project area, gained 76 residents or 28 percent of its 1990 population, and the Town of Dixon, several miles east of Baggs, gained 12 persons to end the period with an estimated population of 79.

3.12.3 Temporary Housing Resources

The nature of CBM drilling and field development activities (relatively short duration tasks performed primarily by contractors) results in demand for temporary housing resources such as motel rooms and mobile home and recreational vehicle (RV) spaces near the project area.

3.12.3.1 Baggs/Dixon Area

In the Baggs/Dixon area, temporary housing resources include rental houses, duplexes, apartments, motels and mobile home parks. Several houses currently under construction are intended to serve the rental market. A 26-space mobile home park in Baggs is equipped to accommodate RV's as well as mobile homes. Within the park there are several rental mobile homes. There is a small four-space mobile home park in Savery and a number of mobile home lots scattered throughout the Little Snake River Valley (Grieve 2000).

There are two motels in Baggs with a total of 64 rooms, most of which can accommodate several guests. Both motels routinely accommodate oil and gas industry workers as well as tourists, travelers and hunters (Willis 2000, Hawkins 2000).

During the summer of 2003, there were more available rental units than in recent years, including vacant rental houses and vacant spaces in mobile home parks (Grieve 2003)

3.12.3.2 Craig, Colorado

The Craig Chamber of Commerce lists 12 motels with a total of 467 rooms and 2 campground/RV parks with a total of 128 spaces (Craig Chamber of Commerce 2000).

3.12.3.3 Wamsutter

Temporary housing resources in Wamsutter include two mobile home operations; one has 26 spaces (Highland 2000, 2002), the other had 75 spaces and some pads equipped to serve RV's (Waldner 2000, 2002). There are two motels in Wamsutter. Although drilling activity in the Wamsutter area was relatively high during the summer of 2003, there were some vacancies in mobile home parks (Carnes 2003)

3.12.3.4 Rawlins

Rawlins has 19 motels and 4 RV parks (Hiatt, 2000). There are also a substantial number of apartment buildings (Hewitt 2000).

3.12.4. Law Enforcement and Emergency Response

Law enforcement services in the southwestern portion of the county are provided by the Carbon County Sheriff's Department. Currently coverage is provided by one full-time and one part-time deputy. The deputies provide coverage for the Town of Dixon and the community of Savery; the Town of Baggs has one police officer (Colson 2000).

Medical services in Baggs are provided by the county-owned clinic, which is staffed by a physician's assistant (PA), supported by other medical and administrative personnel. Emergency response is provided by six volunteer emergency medical technicians (EMT) who staff two county-owned ambulances. Seriously injured patients are transported to Craig or Rawlins, depending on the location of the accident. Casper-based Flight-for-Life is also available if appropriate (Herold 2000).

3.12.5 Local Government and State Government Revenues

Local and state government fiscal conditions most likely to be affected by the Proposed Action and No Action alternatives include county, school and special district ad valorem property tax revenues, state, county and municipal sales and use tax revenues, state severance taxes, and federal mineral royalty distributions. Some county, municipal and special district service expenditures may also be minimally affected.

3.12.5.1 Ad Valorem Property Tax

Carbon County assessed valuation in fiscal year (FY) 2002 totaled about $515 million, which yielded total property tax revenues of $32.4 million. Total mill levies (within Carbon County communities) ranged from 68.39 to 72.89. FY 2002 assessed valuation from 2001 natural gas production totaled $338 million or about 66 percent of total assessed valuation. Assessed valuation from oil production totaled $26.3 million or about 5 percent of total valuation (WTA 2002).

3.12.5.2 Sales and Use Tax

FY 2000 sales and use tax collections in Carbon County totaled about $18.5 million. These include collections from a four percent statewide sales and use tax and a one-percent general purpose local-option sales and use tax (WDAI 2003b).

3.12.5.3 Severance Taxes

In Wyoming, severance taxes are levied against certain minerals produced in the state, including a six percent severance tax on natural gas. In FY 2000, severance tax distributions totaled $299.4 million (WDEA 2003c). Of the total, 43 percent was attributable to severance taxes on natural gas.

3.12.5.4 Federal Mineral Royalty Distributions

The federal government collects a 12.5 percent royalty on oil and natural gas extracted from federal lands. Fifty percent of those royalties are returned to the state where the production occurred. In Wyoming, the state's share is distributed to a variety of accounts, including the University, School Foundation fund, Highway fund, Legislative Royalty Impact Account, and

cities, towns and counties. In FY 2002, a total of $348.6 million in federal mineral royalty funds were distributed to Wyoming entities (WDEA 2003d)

3.12.6 Attitudes and Opinions

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

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

County-wide, 54.9 percent of survey respondents (based on a weighted average; some respondents indicated more than one response) indicated that conservation of land, water and wildlife resources was more important than increased oil and gas production, while 36.9 percent indicated that increased oil and gas production was more important. However, among Baggs respondents, the reverse was true. About 54 percent indicated that increased oil and gas production was more important than conservation of land, water and wild life resources while 36 percent indicated that resource conservation was more important. The land use plan attributes this difference to Baggs' greater economic dependence on future oil and gas employment.

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

Coal-bed methane development was not considered during the survey, therefore resident attitudes and opinions about unique aspects of coal bed methane are not known (Hewitt 2000).

3.12.7 Environmental Justice

Executive Order (EO) 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations" was published in the *Federal Register* (59 FR 7629 on February 11, 1994. EO 12898 requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level).

Communities within Carbon County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of a natural gas development within the project area. Communities potentially impacted by the presence or absence of the proposed natural gas development have been identified above in this section of the DEIS. Environmental Justice concerns are usually directly associated with impacts on the natural and physical

environment but these impacts are likely to be interrelated to social and economic impacts as well.

3.13 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 is served by improved and unimproved BLM roads.

3.13.1 Access to the Project Site

Access to the project site is provide by a combination of Interstate, state highways and BLM roads. Table 3-17 displays specific access routes to the BCPA. The Wyoming Department of Transportation (WYDOT) measures average daily traffic (ADT) on federal and state highways. ADT on highways providing access to the BCPA are shown in Table 3-17.

WYDOT assigns levels of service to highways in the state system. Levels of service (A through F) are assigned based on qualitative measures (speed, travel time, freedom to maneuver, traffic interruptions, comfort and convenience) that characterize operational conditions within traffic streams and the perceptions of those conditions by motorists. A represents the best travel conditions and F represents the worst. Levels of service for highways providing access to the BCPA are also shown in Table 3-17

The BCPA would be accessed from WYO 789 and BLM Rd # 3309. WYO 789 is a two-lane, all-weather paved highway classified as a minor arterial in the state's Primary highway system (WYDOT 2001). BLM Rd. # 3309 (the Wild Horse Road) is an improved dirt road which is accessible except in very wet conditions.

Table 3-17. Access Routes to the BCPA

Highway or Road		
Highway or Road	2001 ADT	Level of Service / Accidents
I-80 (Junction 789)	12,000 (6,260 trucks)	A 1999: 89 5 yr average: 112.4
WYO 789 (Creston Jct. - Baggs)	890 (210 trucks)	B 1999: 27 5 yr average 16.4
BLM Rd # 3309	n/a	n/a

Sources: WYDOT 2001

3.14 HEALTH AND SAFETY

Existing health and safety concerns in and adjacent to the BCPA include occupational hazards associated with oil and gas exploration and operations; risk associated with vehicular travel on improved and unimproved county and BLM roads; firearms accidents during hunting season and by casual firearms use such as plinking and target shooting; and low probability events such as landslides, flash floods and range fires.

3.15 NOISE

Other than vehicle traffic on Wyoming State Highway 789, jet aircraft overflights at high altitudes, localized vehicular traffic on county, BLM and two-track roads and on-going drilling and production operations on lands adjacent to the project area create even modest sound disturbances within, and in the immediate vicinity of, the BCPA.

CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter of the environmental assessment provides an analysis of the potential environmental consequences that would result from implementation of the Proposed Action (federal land development of twelve well locations, access roads, associated facilities and reclamation) and No Action (denial of further federal land development) in the Brown Cow project area (BCPA). Measures that would avoid or reduce impacts under the Proposed Action have been included in Chapter 2. The following impact assessment takes these measures into consideration. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 are presented in this chapter under Mitigation Summary for each resource discipline.

As discussed in Chapters 1 and 2 of this EA, the BCPA lies within the proposed Atlantic Rim CBM project area (Figure 1-2). Drilling and field development activities associated with the Brown Cow EA Proposed Action would be guided by the Interim Drilling Policy (IDP) (see Appendix A), The IDP is a management tool to guide project planners in allowable actions that may be approved during interim exploration while the Atlantic Rim EIS is being prepared. Any approval or authorizations for this project will come from the Decision Record and Finding of No Significant Impact (FONSI) to this EA.

This analysis of environmental consequences addresses only those direct and indirect impacts associated with exploration and development of the Brown Cow interim development pod. The Proposed Action is primarily within an existing gas producing area and would use existing infrastructure for access to and transport of new production. New disturbance would be reduced by use of existing roads, well pads, and injection wells. Information regarding resources in the project area, such as cultural, paleontological, geologic hazards, soils, subsurface water, etc. is available from past drilling and development.

The difference between the Proposed Action and No Action alternatives is small for this project due to the following. The Proposed Action would consist of a 12 well development program, utilizing existing infrastructure to the greatest extent reasonable. The No Action alternative would deny implementation of the proposed action, but the USDI BLM would still be required to allow current production to continue, and new wells could be approved on a case by case basis within existing environmental analyses, as explained in Section 2.2.

The description of the environmental consequences for each resource section in this chapter includes the following subsections:

Impacts The level and duration of impacts that would occur as a result of the Proposed Action or the No Action Alternative. The impact evaluation assumes that the applicant-committed practices described in Chapter 2 would be implemented

Mitigation - A summary of additional measures that could be applied to avoid or reduce impacts. Also, because of the similarity between the Proposed Action and No Action, it is assumed that the mitigation described applies to both alternatives. The measures identified under this section would be considered for application to all Bureau of Land Management-(BLM)

administered lands. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts - A summary of impacts that remain after the application of available and reasonable mitigation and, therefore, would remain throughout the duration of the project and to some point beyond.

Cumulative Impacts - A description of impacts likely to occur due to this project in combination with other on-going and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable future actions or RFFA's).

This environmental analysis addresses cumulative impacts associated with exploration and development of 200 interim CBM wells and other activities, on-going or proposed, within the Atlantic Rim project area. Cumulative impacts associated with exploration and development of the Brown Cow pod are shown in Section 4.15 of this EA..

4.1 GEOLOGY/MINERALS/PALEONTOLOGY

4.1.1 Impacts

4.1.1.1 Proposed Action

Utilization of proper construction techniques described in Chapter 2 would minimize impacts resulting from the topographic alteration of developing twelve CBM wells and associated facilities. As discussed in Chapter 3, no major landslides have been mapped within the project area. Following prescribed procedures construction activities would not likely activate landslides, mudslides, debris flow, or slumps. Seismic activity is low in the area, so the potential for damage of project facilities is minimal.

Inventory of geologic resources revealed no major mineral resources that would be impacted by implementation of the project other than CBM reserves. Drilling of CBM wells would better define the location and nature of CBM resources available within the BCPA. Recovery of CBM would result in the depletion of the natural gas resource.

As discussed in Chapter 2, Project-Wide Mitigation Measures, the mitigation measures presented in the Soils and Water Resources sections would avoid or reduce potential impacts to the surface geologic environment. Implementation of these measures and adherence to Federal and State rules and regulations regarding drilling, testing and completion procedures would avoid or reduce potential impacts to the subsurface geologic environment.

Impacts could occur to the paleontology environment if surface disturbance associated with the Proposed Action results in the exposure and destruction of fossil resources, along with associated loss of geologic information. However implementation of the Proposed Action could also result in new fossil resources being discovered and properly recovered and cataloged into the collection of a museum repository, so that they are available for study.

No existing fossil localities have been identified in the sedimentary deposits that underlie the BCPA, including the late Cretaceous Lance Formation and Lewis. The Lance Formation

satisfies BLM Paleontology Condition 2, in that they include areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. According to the BLM the presence of geologic units from which such fossils have been recovered elsewhere may require further assessment of these same units where they are exposed in the area of consideration. The Lewis Shale satisfies Paleontology Condition 3.

Based on Probable Fossil Yield Classifications (PYCF) under development by the BLM Wyoming State Office (Hanson 2003) the Lance Formation is considered a Class 5 formation and the Lewis Shale is a Class 3 formation. Paleontology Class 5 formations include highly fossiliferous geologic units that regularly and predictably produce either vertebrate fossils or scientifically significant non-vertebrate fossils, or both. The presence of a geologic unit from which such fossils have been recovered elsewhere may require further assessment of the same unit where it is exposed in the area of consideration. Class 5 formations are at risk of natural degradation or human-caused adverse impacts, or both, and require appropriate consideration during environmental evaluation of potential affects to paleontology of surface disturbing activities. Mitigation recommendations for the Lance Formation is provided in Section 4.1.3.1.

Class 3 Paleontology Formations are fossiliferous sedimentary units where fossil content varies in significance, abundance, and predictable occurrence. The land manager's concern for paleoresources on Class 3 acres may extend across the entire range of management. Ground disturbing activities require sufficient mitigation to determine whether paleoresources occur in the area of a proposed action. Mitigation beyond initial findings would range from no further mitigation necessary to full and continuous monitoring of significant localities during the action. No fossil localities are known in the Lewis Shale in the BCPA and the formation is less likely to yield them than the Formation. As a result, no specific mitigation measures are recommended for the Lewis Shale beyond that described in Chapter 2 (Section 2.1.8.2.4).

4.1.1.2 Alternative A - No Action

Under the No Action Alternative, the existing developments in the area would continue. New wells could be proposed, assessed, and possibly approved on a case by case basis.

4.2 AIR QUALITY

4.2.1 Impacts

4.2.1.1 Proposed Action

Under the proposed action, air emissions would occur from the construction and production of coalbed methane wells within the project area. Construction emissions would include PM-10, SO_2, NO_x, CO, and VOCs, from ground-clearing, heavy equipment use, drilling, and completion activities, as well as the construction of necessary additional roads. Construction emissions are temporary and would occur in isolation, without interacting with adjacent wells.

Production emissions of NO_x, CO, SO_2, VOC, and HAPs (formaldehyde) would result primarily from methane gas- or diesel-powered electric generators used to power pumps operating temporarily throughout the BCPA. The emissions generated from methane gas-fired operations would contain negligible amounts of SO_2 and particulate matter due to the composition of coalbed methane gas. Emissions from electric generators would occur until electric line power

is available in the field. Emissions from the coalbed methane wells would be negligible since the coalbed methane gas composition in the BCPA is nearly 100 percent methane and there is no additional production equipment required at well sites. No new compressor engines are proposed in the BCPA at this time.

Pollutant emissions from the construction and operation of natural gas fields in the vicinity of the BCPA have been analyzed in air quality studies performed under NEPA by the BLM. Studies conducted for the Desolation Flats Natural Gas Development Project (BLM, 2003) and for the Continental Divide/Wamsutter II and South Baggs Natural Gas Development Projects (BLM, 1999) indicated potential near-field increases in CO, NO_2, PM-10, and SO_2 concentrations. However, the predicted maximum concentrations were found to be well below applicable state and National Ambient Air Quality Standards. Similarly predicted HAP (formaldehyde) concentrations were found to be below 8-hour maximum Acceptable Ambient Concentration Levels, and the related incremental cancer risks to residences would also be below applicable interest levels

The Desolation Flats Natural Gas Field Development Project included the development of 592 wells. The Continental Divide project analyzed over 3000 wells and the South Baggs project included 90 wells. Based on the relative size of the Proposed Action (12 wells and no new compressor engines) when compared to the magnitude of these projects, no ambient air quality standards would be violated or adverse air quality conditions would be expected to result from the Proposed Action.

4.2.1.2 Alternative A - No Action

Potential air quality impacts would less than those described under the Proposed Action, with impacts from existing field emissions sources remaining at current levels.

4.3 SOILS

4.3.1 Impacts

4.3.1.1 Proposed Action

Approximately 38.8 acres of soils resources would be temporarily disturbed during drilling and field development; after initial reclamation, approximately 7.5 acres would remain disturbed over the life-of-project (see Table 2-2).

Increased susceptibility to wind and water erosion would be a direct impact in newly disturbed areas and may cause sedimentation in drainage channels or impoundments. Soil compaction caused by equipment traffic or by increased raindrop impact after loss of surface vegetation cover would decrease infiltration and percolation, increase runoff, and reduce overall water storage capacity. Susceptibility to erosion would occur primarily in the short term and would decline rapidly over time due to the use of proper construction and reclamation techniques and the implementation of mitigation measures described in Chapter 2.

Due to the high amount of salt or sodium content/high clay material within the project area disturbance and/or use of this material is discouraged. Sodium affected soils could contaminate suitable material and cause dispersion of clays and sealing of reclaimed surfaces. Other direct

chemical impacts to the soil resource could also include reduction of overall fertility based on length of stockpiling of material and loss of nutrients (FS 1984); possible oxidation and release of elements such as boron or selenium, although no analyses were conducted.

Stripping of high clay material, surface sandy or gravelly material, as well as channery material in the subsoil, could reduce the physical suitability of the soil resource used from reclamation. If stripped and stockpiled with suitable material, contamination could result in increased droughtiness and decreased fertility, of reclamation material, as well as hamper actual seeding operations. Other physical impacts to the soils resource during stripping may include: loss of soil structure and decreased permeability; mixing of various textures; and solution of surface organic matter and subsequently soil biota. Stockpiling soil material could degrade physical properties of the soil resource such as bulk density, in addition to the biological and chemical effects mentioned earlier (FS 1984). In addition, stockpiling of material can increase the potential for soil loss until the soil is revegetated.

Topsoil quality in the project area varies based on local topography and source of parent material. Primary limitations overall include: salt or sodium content; high clay content; thin soil development or inaccessibility to stripping operations; channery or high coarse fragment content; or sandy or gravelly soils. Revegetation potentials range from mostly fair to poor, with some areas rated as good. In addition to these limitations, low annual precipitation, susceptibility to wind and water erosion, and short growing season could make reclamation in the project area more difficult.

Due to the small area of disturbance and use of proper construction and reclamation techniques and implementation of mitigation described in Chapter 2, impacts to soil resources in the SDPA are anticipated to be minimal.

4.3.1.2 Alternative A - No Action

Under this alternative, impacts to the soils environment would be similar to those described for the Proposed Action but of a smaller magnitude.

4.4 WATER RESOURCES

4.4.1 Impacts

4.4.1.1 Proposed Action

Surface Water Potential impacts that could occur to the surface water system due to the Proposed Action include increased surface water runoff, off-site sedimentation due to soil disturbance associated with construction activities, water quality impairment of surface waters due to increased sedimentation and stream channel morphology changes due to road and pipeline crossings. The magnitude of the impacts to surface water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, water management methods, soil character, duration of time within which construction activities occur, and the timely implementation and success of mitigation measures. Adverse sedimentation is not expected to occur as a result of implementation of the Proposed Action due to compliance with RMP management directives and Executive Order 11990. Both regulations require avoidance of stream channels to the maximum extent possible.

Where total avoidance is not practical, the BLM AO will be shown why a stream channel and/or floodplain cannot be avoided and how the impacts would be minimized.

Construction activities would occur over a relatively short period of time. Construction impacts would likely be greatest shortly after the start of the project and would decrease in time due to stabilization, reclamation, and revegetation efforts. The construction disturbance would not be uniformly distributed across the project area, but rather, project construction activities would be concentrated within and around the wells.

The proposed project would require relatively little water demand and would not adversely affect existing surface or groundwater sources or rights. The project will use no more than 4.02 acre-feet of water for drilling, completion and dust control operations during construction operations. This water will come from municipal water supplies in Baggs, Wyoming. This water use will not result in surface water depletions and will be contained in reserve pits according to standard drilling practices.

Groundwater The primary impact of the Proposed Action on groundwater resources is best described as the loss of some hydraulic pressure head in the affected coal seam aquifer, and an increase in pressure head in the aquifer in which the coalbed water is injected. The partial removal of groundwater from the coal aquifer results in the reduction of the hydraulic pressure head, thus lowering the water levels in nearby wells competed in the same coal seam. The lowering of water levels in an aquifer is referred to as drawdown. Conversely, water levels will rise in wells completed in the injection zone.

SEO records indicates 13 permitted wells are completed in the Lance Formation, Lewis Shale, the Mesaverde Group, and Quaternary age Alluvium within a one-mile radius of the project area.

Well drilling and completion should have little adverse impact on existing groundwater quality. The improbable degradation of groundwater quality within any aquifers in the project area essentially eliminates the possibility of adverse effects to the area's groundwater right holders. A description of the geology and hydrology of the BCPA is given in Chapter 3.

CBM exploratory wells would produce water that would be disposed of in two injection wells. The proposed injection targets for both injection wells are the Cherokee and Deep Creek Sandstones, which are some 3,000 feet stratigraphically below the coal zones being explored. Background water quality analyses of the injection horizon currently are not available, but it is anticipated that the CBM-produced water that would be injected would be of equal or higher quality in regards to class of use as defined by WDEQ regulations. Injection of the CBM-produced water is not expected to result in any deterioration in groundwater quality within the injection horizon. These sandstones are isolated above and below by competent shale barriers that would prevent the infiltration of the injected water into any overlying fresh water zones. The only effect on the injection horizons would consist of an increase in hydrostatic head emanating from the injection well, which would dissipate with distance away from the wellbore. In terms of water quantity and quality, the Proposed Action's effect on the injection horizon would be minimal. The fracture gradient of the shale aquitards that overlie and underlie the injection horizons would not be expected to be exceeded, so all injected water would be contained in the injection horizon and would not migrate vertically. The fracture gradient will be determined by testing, and no injection will be allowed above that gradient. For this reason, the injected water is not expected to degrade water quality of the Mesaverde, or nearest, aquifer.

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

Monitoring of the quality of CBM produced water, the volume of water produced over time during testing, and the static water levels in nearby wells before, during, and after completion of Project activities would provide information about the groundwater system in the Project Area. This information also would be used to quantify interim drilling project impacts for use in evaluating future field development.

As all produced water is to be injected under the Project, surface water quality or quantity would not be affected directly by the disposal of produced water. Merit would implement BMPs to ensure spills of produced water do not occur.

Implementation of the Brown Cow Project would temporarily decrease water levels from present static conditions within the coal seam aquifer. Relative to the available drawdown within the aquifer, these impacts would be of minor effect. A complete drawdown analysis will be presented in the Atlantic Rim EIS. No measurable impacts to groundwater quantities or qualities are expected from this project.

4.4.1.1 Alternative A – No Action

Impacts to water resources under this alternative would be similar to the Proposed Action but of a lesser magnitude.

4.5 VEGETATION/ WETLANDS/NOXIOUS WEEDS

4.5.1 Impacts

4.5.1.1 Proposed Action

4.5.1.1.1 Vegetation Cover Types

The Proposed Action assumes construction of a total of 12 wells with a supporting infrastructure. Construction and installation of well sites, access roads, and ancillary facilities (including pipelines) would directly reduce the extent of vegetation cover types through disturbance, reduction, and/or removal of vegetation. Potential indirect impacts to the vegetation resource may occur as a result of soil compaction, mixing of soil horizons, loss of topsoil productivity, increased soil surface exposure, and soil loss due to wind and water erosion. During the project's development phase, the Proposed Action would create a surface disturbance of about 38.8 acres (see Table 2-2) which represents about 2.5 % of the surface area of the BCPA. This disturbance would be distributed among the primary and secondary vegetation types on the BCPA identified by the Wyoming GAP Analysis (Merrill et al. 1996).

During the operations (production) phase, all pipeline ROW's would be reclaimed. Of the initial 12.6 acres disturbed by drill pads, approximately 0.06 acre would remain disturbed after

reclamation for the life of the project (LOP). The projected two injection wells (1.03 acres each), and two pumping stations (0.66 acres each) and new roads (5.8 acres) would result in about 7.5 total disturbed acres during the LOP, assuming reclamation is successful. The initial disturbance associated with the construction phase would be reduced to about 7.5 acres over time which represents about 0.5% of the BCPA total land surface area. Any potential impacts would be minimized assuming construction, maintenance and operation of well pad sites and associated disturbances are in accordance with Chapter 2 of this EA, the Interim Drilling Policy, and RMP requirements.

Disturbance of the Wyoming big sagebrush, alkali sagebrush, Utah juniper, greasewood, and saltbush cover types under the Proposed Action would be minor, given that all these associations commonly occur in this area of south-central Wyoming. The short- or long-term loss in acreage described above would have a negligible impact on the overall abundance, distribution, or quality of these habitats.

In general, the extent and duration of impacts on vegetation in the project area would be influenced by the success of mitigation and reclamation efforts and the time required for natural succession to return disturbed areas to pre-disturbance conditions. Reestablishment of pre-disturbance conditions would be influenced by climatic (growing season, temperature, and precipitation patterns) and edaphic (physical, chemical, and biological soil conditions) factors. This would include the amount and quality of topsoil salvaged, stockpiled, and re-spread over disturbed areas. Reseeding and reclamation efforts could proceed after cessation of surface-disturbing activities and original contour and grade are achieved as discussed in Chapter 2 of this EA.

4.5.1.1.2 Wetlands and Waters of the U.S.

Due to a paucity of wetland/riparian sites on the BCPA, the probability of well pads, roads, or pipelines impacting these resources is low. The RMP specifies that a 500 foot minimum buffer around riparian and other water resources (including springs and seeps) will be maintained. Permits under Section 404 of the Clean Water Act would be required for any activities in potential wetlands. Merit would be required to demonstrate to the ACOE that there are no "practical alternatives" to placement of a well location in a wetland. The probability of impacting wetlands and other waters of the U.S. under the Proposed Action is low given the xeric nature of the BCPA and identified mitigation procedures stated in Chapter 2, Merit's APD's, the RMP, ACOE and BLM surface-disturbing guidelines.

4.5.1.1.3 Invasive/Noxious Weeds

Surface disturbing activities could increase the potential for infestation and spread of invasive (includes noxious) plant species. Invasive species, especially weeds, usually thrive on newly disturbed surfaces such as road and pipeline ROW's and out-compete more desirable plant species. As explained in Chapter 2, Merit will be responsible for the management and control of all invasive (including noxious) weed infestations on project-related surface disturbances during the projected LOP and will consult with the BLM Authorizing Officer (AO) and/or local Carbon County Weed and Pest Control District authority for acceptable weed control methods.

The RMP provides no guidelines for herbicide utilization within the RFO management area. Vegetation management activities allowed, including herbicides are detailed in the Record of Decision for Vegetation Treatment on BLM Lands in the Thirteen Western States. However,

good management practice requires that herbicide loading sites will be located at least 500 feet from live water, floodplains, riparian areas, and all special status plant locations. Aerial spraying of chemicals would be prohibited within 1/4 mile of special plant locations with hand application prohibited within 500 feet. Control measures would adhere to those allowed in the *FEIS, Vegetation treatment on BLM lands in the thirteen western states* (USDI-BLM 1991).

4.5.1.2 Alternative A - No Action

Under this alternative, additional APD's and ROW actions could be considered by the BLM on a case-by-case basis consistent with individual site-specific environmental analysis. Transport of natural gas products would be allowed from those wells in the BCPA that are currently productive. Given the unknown extent of these actions, it would be speculative to accurately predict potential impacts on vegetation under the No Action alternative.

4.6 RANGE RESOURCES AND OTHER LAND USES

4.6.1 Impacts

4.6.1.1 Range Resources

4.6.1.1.1 Proposed Action

Anticipated impacts to range resources associated with the Proposed Action are limited to a minimal loss of forage and associated AUM's, an increased potential for vehicle/livestock collisions and an increased potential for the spread of noxious and invasive weeds.

The BCPA lies within the Cherokee Grazing Allotment, described in Section 3.6. Livestock grazing activities would continue during the drilling, field development and operations phases of the project. Forage in the project area would be reduced slightly during drilling and field development and restored as soon as practical thereafter, except for areas used for roads, production equipment and ancillary facilities, which would remain disturbed throughout the productive life of the field (about 7.5 acres).

The increased traffic in the BCPA during the drilling and field development phase would correspondingly increase the potential for vehicle/livestock accidents during that period.

The average stocking rate for the Cherokee Allotment is about 10 acres per AUM. Consequently, the Proposed Action would result in a short-term loss of about 4 AUM's, and long-term loss of less than one AUM. These losses would amount to less than one percent of the total AUM's allocated for this allotment.

Based on the assumptions and estimates contained in this assessment, the Proposed Action would not result in impacts to range resources.

4.6.1.1.2 Alternative A- No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action.

4.6.1.1.3 Mitigation

The BLM would recommend that the operator establish speed limits in the BCPA and coordinate with affected livestock operators to minimize disruption during livestock operations, including lambing season and when young calves are present..

4.6.1.1.4 Residual Impacts

Loss of livestock due to vehicle collisions would be reduced over the long term.

4.6.1.2 Other Land Use

4.6.1.2.1 Proposed Action

Potential impacts to other land uses are limited to recreation resources and wildlife habitat, which are discussed under the sections dealing with those resources.

As described in section 3.6, other land use on and adjacent to the proposed action include wildlife habitat; oil and natural gas exploration, development, and transportation; and dispersed outdoor recreation (primarily hunting in the fall). Effects on wildlife resources are described in Section 4.7. Effects on recreation resources are described in Section 4.9. The preconstruction planning and site coordination process and measures described in Chapter 2 would reduce the potential for conflict with existing oil and gas pipelines, road ROW's and other oil and gas leases.

4.6.1.2.2 Alternative A - No Action

Under the No Action Alternative, other land use conditions described in Chapter 3.6 would remain relatively constant, with the exception that other oil and gas leases on or near the project area might be developed.

4.7 WILDLIFE

4.7.1 Impacts

4.7.1.1 Proposed Action

The proposed development would disturb approximately 38.8 acres, during production phase, of general wildlife habitat. Approximately 7.5 acres of long-term disturbance would remain following reclamation. Analysis of potential impacts of the proposed development upon wildlife assumes development of the wells in the approximate locations identified in Figure 4-1.

During the production phase, the unused portion of well sites and pipelines would be reclaimed. Following completion of production operations (life of the project is estimated at 10-20 years), the well field and ancillary facilities would be reclaimed and abandoned. Well pads would be removed and the areas revegetated with seed mixes approved by the BLM, some of which are specifically designed to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to predisturbance conditions. Grasses and forbs

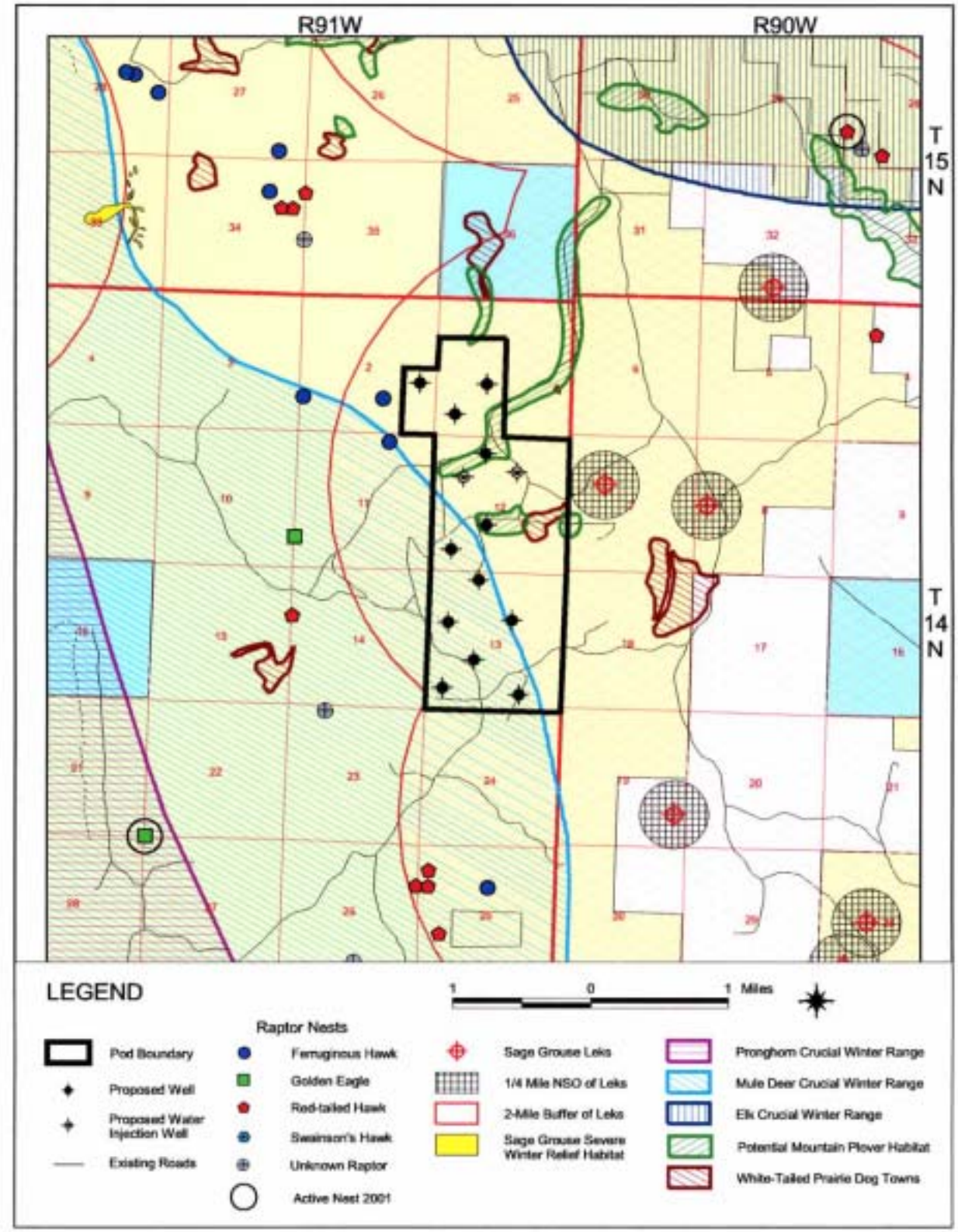


Figure 4-1. Wildlife Concerns in Relation to Proposed Well Locations.

are expected to become established within the first several years following reclamation, however, much more time would be required to achieve reestablishment of shrub communities. Consequently, disturbance of shrub communities would result in a longer-term loss of those habitats.

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

4.7.1.1.1 General Wildlife

The direct disturbance of wildlife habitat in the BCPA and outside of the pod under the proposed development would reduce habitat availability and effectiveness for a variety of common small mammals, birds and their predators. The initial phases of surface disturbance would result in some direct mortality to small mammals and the displacement of songbirds from construction sites. In addition, a slight increase in mortality from increased vehicle use of roads in the project area is expected. Quantification of these losses is not possible; however, the impact is likely to be low over the short-term. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed, small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation of pipelines, unused portions of roads, well pads, and wells that are no longer productive. No long-term impacts to populations of small mammals and songbirds are expected.

4.7.1.1.2 Big Game

In general, impacts to big game wildlife species would include direct loss of habitat and forage, and increased disturbance from drilling, construction, and maintenance operations. Disturbance of big game species during the parturition period and on winter range can increase stress and may influence species distribution (Hayden-Wing 1980, Morgantini and Hudson 1980). There may also be a potential for an increase in poaching and harassment of big game, particularly during winter. According to management directives in the RMP (USDI-BLM 1990), important big game winter ranges will be closed from November 15 - April 30, this closure of areas located in crucial big game winter ranges will reduce disturbance to wintering big game. This closure would also limit the potential for poaching and/or harassment of big game species wintering in the area. Depending upon local weather and site conditions, the BLM would consider exception requests on an individual basis for alteration of these closure dates.

Pronghorn Antelope. The BCPA supports antelope throughout the year. All of the BCPA is classified as pronghorn winter/yearlong range. Approximately 38.8 acres of pronghorn winter/yearlong range would be disturbed under the proposed action. Following reclamation, approximately 7.5 acres of winter/yearlong range would remain disturbed for the LOP.

Activities associated with the construction phase of the project would likely temporarily displace antelope, however, once construction is complete antelope would likely habituate and return to

pre-disturbance activity patterns. Reeve (1984) found that pronghorn acclimated to increased traffic volumes and machinery as long as the traffic and machines moved in a predictable manner. The displacement of pronghorn and disturbance of habitats is considered a minor short-term impact because of the temporary nature of the displacement and the availability of comparable habitats in adjacent areas.

Mule Deer. The BCPA supports mule deer year round. Approximately one-third of the pod is classified as mule deer crucial winter/yearlong range. Six of the proposed wells (Figure 4-1) would be placed within the crucial winter/yearlong range, resulting in approximately 18.6 acres of disturbance of this range type. Following reclamation, approximately 2.9 acres of mule deer crucial winter/yearlong range would remain disturbed for the LOP.

During winter, mule deer primarily utilize shrubs including sagebrush, mountain mahogany, and antelope bitterbrush (DeBolt 2000). Specific placement of roads and wells to avoid destroying habitat patches containing these shrub species will lessen the impact upon the crucial winter range vegetation in the project area. Overall, impacts upon mule deer winter habitat should be limited and no long-term impacts to mule deer in the area are expected because a very small percent of the crucial winter/yearlong range would be disturbed and the availability of similar habitats in the surrounding area. Further, reclaimed disturbance would result in a short term enhancement in forage for mule deer due to young grasses and forbs present in seed mixes.

Disturbance is also a factor that should be considered for big game species. According to management directives in the RMP, crucial big game winter ranges will be closed from November 15 - April 30. This closure of areas located in mule deer crucial winter/yearlong range would reduce disturbance to mule deer wintering on the project area. This closure would also limit the potential for poaching and/or harassment of mule deer. As mentioned above, exceptions may be considered by the BLM, but granting of these exceptions would only occur if weather and site conditions are conducive to minimization of wildlife impacts. No adverse impacts upon the mule deer population utilizing the project area are expected provided that mitigation measures contained in this document and the RMP are implemented.

Elk. The Brown Cow Pod supports elk during the winter months and all of the pod is classified as elk winter range. A total of 38.8 acres of elk winter range would be disturbed under the proposed action. Following reclamation, approximately 7.5 acres of elk winter range would remain disturbed for the LOP. During winter, elk utilize most of the same shrub species preferred by mule deer, but prefer grasses when they are available. Spatial separation of elk and mule deer on the winter range may occur (Hayden-Wing 1980), but they often utilize the same areas (DeBolt 2000). Overall, impacts upon elk habitat would be negligible.

4.7.1.1.3 Wild Horse Management

Wild horses do not occur on the BCPA nor does the project area lie within any BLM designated Horse Management Area (HMA). Therefore, wild horse management is a non-issue for the BCPA and will not be discussed further.

4.7.1.1.4 Upland Game Birds

Greater Sage-grouse. Suitable greater sage-grouse habitat is abundant on and around the project area and specific measures must be taken to avoid impacting this species. Sage grouse are of special concern because populations throughout the west have been declining and they

are likely to be petitioned for listing under the ESA. Under the Proposed Action, 32.3 acres of the Wyoming big sagebrush vegetation cover type would be disturbed during construction and 6.2 acres in the long-term. This amount of habitat disturbance is minimal (0.4% long-term) considering the amount available in the project area, however, sage grouse can be impacted by other activities associated with development including increased human activity, increased traffic disturbance, and pumping noises. Steps should be taken to ensure that impacts to leks, nesting areas, and severe winter relief habitats are minimized. Four active sage grouse leks have been identified within two miles of the project area (Figure 4-1), with one additional inactive lek located on the pod.

Construction activities within a two-mile radius of active leks would be restricted between March 1 and June 30 to provide protection for grouse during the egg-laying and incubation period. Exceptions may be granted if the activity will occur in unsuitable nesting habitat. If all avoidance and mitigation measures identified in this document, the RMP, and the Interim Drilling Policy are implemented, impacts to greater sage-grouse are expected to be minimal.

4.7.1.1.5 Raptors

The potential impacts of the Proposed Action on raptors are: (1) nest abandonment and/or reproductive failure caused by project related disturbance, (2) increased public access and subsequent human disturbance resulting from new road construction, and (3) small, temporary reductions in prey populations.

The primary potential impact to raptors from project activities is disturbance during nesting that might result in reproductive failure. To minimize this potential, disturbance would not be allowed during the critical nesting season (Feb. 1 - July 31, depending on the species) near raptor nesting habitat. The size of the restrictive radius and the timing restriction may be modified depending on species of raptor and whether or not the nest is within the line of site to construction activities. No active raptor nests were located on the BCPA during 2001. An artificial ferruginous hawk nest is present on the pod. If active raptor nests are located on the project area in future years, appropriate avoidance and mitigation measures would be taken to avoid adverse impacts to breeding raptors.

4.7.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.7.2 Mitigation

Given the implementation of the mitigation and avoidance measures outlined in this document, the adherence to existing management direction, and the additional measures that were presented within the discussions for the Proposed Action, significant impacts to wildlife are not expected.

4.7.3 Residual Impacts

Although the potential impacts associated with the Proposed Action would be minor, the effects of some would persist until they were off-set over time. Such effects would include the: (1) long-term loss of 28.2 acres of crucial winter range for mule deer, and (2) long-term reduction of 6.2

acres of potential sage-grouse nesting habitat. Construction of new roads may also cause long-term impacts such as increased human disturbance of wildlife near those roads and an increased potential for wildlife/vehicle collisions, poaching, and harassment.

4.8 SPECIAL STATUS PLANT, WILDLIFE, AND FISH SPECIES

4.8.1 Threatened, Endangered, and Proposed for Listing Species of Plants, Wildlife, and Fish

The following species are either threatened, endangered, or proposed for listing under the ESA. These species may have potential to occur on or near the project area and therefore potential impacts to these species caused by the proposed action are considered.

4.8.1.1 Plant Species

No federally listed threatened or endangered plant species are known to occur on or near the BCPA; therefore, implementation of the proposed development would not adversely impact federally listed species.

4.8.1.2 Wildlife Species

Black-Footed Ferret. In Wyoming, white-tailed prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food, and they depend upon prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980). If disturbance is going to occur within 50 meters of a prairie dog town with burrow density that is greater than or equal to 8 burrows/acre, then ferret surveys would be conducted prior to disturbance. The prairie dog town located in Section 12 is not expected to be disturbed given the current proposed location of wells (Figure 4-1). The proposed development is not expected to impact black-footed ferrets, provided that avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy are implemented.

Canada Lynx. The Canada lynx is not expected to occur on the BCPA because of the lack of suitable habitat, therefore, the proposed action is not expected to impact Canada lynx.

Bald Eagle. Bald eagles typically build stick nests in the tops of large coniferous or deciduous trees along streams, rivers or lakes. This type of habitat is not present on the BCPA, and bald eagles are not known or expected to nest on the pod. Bald eagles may utilize the BCPA during winter months when big game species are more concentrated on winter ranges. However, the BCPA does not support concentrated use by bald eagles and bald eagle use of the pod is likely incidental. Bald eagles may feed on road-killed carrion in the general vicinity of the pod and workers should be educated about the danger of striking a bald eagle with a vehicle along the main highways and roads providing access to the BCPA (especially Wyoming Highway 789). The Proposed Action is not expected to impact bald eagles provided that the avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are implemented.

Mountain Plover. Although ideal mountain plover habitat does not occur in the project area, some areas of potential mountain plover habitat do occur, and these areas may provide limited nesting opportunities. No mountain plover sightings were reported in the WYNDD (2003), and no mountain plovers were observed in the potential habitat areas during surveys conducted in

2001, 2002, and 2003. A portion of the potential mountain plover habitat would be disturbed with implementation of the proposed action (Figure 4-1). Impacts to mountain plovers would be minimized by avoiding construction activities in suitable plover nesting habitat during the nesting period from April 10 -July 10. The exact location of mountain plover nests may change annually, and mountain plover nest activity status and location must be kept current. For this reason, it is recommended that surveys for mountain plovers be conducted, within areas of potential habitat, prior to any surface disturbance in those areas, according to current mountain plover survey protocol (USDI-FWS 2002). No impacts to mountain plovers are expected provided that avoidance and mitigation measures outlined in this document and the RMP are implemented.

4.8.1.3 Fish Species

The lack of large river habitat within the project area precludes the occurrence of adults of the four species of endangered fish. Additionally, critical habitat has not been established anywhere in Wyoming for any of these species (Upper Colorado River Endangered Fish Recovery Program 1999). Yet, suitable habitat for spawning, age-0, and juveniles of these species may be present in the downstream portion of Muddy Creek or in the Little Snake River, which are both within the greater Atlantic Rim project area. Due to the injection of produced water, this project would not affect the hydrography of the Colorado River system, and therefore the water quantity needed for these fish.

Colorado Pikeminnow. Although one adult was collected from the Little Snake River in Carbon County, Wyoming in 1990, subsequent survey attempts to collect Colorado pikeminnow from this area of the Little Snake River by WGFD personnel failed to yield any other specimens (Baxter and Stone 1995). Although Muddy Creek and the Little Snake River may potentially support this species of fish at certain times, the current absence of this species downstream from the project area leads to the conclusion that this project would have no impact on this species.

Bonytail and Humpback Chub. Neither of these species has ever been reported within waters of the project area or immediately downstream from this project. However, the Little Snake River and although very unlikely, parts of Muddy Creek may have the potential to provide habitat for both bonytail and humpback chub.

Razorback Sucker. Suitable habitat for this species is not available on the project area and the species is not known from the Little Snake River drainage.

Within Muddy Creek, sediment levels may be elevated during construction of well access roads. Implementing reasonable precautions to limit offsite sediment movement from these areas would prevent substantial increases in sediment loadings in the downstream section of Muddy Creek and downstream from its confluence with the Little Snake River, and would avoid violation of Wyoming Water Quality Standards (WDEQ 1997; 2000). Because the limited water development and usage for this project are predicted to only affect subterranean aquifers related to the coal seams, surface flows would not be affected by water wells developed for this project.

Although occurrence of these endangered fish species has not been confirmed for the Muddy Creek drainage or immediately downstream in the Little Snake River, their probability of occurrence is highly unlikely. If any of these species are identified within the downstream

portion of Muddy Creek or immediately downstream in the Little Snake River, the BLM should consult with the FWS and develop a protection plan for the fish. Given these precautionary measures, no adverse impacts to any of these species are expected to result from the implementation of the Proposed Action.

4.8.2 Sensitive Plant, Wildlife and Fish Species

4.8.2.1 Plant Species

The occurrence of plant species of concern is likely limited on the BCPA due to a lack of suitable habitat for most of the species. Due to the low likelihood of sensitive plant species to occur on the BCPA and the small amount of disturbance associated with the proposed action, no impacts upon plant species of concern are expected.

4.8.2.2 Wildlife Species

Of the sensitive species listed by the BLM for the RFO area, the species with the highest potential to occur on the BCPA are the burrowing owl, dwarf shrew, white-tailed prairie dog, sage sparrow, Brewer's sparrow, sage thrasher, loggerhead shrike, ferruginous hawk, and the Northern leopard frog. The likelihood of the remaining species, northern goshawk, swift fox, fringed myotis, long-eared myotis, Townsend's big-eared bat, Baird's sparrow, long-billed curlew, white-faced ibis, trumpeter swan, peregrine falcon, boreal toad, and Great Basin spadefoot toad, occurring on the BCPA is low, therefore no impacts upon these species are expected with the Proposed Action. Burrowing owls are typically associated with prairie dog burrows. Burrowing owls may utilize the prairie dog town on the BCPA, however no disturbance is proposed to occur in the prairie dog town; therefore, the proposed development is not expected to impact burrowing owls. No Columbian sharp-tailed grouse leks are located within two miles of the BCPA. Therefore, use of the BCPA by Columbian sharp-tailed grouse would likely be minimal and no impacts are expected with implementation of the Proposed Action. The Wyoming pocket gopher is typically associated with lose gravely soils in greasewood plant communities. Although the Wyoming pocket gopher may be present on the BCPA, the small amount of disturbance associated with the proposed action is not expected to adversely impact the species if it is present. In summary, no serious impacts upon the wildlife species of concern are expected provided that avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are followed.

4.8.2.3 Fish Species

All three of the species (roundtail chub, bluehead sucker, and flannelmouth sucker) are documented to occur within the greater Atlantic Rim Project Area. Thus, suitable habitat for spawning, age-0, juveniles, and adults of these species may be present in the both Muddy Creek and offsite in the Little Snake River, which are both within the greater Atlantic Rim project area. No habitat for these three sensitive fish species occurs on the Brown Cow Pod.

Roundtail Chub. This species is common within the Little Snake River drainage and can also be found in Muddy Creek (Carbon County, Wyoming), a small perennial stream located in the southern portion of the Atlantic Rim project area (Baxter and Stone 1995).

Bluehead Sucker. This species is known to occur downstream from the proposed project area in the Little Snake River. Population sampling results conducted by BLM in 2000 and 2001 indicate the species is present, but rare, in Muddy Creek.

Flannelmouth Sucker. This species is known to occur in Muddy Creek and downstream in the Little Snake River (Baxter and Stone 1995).

If measures to prevent downstream sedimentation are implemented to prevent offsite movement of fluid spills or disturbed soils caused by construction activities under the Proposed Action (WDEQ 1997; 2000), implementation of the Proposed Action is not likely to adversely effect BLM sensitive fish species in either Muddy Creek or downstream in the Little Snake River. Implementation of reasonable precautions to limit offsite sediment movement should prevent violations of Wyoming Water Quality Standards (WDEQ 1997; 2000). Further, to avoid depletion of Muddy Creek and Little Snake River surface flows, and subsequent adverse impacts to these species due to surface or near surface water removals for well site use, water will be drawn from deep aquifer wells. Given these precautionary measures, implementation of this alternative is not likely to adversely effect the roundtail chub, bluehead sucker, or flannelmouth sucker.

4.8.3 Alternative A - No Action

Impacts to special status plant, wildlife, and fish species under the No Action alternative would be similar to the Proposed Action but of a lesser magnitude.

4.9 RECREATION

4.9.1 Impacts

4.9.1.1 Proposed Action

Impacts to recreation would involve temporary displacement of some hunters, particularly during construction and drilling. Some hunters perceive these activities as displacing game species and creating an environment that detracts from the hunting experience. Displacement could be highest during pronghorn season, but the proposed drilling schedule would limit displacement to one season. Hunters could relocate to other hunting areas near the BCPA.

Undisturbed landscapes, isolation and solitude are often important to non-consumptive users such as photographers and back packers. Project related disturbances that adversely impact the characteristic landscape could also contribute to a decline in the recreation experience for these users. There may be some displacement of these users to more pristine landscapes such as the Adobe Town Wilderness study area. The recreation experience for those continuing to use the area would be less satisfying than use under the pre-disturbance conditions described in Chapter 3.

The affects described above would diminish substantially once drilling and construction were completed. However, they would persist at reduced levels. Patterns of game use and population densities may change as a result of the project. Some long term displacement, permanent or relocation, of hunters and non-consumptive users would result from the project. Further, there may be reduced levels of satisfaction for those recreationists who might continue

to use the area. Overall impacts to the recreation resource would not be serious due to the short term nature of drilling and construction activities, concentrated locations of activities, and small number of recreationists affected.

4.9.1.2 Alternative A - No Action

Under the No Action alternative the status of the recreation resource as described in Chapter 3 would persist or change moderately depending on the approval of individual wells. No substantial impacts would be expected.

4.10 VISUAL RESOURCES

4.10.1 Impacts

4.10.1.1 Proposed Action

As noted in Chapter 3, Affected Environment, the BCPA is not pristine. Several off-road vehicle tracks exist throughout the area used occasionally by ranchers, recreationists and mineral developers.

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

As a result of terrain and elevation, only a small portion of the BCPA would be visible from Wyoming State Highway 789. Drill rig masts located on western edges of buttes and ridges may be visible during drilling operations. Other than these temporary, middle-ground visual impacts, potential reviewers of the contrasts described above would be few in number and would include hunters and other recreationists, ranchers, and oil and gas field workers.

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

The short term impacts of drilling and field development would exceed the level of contrast permitted in Class 3 areas; however, because the contrasts would be seen by relatively few viewers and would be short in duration, they would not be considered serious.

Permanent production facilities, as described in Chapter 2, would remain once well drilling activities were completed. The presence of permanent production facilities would have continued impacts in the long term.

These facilities would create contrasts in line, form, color, texture and overall pattern in the landscape and would remain for the duration of the project. Fugitive dust impacts as part of on-going operations would also persist. However, as noted for short term impacts, these contrasts would not be visible to many viewers. With appropriate mitigation, the level of contrast would

not exceed Class 3 standards. Levels of contrast could, however, detract from the experience of those recreating in the immediate area.

Additional fixed facilities such as access road (improved and unimproved roads) would be required to service production facilities. Roads would create additional contrasts in line, color and texture to those described above. With appropriate mitigation, the level of contrast would not exceed Class 3 standards. However, contrasts could diminish the experience of motorists and recreationists.

4.10.1.2 No Action

Under the No Action alternative the status of the visual resource would remain similar to that described in Chapter 3, depending on the number of individually approved wells and ancillary facilities. No substantial impacts would be expected.

4.11 CULTURAL RESOURCES

4.11.1 Impacts

4.11.1.1 Proposed Action

Direct impacts would primarily result from construction related activities. Activities considered to have the greatest effect on cultural resources include blading of well pads and associated facilities, and the construction of roads and pipelines. Sites located outside the BCPA would not be directly affected by the construction activities. If the area of the site crossed by earth disturbing activities does not possess the qualities that contribute to the eligibility of the site, the project is judged to have no effect. Another direct impact would be the visual impact on sites that are eligible under criteria A, B, or C. Setting is a factor for determining eligibility under these criteria and any alteration to the setting may impact eligibility and /or contributing segments.

Indirect impacts would not immediately result in the physical alteration of the property. Indirect impacts to prehistoric sites primarily would result from unauthorized surface collecting of artifacts which could physically alter the sites. At historic sites this could include bottle collecting and the introduction of visual impacts.

Contributing segments of historic trails would be avoided by a ¼ mile buffer zone or outside the visual horizon, whichever is closer. These actions are designed to provide protection for the historic trail corridors.

Cultural surveys have been completed in the BCPA, as required by the Interim Drilling Policy. Identification of important sites prior to disturbance would minimize impacts to cultural resources. The likelihood exists that buried sites could be disturbed during construction. Implementation of measures described in Chapter 2 would reduce impacts and minimize the loss of information.

4.11.1.2 No Action

Under this alternative, impacts to cultural resources would be similar to those described above,

but of a lesser magnitude.

4.11.2 Mitigation

Decreasing the heights of tanks and painting tanks a color compatible with the local environment could reduce visual impacts to sites eligible for the NRHP under criteria A, B, or C.

4.12 SOCIOECONOMICS

4.12.1 Impacts

4.12.1.1 Proposed Action

Socioeconomic Impacts of the Proposed Action would be largely positive. The project would enhance regional economic conditions and generate local, state and federal government tax and royalty revenues. The relatively small, short-term drilling and field development workforce would not generate serious demand for temporary housing or local government services. Successful implementation of the produced water re-injection program could help avoid community dissatisfaction with the Propose Action.

4.12.1.1.1 Economic and Employment Effects

The Proposed Action as described in Chapter 2 of this assessment would involve the drilling of 12 CBM wells, two or three produced-water injection wells, gathering and compression systems and other field infrastructure.

CBM drilling typically requires two shifts of 5 workers, an engineer and a mechanic. Completion crews are similarly sized. Leases in the Brown Cow pod are held by two operators, consequently several contractors could be drilling at one time. In addition, electric power lines, gas and produced-water gathering systems and other infrastructure would require construction crews. These activities would be temporary in nature, involving small crews working in the area for a matter of days or weeks. Given the relatively well-developed oil and gas service industry in Carbon and Sweetwater counties, construction crews are likely to be locally-based.

As discussed above, development and operation of the Proposed Action would require goods and services from a variety of local and regional contractors and vendors, from the oil and gas service industry and from other industries. Expenditures by the proponent for these goods and services, coupled with employee and contractor spending, would generate economic effects in Carbon County, southwest Wyoming and the nation as a whole.

The recent Jack Morrow Hills Coordinated Activity Plan (US BLM 2003), estimated that the drilling phase of a CBM well will would result in an average of $143,000 in direct expenditures, not including completion and field infrastructure costs. Including secondary spending, the drilling phase of each well would result in an estimated $194,000 in total economic impact in southwest Wyoming including $30,000 in earnings per well and the equivalent of one-full time job on an annual basis, considering the related direct and indirect employment (all estimates in inflation-adjusted $2001 dollars). Note that although each well would require a larger number of direct drilling and completion workers, these workers would be employed for only a few days on each well.

Based on these estimates, the 12 well drilling program would involve an estimated $3.4 million in direct expenditures, which would generate an estimated $4.7 million in total economic activity in southwest Wyoming, including $700,000 in earnings associated with the equivalent of 24 direct and indirect jobs. Although cost estimates are not available for completion and field development, the economic activity, earnings and employment of these activities could be equal to or greater than those associated with the drilling phase.

Economic effects of the production phase of CBM development have not been specifically analyzed for southwest Wyoming, however, research conducted for the Southwest Wyoming Resource Evaluation (UW 1996) and updated for the Jack Morrow Hills Coordinated Activity Plan (US BLM 2003) estimated the effects of natural gas production on the southwest Wyoming economy. This research based on averaged and inflation-adjusted ($2001) US Department of Energy forecasts for natural gas sales prices, estimated that each MMCF of natural gas produced would generate $2,793 in total economic impact in southwest Wyoming, including $188 in earnings and 0.005387 annual job equivalents (direct and indirect).

Based on these estimates, per well gross reserve estimates, and assuming all wells are productive, the Proposed Action would result in an estimated $67 million in revenues from natural gas production over 15 years. This would include an estimated $66.8 million in total economic impact in southwest Wyoming, including $4.5 million in earnings associated with an annual average of 9 jobs.

These estimates may changes as information about employment, infrastructure and maintenance requirements and other economic effects of CBM production in southwest Wyoming becomes available.

4.12.1.1.2 Carbon County Oil and Gas Activity

Successful completion of the Proposed Action would slightly increase natural gas production in Carbon County, particularly during the first several years of production. For example, the Proposed Action would result in an estimated 3.9 MMCF of methane during the second year of production. This is almost four percent of total 2002 Carbon County natural gas production. Natural gas production associated with the Proposed Action is anticipated to decrease each year thereafter (see Figure 4-2).

In 2002, a total of 199 APD's were issued for Carbon County. If this level of drilling activity were to remain constant, the 12 wells associated with the Proposed Action would increase the 2000 APD level for the county by about 6 percent.

4.12.1.1.3 Effects on Economic Activities in the Vicinity of the Proposed Action

As outlined in Section 3.11, economic activities occurring in the vicinity of the Proposed Action include other oil and gas exploration, grazing, and recreation, primarily hunting.

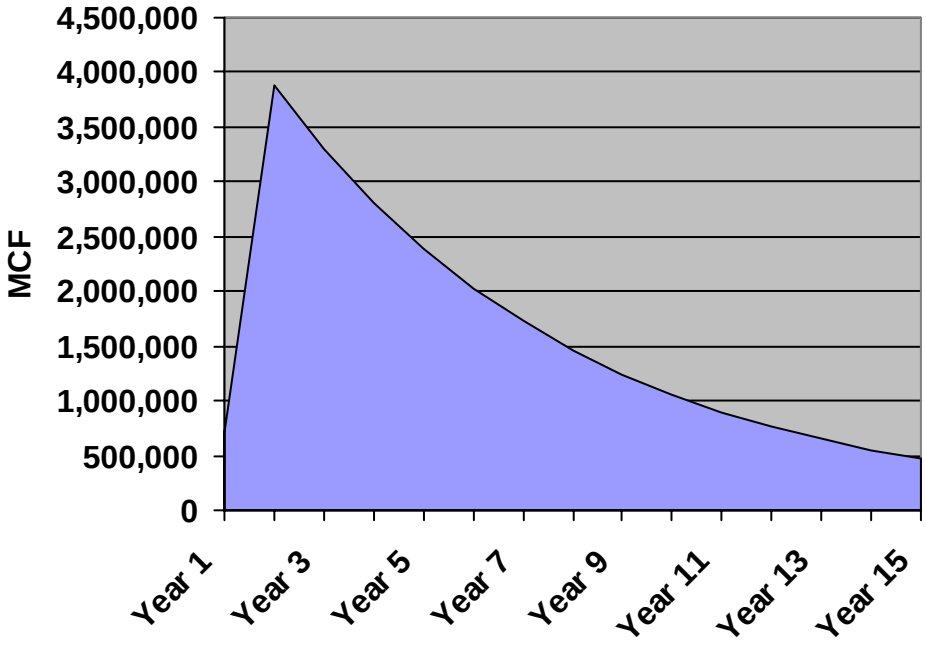
Properly performed, the pre-construction planning and coordination activities outlined in Section 2 would avoid economic effects on other oil and gas interests in the vicinity of the Proposed Action.

Economic effects on grazing activities would include losses of forage due to temporary and

long-term disturbance. As described in Section 4.6, temporary disturbance would result in the minor loss of AUMs. If these AUMs are not replaced in other allotments, the associated economic activity in Carbon County would also be lost. Given that these losses are relatively small and may be relocated to other areas, economic effects on grazing are anticipated to be minimal.

According to the recreation analysis conducted for this assessment (see section 4.8), some hunters and other recreationists may be temporarily displaced from the area associated with the Proposed Action during drilling and field development, and perhaps a lesser number during project operations. The effects of the Proposed Action on the Carbon County hunting and recreation economy are anticipated to be minimal, given the short term nature of the drilling and field development period, the relatively few hunters and recreationists who use the area and the potential that hunter's and recreationists may use other areas within Carbon County during this period.

Figure 4-2. Projected Proposed Action-Related Total Annual Gas Production.



Source: Sun Dog EA

4.12.1.1.4 Population Effects

Population effects of the Proposed Action would be minimal. Most of the skills and services required for the Proposed Action are available in the local and regional labor pool, although the recent increase in both conventional and CBM drilling activity in southwest Wyoming has absorbed much of the available oil and gas service workforce. A portion of the short-term demand for drilling workers may be filled by contractors from other areas of Wyoming (e.g., the Powder River Basin), but most field development workers are likely to be drawn from the local

or regional pool of workers and contractors (Little Snake River Valley, Rawlins, Wamsutter, Rock Springs and Craig). Given the short duration of the drilling phase (6 to 12 months), most non-local workers would be likely to relocate to Carbon County single status, i.e., without family members.

Given the relatively small workforce and short-term nature of the drilling and field development phase of the Proposed Action, it is likely that area businesses would accommodate the increase in economic activity with existing employees. For the operations phase, it is assumed that an annual average of nine job equivalents (direct and indirect) would be created in southwest Wyoming by the Proposed Action. Additionally, many of these jobs would be filled from the local labor pool, consequently, the population associated with the operations phase of the Proposed Action would be minimal.

4.12.1.1.5 Temporary Housing Demand

The relatively small Proposed Action-related demand for temporary housing during drilling and field development would be accommodated by existing temporary housing resources. Demand may be accommodated in Baggs, Rawlins, Rock Springs and/or Craig, depending on seasonal considerations and other oil and gas industry activity.

4.12.1.1.6 Law enforcement and Emergency Response

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

4.12.1.1.7 Fiscal Effects

The Proposed Action would generate tax revenues including:

- local ad valorem property taxes on production and certain field facilities;
- sales and uses taxes to the State of Wyoming, Carbon County and its incorporated municipalities;
- mineral royalties to the federal government, a portion of which are returned to the State and local governments; and,
- state severance taxes.

Ad valorem and severance taxes and federal mineral royalty estimates are based on $2.81/MCF DOE EIA gas price forecasts, averaged and adjusted for inflation ($2001).

4.12.1.1.7.1 Ad Valorem Taxes

The Proposed Action would generate ad valorem property tax to Carbon County, the Wyoming School Foundation Fund, Carbon County Schools and various taxing districts within the county. Ad valorem taxes would be generated from two sources: 1) the fair market value of methane produced and sold; and 2) the value of certain capital facilities within the well fields (all underground facilities associated with wells are exempt by state statute).

Constant Carbon County mill levies were assumed in the preparation of these estimates. In reality some mill levies are set each year by the Carbon County Commissioners, officials of the

various special and school districts or the State; some change each year. Mill levies reflect the revenue needs of the taxing entity and estimates of assessed valuation within the entity. Natural gas is assessed based on the previous year's production, therefore the revenues associated with these levies would be received the year following these estimates.

According to estimates provided by the proponent, gas production in the BCPA would peak in the second year of production and decline thereafter over the 15 year projected life of the project. Consequently, production-related ad valorem property tax revenues associated with the Proposed Action would be highest in the third year of production, and diminish annually thereafter. Under the assumptions described above, ad valorem tax revenues from production and facilities would total $4.1 million over the 15 year life of the project, including about $800,000 for the county and its districts based on 12 mills, $67,000 to the weed and pest district based on 1 mill, $3 million for schools based on 45 mills (12 for the State School Fund, 6 for the countywide school levy and 27 for the school district levy and other school taxes) and $243,000 for a variety of special districts (museum, cemetery, water conservancy and conservation) based on levies totaling 3.42 mills.

Table 4-1 Estimated Ad Valorem Property Tax Revenues Tax over the 15- year life of the Proposed Action

Carbon County (12 mills)	Weed & Pest (1 mill)	Total Schools (45 mills)	Special Districts (3.42 mills)	Total
$800,000	$67,000	$3,000,000	$243,000	$4,100,000

Source: Blankenship Consulting LLC based on production estimates. All estimates rounded.

4.12.1.1.7.2 Federal Mineral Royalties and Wyoming Severance Taxes

The federal government collects a 12.5 percent royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund. Actual Mineral Royalty revenues collected would vary based on actual production levels, gas sales prices, and production and transportation costs.

Table 4-2. Estimated Federal Mineral Royalties and Severance Tax over the 15- year life of the Proposed Action

Federal Mineral Royalties	Wyoming Severance Tax
$7,266,000	$3,051,000

Source: Blankenship Consulting LLC based on production estimates. All estimates rounded.

The State of Wyoming collects a six percent severance tax on the fair market value of natural gas produced within the state. Federal mineral royalty payments and production and transportation costs are exempt from this tax. The state uses revenues from this fund for a variety of purposes (e.g., General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve) and returns a portion to counties and municipalities. Estimated severance tax revenues are displayed in Table 4-2. Actual severance tax revenues would vary based on actual production levels, gas sales prices, and production and transportation costs. Actual

severance tax revenues may be less than these estimates if a portion of the gas is used for production purposes.

4.12.3.1.7.3 Sales and Use Tax

Wyoming levies a four percent sales and use tax on the gross receipts of tangible goods and certain services (drilling services are exempted). The state returns 28 percent of the revenue (less administrative costs) to the county and municipalities where the taxes were collected. Carbon County also levies a one percent local option sales and use tax which is distributed to the county and its municipalities.

During the field development phase of the Proposed Action, an estimated $3.4 million would be spent for goods and services subject to state and local sales and use taxes. This amount would generate about $59,000 for the State of Wyoming and about $43,000 for Carbon County and its municipalities.

4.12.1.1.8 Local Attitudes and Opinions

The 1996 resident survey conducted for the Carbon County Land Use Plan (discussed in Section 3.11.6) did not specifically address CBM development, but it provides a basis for assessing attitudes and opinions about issues associated with the Proposed Action. For example, it is reasonable to assume that survey respondents would have similar attitudes about CBM development activities that are similar to traditional natural gas development activities (i.e., seismic exploration, drilling, field development and production).

However, the importance that survey respondents placed on water conservation and the availability of water to support future land use suggests that the produced water aspects of CBM development could be of concern to them. Successful implementation of the produced water re-injection program described in Section 2.1.3.4.2 should mitigate those concerns.

According to the Carbon County Land Use plan, resident response to the survey suggests “a need to balance the conservation of natural resources and the economic viability of resource-based industries in the county.” This sentiment coupled with partial support for leasing more federal lands for oil and gas development (about 50 percent countywide, somewhat higher in every community but Rawlins and Saratoga) suggests that development of CBM resources would be generally supported by residents of the Little Snake River Valley, as long as they perceive that such development does not damage water resources or wildlife habitat, or degrade the quality of recreation resources in the area. The conclusions of the analyses conducted for this assessment are that impacts to water, wildlife and recreational resources would not be serious. If these conclusions are correct, the Proposed Action should not generate high levels of dissatisfaction among Carbon County residents. Conversely, if unanticipated impacts to water resources, wildlife habitat or recreation resources occur, resident dissatisfaction with the Proposed Action could be high.

4.12.1.1.9 Environmental Justice

The Proposed Action would not directly affect the social, cultural, or economic well-being and health of minorities or low income groups. The BCPA is relatively distant from population centers, so no populations would be subjected to physical impacts from the Proposed Action.

4.12.1.2 No Action

Implementation of the No Action alternative would result in socioeconomic conditions similar to those described in Section 3.11, unless other oil and gas development occurs in the vicinity of the Proposed Action.

4.13 TRANSPORTATION

4.13.1 Impacts

4.13.1.1 Proposed Action

4.13.1.1.1 Federal and State Highways

The Proposed Action would generate increases in traffic volumes on highways providing access to the project area and on county and operator-maintained roads within the project area. These increases would result from the movement of project-related workers, equipment and materials to and from the project area to perform drilling, field development, well service, field operations and reclamation activities.

Table 2-1 in Chapter 2 shows the estimated average number of trips associated with various well field activities. According to information provided by the proponent, drill rigs, water trucks and other items of heavy equipment would be transported to the BCPA and remain within the project area until drilling is completed. Materials and supplies would be delivered on a weekly basis and stockpiled within the project area at a staging area. Drilling and completion crews and other personnel would commute to the project area daily, except for drilling engineers who would stay at a trailer within the at the drill site during the workweek. Based on these plans and the estimates contained in the table, the Proposed Action would generate between 15 to 20 round trips per day over the drilling and field development period. After the drilling and field development phase is completed, Proposed Action-related traffic would average one or two trips per day, with slightly higher peak periods when maintenance activities are performed on wells and facilities.

Based on these assumptions and estimates, the incremental increase in area traffic associated with the Proposed Action would not result in a noticeable deterioration of level of service for I-80 or SH 789 (Rounds 2000).

Given the relatively small increment of traffic and the relatively short duration of the drilling and field development phase, it is unlikely that the Proposed Action would result in a measurable increase in accident rates on federal and state highways; during the operations phase, the probability of an increase in accident rates attributable to the Proposed Action is negligible.

4.13.1.1.2 BLM Roads

The Proposed Action would result in increases in traffic on BLM Rd. # 3309. The relatively small, short-term increases in traffic are unlikely to result in noticeable deterioration of this road or substantial increases in accidents. The primary effect of Proposed Action-related traffic on BLM Rd. # 3309 would be to accelerate road maintenance requirements

Increased traffic would generate an increased in the potential for vehicle/stock accidents, although the slower speeds required by the condition of county roads tend to minimize the frequency of such accidents (Warren 2000). Coordination with livestock operators during sensitive periods (e.g., cattle movements and calving season) could further reduce potential for vehicle/stock accidents.

4.13.1.1.3 Internal Roads

Section 2.1.2.1 (Access Road Construction) describes the measure proposed by the proponent to develop the transportation network necessary to access wells and ancillary facilities within the BCPA. Based on these proposals, an estimated 2.3 miles of new roads would be constructed within the project area. The proponent would be responsible for constructing and maintaining new and improved roads within the project area, therefore no fiscal impacts are anticipated for the BLM.

4.13.1.2 Alternative A - No Action

Implementation of the No-Action alternative would result in transportation conditions similar to those described in Section 3.12, unless other oil and gas leases are developed.

4.14 HEALTH AND SAFETY

4.14.1 Impacts

4.14.1.1 Proposed Action

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

Occupational Hazards

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

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

During the drilling and field development phase of the project the statistical probability of injuries

is low. During field operations, the annual statistical probability of injuries is minimal, given the low level of employment.

The US BLM, OSHA, USDOT and Wyoming OGCC and OHSA each regulate certain safety aspects of oil and gas development. Adherence to relevant safety regulations on the part of the Proponent and enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the project area, and the relatively low use of these lands by others (primarily grazing permittees and hunters), occupational hazards associated with the Proposed Action would mainly be limited to employees and contractors rather than the public at large.

Pipeline Hazards

Increasing the miles of gathering line within the analysis area would increase the chance of a pipeline failure. Accidents rates for gas transmission pipelines are historically low. Nationwide, injuries associated with gas transmission pipelines averaged 14 per year from 1990 through 1996, fatalities averaged one per year and incidents such as ruptures averaged 79 per year (U.S. Department of Transportation 1998). Therefore, the relatively small amount of new pipeline associated with the Proposed Action, coupled with the low probability of failure and the remoteness of the project area would result in minimal risk to public health and safety. Signing of pipeline rights-of-way could reduce the likelihood of pipeline ruptures caused by excavation equipment--particularly in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

Other Risks and Hazards

Highway safety impacts are discussed in Section 4.12 (Transportation). Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Section 2.1.7.2.16.

The potential for firearms-related accidents would occur primarily during hunting season. During this season the substantial activity in the project area would encourage hunters to seek more isolated areas thus reducing the potential for accidents. During operations, the relatively few personnel on site would result in minimal risk of firearms-related accidents.

The risk of fire in the analysis area would increase under the Proposed Action. This is an unavoidable impact associated with construction activities, industrial development and the presence of fuels, storage tanks, natural gas pipelines and gas production equipment. However, this risk would be reduced by the placement of facilities on pads and locations that are graded and devoid of vegetation which could lead to wildfires. In the event of a fire, property damage most likely would be limited to construction or production related equipment and range resources. Fire suppression equipment, a no smoking policy, shutdown devices and other safety measures typically incorporated into gas drilling and production activities would help to minimize the risk of fire. There would be a heightened risk of wildfire where construction activities place welding and other equipment in close proximity to native vegetation. Given the limited public use and presence in the project area, the risk to the public would be minimal. There would be a small in increase in risk to area fire suppression personal associated with the Proposed Action.

Based on the foregoing assessment, risks to public health and safety should only minimally

increase as a result of the Proposed Action.

4.14.1.2 Alternative A - No Action

Under the No Action alternative, health and safety risks would remain essentially as they are at the time of this assessment, unless other oil and gas leases within the area are developed.

4.15 NOISE

4.15.1 Impacts

4.15.1.1 Proposed Action

Noise associated with drilling, construction and natural gas production operations can create a disturbance that affects human safety (at extreme levels) or comfort as well as modifies animal behavior. Determining activities that exceed the maximum standards is not a simple issue since perception of sound varies with intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. Noise levels in excess of the 55 dBA maximum standards can occur at construction and production operations. Under typical conditions, excess levels decline below the level of significance (55 dBA) at 3,500 feet from the source (BLM 1991). Construction and drilling -related impacts would be short-term, lasting as long as activities were ongoing at well sites, access roads, pipelines, and other ancillary facilities such as compressor sites. Noise would be created over a longer term at the individual well sites as a resulting of drilling activities.

Given the low human population densities in the project area, construction and development operations under the Proposed Action would be sufficiently distant from residences that none would likely be affected by construction or development operations. Overall noise produced by construction and support services equipment during peak activity periods would be moderate because of the dispersed and short-term nature of these activities.

4.15.1.2 No Action

Implementation of the No Action Alternative would not add to existing noise levels within the BCPA, except for noise associated with wells and ancillary facilities approved on a case-by-case basis.

4.15.2 Mitigation Summary

The BLM may require that noise levels be limited to no more than 10 dBA above background levels at sage grouse leks.

4.15.3 Residual Impacts

Where indications ae that noise levels are above 10 dBA at lek locations, the implementation of the mitigation measures should minimize the impact of noise from production facilities on strutting sage grouse.

4.16 CUMULATIVE IMPACTS

Cumulative impacts are those that would result from the incremental impacts of the Proposed Action when added to past, present, and reasonably foreseeable future actions (RFFA's). Reasonably foreseeable development is that development likely to occur within the BCPA, or cumulative impact assessment area (CIA) within the next 5 years. CIA areas vary between resources and are generally based on relevant landscapes, resources, projects, and/or jurisdictional boundaries.

The only major resource development currently proposed near the project area is the exploration activity allowed under the Interim Drilling Policy for the Atlantic Rim Coalbed Methane area. The interim drilling policy allows a maximum of 200 coalbed methane wells within the Atlantic Rim project area, for research and exploratory purposes, during the interim period in which the Atlantic Rim EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple zones to be evaluated. Surface-disturbing activities for these 200 wells may affect an estimated 650 acres, including an estimated 60 miles of new road access (new roads associated with the interim drilling program will likely be in the form of spur roads from the existing road network) and an estimated 100 miles of water and gas flowlines. If productive, and following reclamation, long-term disturbance associated with the 200 well interim drilling program would likely affect an estimated 200 acres for the LOP. Total distance between Pod 1 and Pod 9 is about 40 miles. The distances between the individual pods vary, from 1 ½ miles between pods 2 and 3, to over 6 miles between pods 7 and 8 (see Figure 1-2). The Brown Cow pod is Pod #8 of the 200 well interim drilling program.

Past or existing actions on or in the vicinity of the BCPA that continue today and have major influences on the area include the road network; oil and gas wells; ranching/livestock facilities (i.e. fences, stock watering facilities, ranch houses, power lines, a pipeline etc.); and previously approved CBM wells and associated facilities.

The CIA area for soils, vegetation and wetlands, and water resources is the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim project area. To date, 109 wells have been drilled within this area. Of that total, 59 oil and gas wells have been plugged and abandoned and are probably within various stages of reclamation; 37 oil and gas wells are in various stages of completion, resulting in approximately 337 acres of long-term disturbance (related facilities disturbance included); and 13 CBM and water injection wells, and related facilities, have been drilled, resulting in approximately 13 acres of long-term disturbance. Pods 5, 6, 7, and 8 of the interim drilling program are located within this CIA area and would account for approximately 93 acres of additional long-term disturbance. The existing disturbance of 359 acres resulting from current oil and gas activities, added to the approximate 93 acres associated with the four pods under the 200 CBM well interim drilling program proposed for the Atlantic Rim area totals 452 acres (0.2 percent) of long-term oil and gas related disturbance within the 219,500-acre Muddy Creek CIA area.

Table 4-3 provides a summary of the cumulative impacts analysis requirements for each of the resource values in the other eight pods associated with interim development in Pod 8.

Table 4-3. Cumulative Impacts Analysis Matrix - Cumulative Impacts Associated with the Brown Cow Pod.

RESOURCE VALUE	POD1	POD2	POD3	POD4	POD5	POD6	POD7	POD9	DISCUSSION
Geology	X	X	X	X	X	X	X	X	All wells completed in the Almond Formation of the Mesaverde Group
Air Quality	X	X	X	X	X	X	X	X	All in Laramie Air Basin
Soils	O	O	O	O	X	X	X	0	Limit impact discussion to the Muddy Creek CIA area
Surface water	O	O	O	O	X	X	X	O	Pod 8 located in Muddy Creek CIA area; Pod 8 would have no impacts to other watersheds
Ground water	X	X	X	X	X	X	X	X	Production of ground water for all pods from Almond Formation
Vegetation	O	O	O	O	X	X	X	O	Limit impact discussion to the Muddy Creek CIA area
Range Resources	O	O	O	O	X	X	O	O	Pods 5, 6, 7 in the Doty Mountain Allotment
Wildlife	X	X	X	X	X	X	X	X	Sage grouse habitat in all pods, no drilling within 1/4 mile of leks & within sage grouse crucial wintering areas. No drilling in prairie dog towns that meet the requirement for potential t black-footed ferret (BFF) habitat without a BFF survey
Crucial WR	X	X	X	X	X	X	X	X	Pod 7 pronghorn CWR; Pods 8 & 9 mule deer CWR
Recreation	X	X	X	X	X	X	X	X	Minimal displacement of hunters & recreationists
Visual	X	X	X	X	X	X	X	X	Minimal displacement of recreationists
Cultural	O	O	O	O	O	O	O	O	Block surveys required in each pod, with additional mitigation; no cumulative relationship
Socioeconomic	X	X	X	X	X	X	X	X	All pods within the same socioeconomic area
Transportation	X	X	X	X	X	X	X	X	Increased traffic
Health and Safety	X	X	X	X	X	X	X	X	Major related health and safety issues related to travel
Noise	O	O	O	O	O	O	O	O	Localized affect on wildlife

X - Discussed in the EA; O - Not discussed in the EA (no cumulative relationship)

4.16.1 Geology/Minerals/Paleontology

Existing, proposed, and reasonably foreseeable actions would not affect landslide deposits and would be unlikely to trigger geologic hazards such as landslides, mudslides, debris flows, or slumps, no incremental increase in cumulative impacts associated with geologic hazards would occur. If the terms of the interim drilling policy are followed and proper well pad and facility siting, construction, and reclamation techniques are used the cumulative impacts to the surface geologic environment would be minimized. Proposed and RFFA's would require the restoration of disturbed lands to predisturbance conditions and as such would minimize topographic alterations. Standard stipulations and project- and site-specific construction and reclamation procedures would be required for additional development on federal lands and these measures would further minimize cumulative impacts of surface geologic environment.

With the exception of CBM, no major surface mineral resources would be impacted by the implementation of the RFFA's. Protection of subsurface mineral resources is provided by the BLM casing and well bore cementing policy.

No cumulative adverse impacts are expected to occur to potential fossil resources beyond those discussed in Section 4.1.1.1 as a result of the Proposed Action in combination with existing, proposed, and reasonably foreseeable actions. Adoption of mitigation measures prescribed in that section could foster cumulative beneficial impacts of the project by either resulting in the discovery of new fossil resources or providing paleontologists with evidence of absence of such resources in the area.

4.16.2 Air Quality

Cumulative impacts from emissions resulting from the implementation of past oil and gas projects and the proposed 200 well program would be much the same as those found on similar oil and gas projects such as Continental Divide. Emissions from oil and gas facilities approved prior to 1999 were included in the 3,000 well air quality analysis prepared for the Continental Divide EIS, of which only 2,130 wells were approved. The emissions from the 200 well interim drilling program would still be covered under the air quality model completed for the Continental Divide project.

4.16.3 Soils

The CIA area for soils includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. Cumulative impacts include soil impacts from on-going exploration and development activities, recently constructed projects, and RFFA's, as described in Section 4.15. Cumulative long-term disturbance of 452 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek Drainage CIA area. This amount of cumulative impacts upon the soil resources would be minimal, provided that all mitigation and avoidance measures are implemented

4.16.4 Water Resources

The water resources CIA area includes the 219,500-acre portion of the Muddy Creek Watershed, which overlaps the Atlantic Rim Project Area (ARPA). Existing and future disturbance consists of approximately 39.79 acres, or 0.015 percent of the Muddy Creek

Drainage CIA area. The area of possible water impacts related to the full development of the local watershed containing the Brown Cow pod is 2,977 acres, or 1.4 percent of the CIA area. This cumulative disturbance would minimally impact surface water or groundwater quantity or quality.

The impacts predicted to occur are based upon the current knowledge of the geology, CBM resources, and groundwater hydrology in the area. Both methane and water production rates from future CBM wells, and specifics related to groundwater injection, cannot be accurately predicted. These variables could potentially affect the configuration of field production, gas processing, and gas and water conveyance facilities; however, none of these changes are expected to measurably affect the conclusions presented herein. Federal regulations provide for additional analysis if substantial changes in resource conditions would alter the conclusions reached herein.

Cumulative impacts to surface water resources would be maximized shortly after the start of construction activities, decreasing in time due to reclamation efforts, then stabilizing during the production/operation period when routine maintenance of wells and ancillary facilities takes place. Additionally, all roads, well locations, and facility infrastructure would be regularly inspected and maintained to minimize erosion, sedimentation, and surface water quality impairment.

Impacts to groundwater within the project area are not anticipated. The springs in the area are classic “contact” springs, which result from permeable rocks overlying rocks of much lower permeability. In the ARPA, the permeable Browns Park Formation overlies the less permeable Almond Formation, which is a member of the Mesaverde Group. Water easily percolates through the Browns Park Formation, and is perched on the lower permeability clay and shales of the Almond Formation. Where this contact is exposed by erosion, a line of springs can result. The source of the springs is infiltrating precipitation, and this source would not be removed by pumpage of the underlying coal seams. For these reasons, pumping water from Almond Formation coal seams during exploration drilling within the ARPA would likely have little impact on the ability of these springs to produce water.

Due to thick confining layers, wells completed in water-bearing strata above or below the Almond coal seams are not likely to be impacted. Wells completed in the Almond Formation coal seams in close proximity (less than one mile) to the pod could be impacted. Tritium analysis of groundwater withdrawn from a CBM well in the Brown Cow Pod indicates that groundwater from the Almond Coal seam does not contribute to surface water flows in the Colorado River Basin. Tritium is a radioactive isotope that would be present if water had been deposited after nuclear testing in the 1940s. Tritium is measured in tritium units and would show values of 0.8 or higher if present. Other isotopic analysis has shown the water in these formations was deposited during the last ice age or earlier.

Cumulative impacts to the groundwater resources within the Mesaverde Group would be limited to a temporary decline in hydrostatic head in coal seams within the Almond Formation resulting from development of the Brown Cow pod and subsequent pods associated with the interim drilling program. For purposes of this EA, existing impacts to groundwater resources within the Mesaverde Group resulting from prior development are so limited as to be non-existent.

Current and future oil and gas exploration and development activities in the Project Area must comply with federal and state environmental regulations. Therefore, impacts to groundwater

quantity or quality on a cumulative scale are not expected. This is particularly true given the fact that wells would be completed in accordance with Onshore Order No. 2 and the recent BLM guidelines that reduce the potential for groundwater contamination.

This pod is development that would be accomplished in the interim period while the Atlantic Rim EIS is being completed. Ground water monitoring wells and drawdown modeling would be completed for the entire Atlantic Rim Project Area, of which the BCPA is a part, during the water resource analysis of the EIS.

4.16.5 Vegetation and Wetlands

The CIA area for vegetation and wetlands includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area, and encompasses some 219,500 acres. Cumulative impacts includes impacts to vegetation and wetlands from on-going exploration and development activities, recently constructed projects, and RFFA's.

Cumulative long-term disturbance of 7.5 acres would be approximately 0.003 percent of the 219,500-acre Muddy Creek Drainage CIA area. This amount of vegetation loss would be minimal, and no direct impacts of aquatic and riparian areas are expected because current proposed project activities would avoid these areas. Provided that soil erosion mitigation measures are followed, no indirect aquatic and riparian impacts are expected. Cumulative impacts upon both vegetation and wetland resources would be minimal, provided that all mitigation and avoidance measures are implemented.

4.16.6 Range Resources and Other Land Uses

4.16.6.1 Range Resources

Portions of the Blue Sky Pod (7) and Pod 9, and all of the Brown Cow Pod (8), of the 200-well interim drilling program, are located within the Cherokee Grazing Allotment. Based on the known LOP disturbance to the Blue Sky Pod, the proposed disturbance to the Brown Cow Pod, and an average per pod for Pod 9, the total LOP disturbance would be approximately 48 acres, as a result of CBM drilling operations on the three pods. The approximate 48 acres of long-term disturbance equates to a reduction of five AUM's (0.03 percent) from the total of 17,089 available in the Cherokee Grazing Allotment, which would be a minimal impact.

4.16.6.2 Other Land Use

Potential cumulative impacts to other land uses are limited to recreation resources and wildlife habitat, which are discussed under the sections dealing with those resources.

4.16.7 Wildlife

The CIA area varies with species, as indicated within the respective analyses. The disturbance of wildlife habitat resulting from implementation of the interim drilling program of the nine pods would reduce habitat availability and effectiveness for a variety of common mammals, birds and their predators. Initial phases of surface disturbance would result in some direct mortality to small mammals, displacement of songbirds, along with a slight increase in mortality from increased vehicle use in the areas of the nine pods. Due to the relatively high production potential of these species and the relatively small amount of additional habitat disturbed

(0.003% of the Atlantic Rim project area), small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation, and no long-term impacts to these populations are expected.

Activities associated with the construction phase of each of the nine pods in the interim drilling program would likely temporarily displace antelope, mule deer, and elk; however, once construction is completed they would likely habituate and return to pre-disturbance activity patterns. Elk crucial winter/yearlong range does not occur on any of the pods and should not be affected by project activities. Pronghorn crucial winter/yearlong occurs within the Cow Creek Pod (6) and the Blue Sky Pod (7). The proportion of pronghorn crucial winter/yearlong range within the Baggs Herd Unit that would be affected over the short-term and long-term, would be 0.03 and 0.008 percent, respectively. Mule deer crucial winter/yearlong range occurs on the Cow Creek Pod (6), Brown Cow Pod (8) and Pod 9. The proportion of mule deer crucial winter/yearlong range within the Baggs Herd Unit that would be affected over the short-term and long-term, would be 0.05 and 0.01 percent, respectively. Construction activities on crucial winter/yearlong range would be limited to May 1 - Nov 14. Provided that mitigation measures contained in Chapter 2, the Interim Drilling Policy, and the RMP are implemented, cumulative impacts to big game populations within their respective herd units are expected to be minimal.

Greater sage-grouse occupy the area of the nine pods year-round and make seasonal use of the habitats. Approximately 11,000 acres (56 percent) of the total surface area of the nine pods overlap the 2-mile radius of the historical leks in the area. Therefore, approximately 365 (3.3%) and 112 (1.0%) acres of potential sage grouse nesting habitat would, respectively, be affected by short-term and long-term disturbances associated with the production activities. Considering the vast amount of potential nesting habitat available, the 112-acre loss would be minimal. Sage grouse within Sierra Madre Upland Game Management Unit (Area 25) would only be minimally impacted from the cumulative LOP disturbance associated with the proposed action of the nine pods, provided the implementation of the NSO's, interim drilling guidelines, seasonal closures, reclamation, and mitigation measures provided are followed.

Although no active raptor nests were located on the nine pods during 2001 aerial surveys, implementation of protection measures identified in Chapter 2, the RMP, and the Interim Drilling Policy are expected to protect the raptor populations within the interim drilling area. Therefore, only minimal cumulative impacts to raptors within Muddy Creek Watershed are likely to occur.

4.16.8 Special Status Plant, Wildlife, and Fish Species

4.16.8.1 Plant Species

The distribution of plant species of concern is likely limited within the Atlantic Rim area due to a lack of suitable habitat for most of the species. The required application of existing FWS and BLM monitoring and mitigation measures is expected to provide adequate protection for threatened, endangered, and special status plant species. Thus, impacts to Special Status Plant Species are expected to be minimal.

4.16.8.2 Wildlife Species

Acreages and burrow densities that are adequate to support black-footed ferrets (200 or more acres with 8 or more burrows per acre) occur on three of the nine pods on the project area (Cow Creek Pod, Sun Dog Pod, and Blue Sky Pod). No disturbance to the town was proposed in the

Cow Creek Pod, so black-footed ferret surveys were not required. However, black-footed ferret surveys have been conducted on the other two pods and no ferrets or ferret sign were found. Because of the fact that black-footed ferret surveys are required (per interim drilling guidelines) on all prairie dog towns with proposed development, no impacts to this species are expected as the result of the proposed 200-well interim drilling activities.

The required application of existing FWS and BLM monitoring and mitigation measures is expected to provide adequate protection for threatened, endangered, and special status plant species. Thus, impacts to Special Status Wildlife Species are expected to be minimal.

4.16.8.3 Fish Species

Proposed development in the pods is not expected to result in reductions in BLM sensitive, Threatened, or Endangered adult fish numbers, or their exclusion from, or degradation to their spawning areas within the Muddy Creek watershed or in downstream waters of the Little Snake River. Additionally, permitted disturbances associated with the exploratory CBM pod development and other development within the Muddy Creek watershed would employ erosion control measures and construction techniques suitable to limit offsite soil movement and downstream degradation of fisheries habitat due to sediment inputs. The required application of existing FWS and BLM monitoring and mitigation measures to the proposed CBM interim drilling program is expected to provide adequate protection for threatened, endangered, and special status species. Thus, the cumulative impacts to fish species found within the affected watersheds are expected to be minimal.

4.16.9 Recreation

BLM does not have statistics on historical use of the project area by recreation groups which could be used to determine trends in cumulative impacts on recreation use and displacement. Cumulatively, overall impacts to the recreation resource are expected to be minimal with some temporary displacement of hunters and recreationists during the short-term drilling periods. Some long-term displacement of hunters and non-consumptive users may occur, and there may be reduced levels of satisfaction for those who might continue to use the area.

4.16.10 Visuals

As discussed in Chapter 3, existing visual qualities in the BCPA and adjacent lands have already been affected by ongoing natural gas development, including road building and pipeline construction. Existing, proposed, or reasonably forseeable development would add to the level of impact to visual resources in the immediate area. The composite experience of those traveling through the area, particularly on back roads, is one of a modified landscape. Contrasts in line, form, color and texture from development activities begin to dominate the viewer's experience. These conditions would increase the likelihood that viewers, particularly back country recreationists, would be dissatisfied with the visual component of their recreation experience. However, the cumulative impact of existing, proposed, or reasonably forseeable development on visual resources would still be consistent with the current VRM Class 3 designation with implementation of mitigation measures proposed by Merit in Chapter 2, Section 2.1.8.2.11.

4.16.11 Cultural Resources

Cultural resources on public lands, including archaeological sites and historic properties, are protected by federal law and regulations. Current CBM operations must comply with these protective regulations, and BLM has required the completion of cultural resource inventories prior to surface-disturbing activities. These inventories have been used to identify sites potentially eligible for inclusion on the National Register of Historic Places and to identify sites which BLM has required past exploration and development activities to avoid.

Because Class III cultural resource inventories have been completed on the BCPA, the potential for increased impacts on cultural artifacts would be minimized. By avoiding known cultural and historical sites during the layout of drill sites, access roads, and pipeline corridors, the potential for incremental increases in cumulative impacts would be avoided. Completion of cultural resource inventories would have a beneficial, cumulative impact on the level of cultural information about the project area. Some unintentional damage to subsurface resources could occur during grading or excavation activities. However, implementation of resource protection and mitigation measures described in Chapter 2, Section 2.1.8.2.15 would protect such resources upon discovery.

4.16.12 Socioeconomics

Southwest Wyoming is currently experiencing an increase in the pace and level of natural gas development. Drilling and field development is occurring in areas near the BCPA including Continental Divide/Wamsutter II, South Baggs, Mulligan Draw, Creston/Blue Gap, Hay Reservoir and potentially, Desolation Flats. While this surge in development will result in increased employment, income and tax revenues in the region, it will also result in increased housing demand and increased demand for local and state government facilities and services.

Communities such as Rawlins and Rock Springs are still below peak population levels of the 1980's and have infrastructure and housing to accommodate some population growth. Smaller communities near the BCPA, such as Wamsutter, are struggling to accommodate population growth associated with development of the currently approved natural gas fields identified above.

At the recent pace of development, neither the relatively small, short-term drilling and field development workforce or the minimal operations employment and activity associated with the existing, proposed, or reasonably forseeable development would add appreciably to cumulative housing and local government service demand in the area.

If the current pace of drilling and field development in southwest Wyoming continues, however, the potential for degradation of the quality of some recreation resources in the area would increase. If Carbon County residents perceive that degradation of recreation resources has occurred, levels of dissatisfaction among some residents and area visitors would correspondingly increase.

4.16.13 Transportation

Increased oil and gas development in western Carbon County and eastern Sweetwater County will result in increased traffic on affected segments of I-80 and WSH 789. The condition of these highways is adequate to accommodate existing levels of traffic and some increases

(Rounds 2000).

Currently known cumulative impacts on BLM RD # 3309 would be limited to grazing and recreation activities described in Chapter 3, and occasional traffic associated with oil and gas exploration activities. The increased traffic associated with drilling and field development of the interim drilling program would accelerate maintenance requirements; however, associated costs may be offset by project-related revenues generated, which are described in Section 4.11.

4.16.14 Health and Safety

Cumulative health and safety impacts would be limited to those associated with the 200 well interim drilling proposal and existing grazing and recreation activities. Occasional traffic and activity associated with oil and gas exploration activities would generate small increases in risks to project workers and the public. Cumulative impacts to health and safety conditions are anticipated to be similar to those described for the Proposed Action.

4.16.15 Noise

Noise would result from on-going construction, drilling, and CBM operations during the life of the project. Increased traffic on existing transportation system roads within the project area would occur, thus adding to existing traffic noise. Given the current and anticipated low traffic volumes, and dispersed nature of traffic and CBM operations within the BCPA, the projected additions to cumulative, traffic-related noise impacts would be minimal.

CHAPTER 5

CONSULTATION AND COORDINATION

5.0 CONSULTATION AND COORDINATION

An environmental assessment (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 action alternatives, and the impacts to be included in the document.

The Council on Environmental Quality (CEQ) regulations (40 CFR, Parts 1500-1508) require an early scoping process to determine the issues related to the proposed action and alternatives that the EA should address. The purpose of the scoping process is to identify important issues, concerns, and potential impacts that require analysis in the EA and to eliminate insignificant issues and alternatives from detailed analysis.

The Brown Cow CBM project EA was prepared by a third party contractor working under the direction of and in cooperation with the lead agency for the project, which is the Bureau of Land Management (BLM), Rawlins Field Office, Rawlins, Wyoming.

5.1 PUBLIC PARTICIPATION

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

As a part of the scoping process, the interim drilling programs proposed by Merit and other operators was included in the scoping notice. The scoping period ended on July 25, 2001

During preparation of the EA, the BLM and the consultant interdisciplinary team (IDT) have communicated with, and received or solicited input from various federal, State, county, and local agencies, elected representatives, environmental and citizens groups, industries, and individuals potentially concerned with issues regarding the proposed drilling action. The contacts made are summarized in the following sections.

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

FEDERAL OFFICES

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

CHAPTER 5: CONSULTATION AND COORDINATION

STATE AGENCIES

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

COUNTY GOVERNMENT

Carbon County Commissioners
Carbon County Planning Commission

MUNICIPALITIES

Mayor-Baggs
Mayor-Rawlins
Mayor-Wamsutter

NATIVE AMERICAN TRIBES

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

GRAZING PERMITTEES

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

LEASE AND ROW HOLDERS

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

LANDOWNERS

This scoping notice has been sent to 111 landowners potentially affected by the proposal.

LOCAL MEDIA

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

OTHER AGENCIES, INDUSTRY REPRENSENTATIVES, INDIVIDUALS, AND ORGANIZATIONS

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

5.2 LIST OF PREPARERS

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

Table 5-1. List of BLM Interdisciplinary Reviewers.

Name	Responsibility
RAWLINS FIELD OFFICE	
Travis Bargsten	BLM IDT Lead
Krystal Clair	Visual Resources/Recreation
Pamela Huter	Cultural Resources
Lloyd Chism	Petroleum Engineer
Andy Warren	Vegetation/Range Issues
Mark Newman	Paleontology/Geology
Susan Foley	Soils/Pipeline construction/reclamation
Bob Lange	Hydrology/Water Quality
Frank Blomquist	Riparian/Wetland/Wildlife/T & E Issues
Janelle Wrigley	Realty Specialist
David Simons	Environmental Coordinator
Mike Jensen	Road Engineering
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Susan Caplan	Air Quality

Table 5-2. List of Consultant Interdisciplinary Team EA Preparers.

Principal Interdisciplinary Team		
Name	**Affiliation**	**Responsibility**
Gary Holsan	Gary Holsan Environmental Planning	Interdisciplinary Team Leader, Project Manager
Mike Evers	Western Water Consultants	Water Resources
Larry Hayden-Wing	Hayden-Wing Associates	Wildlife/Fisheries, Special Status Animals and Fish, Range, Vegetation and Wetlands
George Blankenship	Planning Information Corporation	Socioeconomics, Transportation, Range, Other Land Use, Health and Safety, Noise
Jim Zapert, Susan Eatinger	TRC Environmental Corporation	Air Quality
Julie Hatcher	Pronghorn Archaeology	Cultural Resources
Gustav Winterfeld	Erathem-Vanir Geological Consultants	Geology/Paleontology, Mineral Resources, Soils
Charles Bucans	Star Valley Engineering	Editor, Coordinator

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APPENDIX A

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

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

Section 1506.1

> *(a) Until an agency issues a record of decision as provided in para. 1505.2 (except as provided in paragraph (c) of this section), no action concerning the proposal shall be taken which would:*
>
> > *(1) Have an adverse environmental impact; or*
> > *(2) Limit the choice of reasonable alternatives.*
>
> *(b) If any agency is considering an application from a non-federal entity, and is aware that the applicant is about to take an action within the agency=s jurisdiction that would meet either of the criteria in paragraph (a) of this section, then the agency shall promptly notify the applicant that the agency will take appropriate action to insure that the objectives and procedures of NEPA are achieved.*
>
> *(c) While work on a required program environmental impact statement is in progress and the action is not covered by an existing program statement, agencies shall not undertake in the interim any major Federal action covered by the program which may significantly affect the quality of the human environment unless such action:*
>
> > *(1) Is justified independently of the program;*
> > *(2) Is itself accompanied by an adequate environmental impact statement; and*
> > *(3) Will not prejudice the ultimate decision on the program. Interim action prejudices the ultimate decision on the program when it tends to determine subsequent development or limit alternatives.*
>
> *(d) This section does not preclude development by applicants of plans or designs or performance of other work necessary to support an application for Federal, State or local permits or assistance....*

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

APPENDIX A - INTERIM DRILLING POLICY

Activities Allowed on Federal Lands and Minerals During EIS Preparation

1. A maximum of 200 coalbed methane wells will be allowed within the project area, for research and exploratory purposes, during the interim period in which the EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple zones to be evaluated (see map).

2. Activities within individual pods will be authorized by BLM. For any pod location which overlaps the boundary of a sensitive resource area for sage grouse, mountain plover, raptors, big game migration corridors, and sensitive plants, appropriate stipulations and mitigation will be applied to protect any sensitive resources present (see Term Definitions below). Some sensitive resources such as high density paleontological or cultural resources sites, are not mapped and will also be handled on a pod basis.

3. Existing coalbed methane wells (two wells re-completed as coalbed methane producers in the Cow Creek Unit by Double Eagle and one new well completed by Petroleum Development Corporation, to the east of this unit) will count toward the above well limits. As Federal 1691 #10-8 has been plugged and abandoned, it will not count toward the above well limit. In addition, the six coalbed methane wells originally permitted by North Finn LLC and drilled in Section 5, T17N, R90W, and the well located in Section 36, T15 N, R91W, will not count toward the allowed well number, as long as they are not included as part of any proposed pod. In addition, required injection wells and monitoring wells will not count toward the well limit.

4. Any modifications proposed to the approved pods (i.e. changing pod locations, drilling wells outside of the current pod locations, or increasing the total number of wells allowed during interim drilling), will only be approved if geologic, hydrologic, or reservoir characteristics support a change. These changes will be allowed after review by, and concurrence of, the Reservoir Management Group and authorization by the BLM, Rawlins Field Office. Additional federal drainage protection wells may be required.

5. During preparation of the EIS, coalbed methane wells and associated roads and pipelines on any private surface/private mineral where the operator has, or has obtained legal access (i.e., county roads, approved BLM ROW grant or private access road) prior to approval of the interim drilling plan, may be developed as deemed appropriate by the operator/lessee. However, these wells will count toward the total number of wells allowed to be drilled under this interim drilling policy.

Criteria and Conditions that Apply to Interim Drilling Operations

1. A detailed Plan of Development/Surface Use Plan (POD/SUP) and Master Drilling Plan for each individual pod, using guidance provided by the BLM Rawlins Field Office, will be submitted and approved prior to surface disturbing activities.

2. The operator(s) agree to supply the geologic, coal, and water data information discussed in Appendix C of this document.

3. Prior to initiating interim drilling, an environmental assessment (EA), including a detailed Water Management Plan will be prepared and approved for each individual pod. Because of the current BLM workload, and in order to expedite the completion of the EAs, it is

recommended that these documents be prepared by a third-party contractor.

4. All pod EA=s will be submitted to the BLM in pdf format and each document will be placed on the BLM Wyoming web page. A 30-day public review of each document will occur from the date the document is placed on the site. BLM will be responsible for writing the Decision Record for each EA.

5. A 1/4 mile buffer is required between surface disturbing activities and the Overland Trail.

6. Block surveys for cultural resources will be required for each pod.

7. No interim drilling will be allowed in the Sand Hills Area of Critical Environmental Concern as described in the Great Divide Resource Management Plan Record of Decision (RMP-1990).

8. The Great Divide RMP states the BLM will include intensive land-use practices to mitigate salt and sediment loading caused by surface disturbing activities within the Muddy Creek watershed. The Muddy Creek Coordinated Resource Management (CRM) group was established as an advisory group to address this issue. Because this area overlaps with the Muddy Creek CRM effort, and since road use contributes the most in increasing the amount of sediment in the Muddy Creek drainage, the POD/SUP will be reviewed by the Muddy Creek CRM Road Committee and recommendations of the group will be considered by BLM. Changes to the POD/SUP will be made prior to initiating work on the pod EA.

9. Surface discharge as a method of disposal for produced coalbed methane waters will be considered for each individual pod during interim drilling activities within the Great Divide Basin. This is subject to the approval of the Water Management Plan and upon obtaining all required federal, state and local permits.

10. Prior to completion of the EIS, water produced from coalbed methane wells located in the Colorado River Basin will be disposed of by re-injection. The only exception to this would be waters produced from the Double Eagle=s coalbed methane existing and proposed wells located in the Cow Creek POD. Double Eagle has applied to the Wyoming Department of Environmental Quality (WDEQ) for a National Pollutant Discharge Elimination System (NPDES) permit for their two existing wells and four wells permitted recently by BLM. Should Double Eagle receive their state permit, they will be allowed to surface discharge from these six wells. Prior to any additional drilling of CBM wells by Double Eagle in the Cow Creek Pod, an environmental assessment, including a Water Management Plan, will be prepared and submitted to BLM which will examine the environmental impacts from these wells. Double Eagle will be allowed to dispose of produced CBM waters to the surface only after completion of the environmental analysis and a determination is made that the additional surface discharge will cause no significant impact to the environment.

11. No drilling activities will be allowed in prairie dog towns during interim operations. However, drilling will be allowed in each individual pod containing prairie dog towns upon the completion of black-footed ferrets survey using methods approved by the United States Fish and Wildlife Service. These surveys will clear the pod for a one year period. The operators also have the option of completing surveys in the whole EIS area which would clear the area for the life of the project.

    In the event a black-footed ferret or its sign is found, the BLM Authorized Officer shall stop

all action on the application in hand, and/or action on any application that may directly, indirectly, or cumulatively affect the colony/complex, and initiate Section 7 review with the USFWS. No project related activities will be allowed to proceed until the USFWS issues their biological opinion. The USFWS biological opinion will specify when and under what conditions and/or prudent measures the action could proceed or whether the action will be allowed to proceed at all.

12. No drilling or disturbance will be allowed in those areas determined to be critical winter habitat for sage grouse.

13. No drilling or disturbance will be allowed in areas where any two or more big game (elk, deer, or antelope) crucial winter ranges overlap.

14. The operators will be required to submit a drilling schedule as part of the Master Drilling Plan. This schedule will be reviewed, and approved by BLM, to ensure that activities are limited within proven big game migration corridors at critical use times during the year.

15. Pipelines, power lines, waterlines, fiber optic lines will be buried and, where possible, will follow the road rights-of-way.

16. Fish passage structures will be installed for roads which cross drainages with fisheries concerns as identified by BLM.

Term/Definitions

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

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

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

APPENDIX B

Table B-1. Federal, State, and County Permits, Approvals, and Authorizing Actions.

AGENCY	NATURE OF ACTION
DEPARTMENT OF INTERIOR	
Bureau of Land Management (Rawlins Field Office) (Casper District - Reservoir Management Group)	Approves Applications for Permit to Drill (APDs), Sundry Notices and Reports on Wells (sundry notices), production facilities, disposal of produced water, gas venting or flaring, and well plugging and abandonment for federal wells. Approval to dispose of produced water on BLM-managed lands. Grant ROWs to Operators for gas field development actions on BLM surface outside of federal lease or unit boundaries and to third party applicants (i.e., non-unit operator or non-lease holder) both within and outside of the unit boundary. Reviews inventories of, and impacts to cultural resources affected by undertakings, and consults with SHPO and ACHP. Review impacts on federally listed or proposed for listing threatened or endangered species of fish, wildlife, and plants, and consult with U.S. Fish and Wildlife Service. Grants Unit Area Agreement and subsequent actions relative to the unit. Administers drainage protection and protection of correlative rights on federal mineral estate.
U.S. Fish and Wildlife Service	Reviews impacts on federally listed, or proposed for listing, threatened or endangered species of fish, wildlife, and plants. Migratory bird impact coordination.
DEPARTMENT OF THE ARMY	
U.S. Army Corps of Engineers	Issues (Section 404) permit(s) for placement of dredged or fill material in or excavation of waters of the U. S. and their adjacent wetlands.

APPENDIX B - AUTHORIZING ACTIONS

AGENCY	NATURE OF ACTION
WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY	
Water Quality Division	Administers Storm Water Pollution Prevention Plan. Approves Surface Discharge. Issue NPDES permits for discharging produced water and storm water runoff. Approves wastewater and sewage disposal. Permits to construct settling ponds an wastewater systems, including ground water injection and disposal wells. Administrative approval for discharge of hydrostatic test water.
Air Quality Division	Permits to construct and permits to operate.
Land Quality Division	Mine permits, impoundments, and drill hole plugging on state lands.
Solid Waste Division	Construction fill permits and industrial waste facility permits for solid waste disposal during construction and operations.
WYOMING STATE ENGINEER'S OFFICE	
	Issues permits to appropriate groundwater and surface water. Issues temporary water rights for construction permits to appropriate surface water.
WYOMING STATE HISTORIC PRESERVATION OFFICE	
	Provides consultation concerning inventory of, and impacts to, cultural resources. Programmatic agreements, consultation.

APPENDIX B - AUTHORIZING ACTIONS

AGENCY	NATURE OF ACTION
WYOMING DEPARTMENT OF TRANSPORTATION	
	Permits for oversize, overlength, and overweight loads. Access permits to state highways
CARBON COUNTY	
	Grants small wastewater system permits, where applicable. Issues driveway access permits where new roads intersect with county roads. Prepares road use agreements and/or oversize trip permits when traffic on county road exceeds established size and weight limits or where the potential for excessive road damage exists. Issues construction and conditional use permits for all new structures. Administers zoning changes where applicable.

APPENDIX B - AUTHORIZING ACTIONS

AGENCY	NATURE OF ACTION
WYOMING OIL AND GAS CONSERVATION COMMISSION	
	Acts as primary authority for drilling on state and privately held mineral resources, and secondary authority for drilling on federal lands. Holds authority to allow or prohibit flaring or venting of gas on private or state owned minerals. Regulates drilling and plugging of wells on private or state owned minerals. Issues Aquifer Exemption Permit Approves directional drilling. Administers rules and regulations governing drilling units. Grants gas injection well permits. Administers drainage protection and protection of correlative rights on private/state mineral estate.

ONSHORE OIL & GAS ORDER NO. 1
Approval of Operations on Onshore
Federal and Indian Oil and Gas Leases

The Merit Energy Company Brown Cow Interim Development Coalbed Methane Project is located in Carbon County, Wyoming. The Brown Cow POD is one of nine PODS that comprise the Atlantic Rim Coalbed Methane Interim Drilling Project.

The primary targeted reservoir in the Brown Cow Area is coalbed methane from the coal seams within the Mesa Verde Group. Drill site locations will be on approved 80-acre spacing. All unproductive wells will be plugged and abandoned as soon as practical after the conclusion of production testing. Productive wells may be shut-in temporarily for installation of gas pipeline connections or construction of production facilities.

All proposed facilities including water lines, gas lines, electrical lines, access roads, well locations, compressor station, water injection/disposal wells and water transfer facilities will be located within the Brown Cow Unit and no rights of ways will be necessary.

1. EXISTING ROADS

a. Access to the Brown Cow Project Area is provided by the two-lane paved Wyoming State Highway 789 from Interstate 80 at Creston Junction south towards Baggs, Wyoming, or north from Baggs, Wyoming.

General directions to the Brown Cow POD from Baggs, Wyoming are as follows:

From Baggs, proceed north on Highway 789 for approximately 7.7 miles, Turn right and proceed northeasterly along BLM Road 3309 for a distance of approximately 5.5 miles until entering the existing Browning Field, operated by Merit Energy Company.

b. Maps A and B show specific directions to each well within the POD area.

c. All existing roads within a 2-mile radius are shown on Maps A & B. A total of 10.3 miles of existing roads will be utilized. Approximately 0.8 miles of existing road will be upgraded.

d. Refer to Map E for lease boundaries. Two federal leases are located within

the POD outline area. Lease descriptions are also included as attachments for reference. All wells are located on Federal surface managed by the Bureau of Land Management.

e. Improvement to existing roads will not be necessary as the have been previously improved and are used daily for maintenance of production facilities within the Browning Unit.

f. Existing roads will be maintained in the same or better condition as existed prior to the start of operations. Maintenance of existing roads used to access the drill locations will continue until final abandonment and reclamation of the well locations.

g. Roads will not be flat bladed. Excessive rutting or other surface disturbance will be avoided. Operations will be suspended temporarily during adverse weather conditions if excessive rutting is occurring when access routes are wet, soft, or partially frozen.

h. Existing roads and newly constructed roads on surface under the jurisdiction of any Surface Managing Agency will be maintained in accordance with the standards of the SMA.

i. All roads outside the Brown Cow Unit are covered under existing rights of ways held by Merit Energy Company for the Browning Field.

j. All vehicles shall use only the authorized access road(s), as depicted in the approved APD's. Vehicles shall not use any other access route to the drill/well pad and any ancillary facilities including, but not limited to, any two-track roads or trails and pipeline rights-of-way.

k. If snow removal outside the new and existing roadways is undertaken, equipment used for snow removal operations shall be equipped with shoes to keep the blade at least six inches off the ground surface. Special precautions shall be taken where the surface of the ground is uneven to ensure that equipment blades to not destroy the vegetation.

l. Unless otherwise exempted, free and unrestricted public access shall be

maintained on the access roads.

2. ACCESS ROADS TO BE CONSTRUCTED AND RECONSTRUCTED

a. All new roads to be built, or reconstructed roads are shown on Maps A & B. A total of 1.2 miles of new construction will be necessary. Of this, 0.8 miles of new construction will be designed.

b. Short segments to each well pad will be constructed in accordance with BLM standards. Roads will be crowned and ditched and surfacing material (to a depth of approximately 4 inches) will be placed on the roads and pads prior to the first precipitation event following road construction/reconstruction, unless otherwise agreed to by the BLM Authorized officer.

c. Roads will be built to a minimum running surface of 14 feet. Turnouts will be installed where necessary along the proposed access routes.

d. Road designs have been requested by the BLM on two road segments leading to the #12-13 and the #32-13. These designs will be prepared by Uintah Engineering and Land Surveying and will be submitted under separate cover.

e. All new access will be maintained year-round so that environmentally-sound access can be achieved. Merit Energy Company will be responsible for limiting access of field personnel to times when rutting and other resource impacts won't occur. Merit Energy Company will be responsible for performing any remediation and/or necessary road upgrading (elevating, surfacing, culverts, low-water crossings, water-wings, etc.) as directed by the BLM Authorized Officer, resulting from untimely access.

f. The maximum grade of the proposed access routes will be approximately 6-10%.

g. Cuts and fills along the access road will be kept to a minimum. Balanced cut and fill techniques shall be utilized. Fill slopes shall be compacted in 1 foot lifts. If soils are dry during construction, a water truck shall be used to periodically water the working material.

h. A total of 19 culverts will be installed throughout the field. All culverts

needed, (and their sizes) are shown on Map B. No low water crossings will be necessary. All culverts will have a minimum of 12" fill or ½ the pipe diameter of fill, whichever is greater, placed on top of the culvert, and shall be of length sufficient to allow at least 24" of culvert to extend from the fill slope face (on both the inlet and outlet sides). The inlet and outlet shall be set at the gradient of the native ground or existing channel. If the culvert is being placed in an existing watercourse channel, the culvert shall be aligned with the existing channel. The entire length of pipe shall be bedded on native material before backfilling,. Backfilling shall be completed using unfrozen material and rocks no larger than two inches in diameter. Care shall be exercised to thoroughly compact the backfill around and under the culvert. The backfill shall be brought up evenly in 6" lifts on both sides of the culvert and compacted. The permanent marker shall be installed at the inlet and outlet of the culvert to prevent vehicles from damaging the culvert.

i. Any other culverts, not previously identified, or other road drainage control structures, such as drainage dips, ditches, or water bars, will be installed at specific locations as specified by the BLM. Drainage structures will be designed to pass run off from 50-year storm events, as specified by the BLM. Where needed, rip-rap will be placed at the outlets of culverts to minimize erosion.

j. Where needed, a Merit representative will conduct a “Plans in Hand” review with contractors to review the access routes to well locations. Where needed, directional markers will be temporarily placed to mark access routes. All markers will be removed as soon as they are no longer needed.

k. After wells are completed and equipment is installed, travel to wells generally would be limited to one visit every other day. A light truck or utility vehicle would be used to check on operations, read meters, and provide light service during the life of the project. Well service trips could be rescheduled or postponed during periods of wet weather when vehicle traffic could cause rutting.

Compressor Site and Water Injection/Disposal Well Access

l. All access roads to the compressor site and water injection/disposal facilities

have been crowned and ditched and previously surfaced. These roads will be kept in good repair throughout the life of the project.

m. Water turnouts will be installed where deemed necessary by the dirt contractor. If water turnouts appear to be insufficient to prevent erosion, additional water turnouts may be required by the BLM.

n. All cattle guards are existing. No additional cattle guards will be necessary. Cattleguards will be maintained in good working condition.

o. Surface disturbance and vehicular travel will be limited to the approved location and approved access route. Any additional area needed will be approved in advance.

p. If there is snow on the ground when construction begins, the operator will remove it before the soil is disturbed, and pile it downhill from the topsoil stockpile location.

q. The compressor station and water injection/disposal well sites shall be surrounded by an impervious dike of sufficient size to hold the entire storage capacity of the largest tank in the facility and still allow one foot or freeboard or 110% of the capacity of the largest tank in the facility.

3. LOCATION OF EXISTING WELLS WITHIN A 1-MILE RADIUS OF THE PROPOSED LOCATION. SEE MAP "C".

a. Water Wells - none

b. Injection/Disposal Wells - none

c. Producing Wells - six

d. Drilling Wells - none

e. Abandoned or Temporarily Abandoned - twelve

f. Shut In Wells - seven

g. Disposal Wells - none

4. LOCATION OF EXISTING AND/OR PROPOSED FACILITIES IF THE WELL IS PRODUCTIVE.

a. No production facilities will be located at the wellhead. Only a meter containment structure will be located at each well. V-cone meters with electronic flow meters are being used.

b. Proposed Water Disposal Wells: The #1-2 well (currently shut-in) is proposed as the primary disposal site. The #3-12 and #4-12 will be added as needed, based on water flow rates. See Map D for location of proposed disposal sites.

c. Compressor Facilities: Currently, the gas from the Browning Field enters a low pressure gathering system that ties into a sales meter at the #1-12 location. The gas enters an existing gas line that goes to the Wild Cow compressor located in the SW NE Sec. 23, T15N - R91W. Initially, Brown Cow CBM will be gathered in the same fashion (without compression). At some point, it will necessary to add compression to lower the pressures at the well head and boost the gas to the Wild Cow Compressor. The proposed compressor site would be located on the #3-12 well pad. See Typical Compressor Facility - Exhibit #1, attached.

d. All permanent above-the-ground structures that will remain longer than six months will be painted Carlsbad Canyon (color 2.5Y 6/2 of the Standard Environmental Colors). The exception being that Wyoming Occupation Health and Safety Act Rules and Regulations are to be complied with where special safety colors are required.

e. Wells will be shut-in temporarily until all pipelines and disposal facilities are authorized and constructed. Working pits on the well pads will be closed once the contents have dried. Once the wells become operational, produced water will be separated from the gas and collected in a buried polyethylene

flow line for transportation to an approved produced water disposal location.

f. The primary objectives for water disposal are the Deep Creek and/or Cherokee Creek Sandstone. The Deep Creek and/or Cherokee Creek formations are isolated above and below by competent shale barriers that will prevent the initiation and propagation of fractures through overlying strata to any fresh water zones. Where possible, produced water flowlines and gas flowlines will be co-located with the road. Areas have been identified where it is uneconomical to co-locate water and/or gas lines within the access roads. See Map "D".

g. The surface equipment at the well will consist of the wellhead and an insulated wellhead cover. See attached schematic diagram of a typical coalbed natural gas well site - Exhibit #2. After drilling, the well site will be reduced to approximately 1/4 acre (104' x 104') with deadmen anchors set at 160' x 160' as shown on the attached exhibit.

h. Existing compression facilities will be used. If production exceeds current compression capability a compressor site facility will be constructed. The site will encompass approximately one acre (200' x 200'). A drawing of a typical compression site is attached. See Exhibit #1. About one-half of the compressor site will be affected by the construction, maintenance and operation of the facility. The compressor site facility will be of all-weather construction having a thick layer of gravel over the pad site. If feasible, topsoil will be removed and conserved for later reclamation activities.

i. The compressor site will consist of an insulated header building containing allocation meters for each well and a single sales meter. The header building will also contain a de-hydrator that will remove water from the wet gas stream. If different production facilities are required, plans will be submitted in a Sundry Notice. The holder shall muffle and /or house the compressors so that noise levels are less than 60 decibels, as measured, one-quarter mile from the project site.

j. Water injection/disposal facilities are expected to be constructed within an approximate area of 150' x 150'. A drawing of a typical water disposal facility

- Exhibit #3 is attached. The injection/disposal facility will be of all weather construction having a thick layer of gravel over the pad site. If feasible, topsoil will be removed and conserved for later reclamation activities.

k. Approximately 3 water transfer pumping facilities would be utilized during production operations to transfer produced water from the coal bed methane wells(s) to the injection/disposal well in areas where elevation differences require supplemental pumping to transfer the produced water. Each pumping station would be constructed within an approximate area of 125' x 125'. See Exhibit #4. An approximate 3' berm would be constructed around the perimeter of the pumping station area to contain any potential spills. Water facilities will be located near proposed areas of disturbance and will not be located within known cultural resources sites or sensitive wildlife areas. Water transfer facilities will be located at existing or proposed well sites. The proposed locations are at the #32-13, the #23-12 and the #3-12. The location of water transfer facilities is shown on Map D. The total disturbed area for the #3-12 well site will be approximately 360' x 360' because it will contain the water transfer facility, the water disposal facility and the compressor facility.

l. A typical pumping station would consist of one (2) 400 barrel water tanks and a small centrifugal water pump. A small pump house would be constructed immediately outside of the bermed area to house the centrifugal pump.

m. All access roads will be maintained as necessary to prevent erosion and accommodate year-round traffic.

n. The reserve pits shall be fenced on three sides during drilling, and the working side shall be fenced immediately after the drilling rig is released. The reserve pit shall remain adequately fenced until the reserve pit is reclaimed.

o. All appropriate permits will be filed with the Wyoming DEQ for re-injection of produced water, and approved prior to water disposal operations.

p. The location of proposed gas lines is shown on Map D. Any power lines will be buried following the same alignment as gas lines, (where possible) , but will be contained in a separate trench. Approximately 5.2 miles of pipeline will be constructed. See Map D for location of pipelines. Refer to Pipeline

Attachment regarding pipeline specifications.

q. All site security guidelines identified in 43 CFR 3162.7 will be adhered to.

Pipelines and Flowlines

r. Pipeline construction shall not block nor change the natural course of any drainage.

s. Pipeline trenches shall be compacted during backfilling. Pipeline trenches shall be maintained in order to correct settlement and erosion.

t. Waterbars are to be constructed at least one (1) foot deep, on the contour, with approximately two (2) feet of drop per 100 feet of water bar, to ensure drainage. Water bars are to be extended into established vegetation. All water bars are to be constructed with a berm on the downhill side of the water bar, to prevent soft material from silting in the trench. The initial water bars should be constructed at the top of the back slope.

Subsequent water bars should follow the following general spacing guidelines:

% Slope	*Spacing Interval (feet)*
2 or <	200
2 - 4	100
4 - 5	75
5 or >	50

5. LOCATION AND TYPE OF WATER SUPPLY

a. Drilling water will be hauled from the municipal source in Baggs, WY.

b. Water will be hauled by truck to each wellsite.

c. No water wells are to be drilled.

d. The source of water is located federal lands.

e. The water volume needed for drilling operations is dependent upon the depth of the well and any losses that might occur during drilling.

6. CONSTRUCTION MATERIALS

a. Surface and subsoil materials in the immediate area (those areas which will be disturbed by pad construction or road construction) will be utilized.

b. No construction materials will be removed from Federal lands.

c. Gravel, stone and sand will be purchased from a local supplier having a permitted source of materials for the area. This material will be used for road construction to access wells, compressor and injection/disposal facilities.

d. Any materials to be used which are under BLM jurisdiction shall be approved in advance, as per CFR 3610.2-3.

7. METHODS FOR HANDLING WASTE DISPOSAL

a. No hazardous substance as defined by CERCLA will be used in the drilling of the wells and/or construction of the well sites and access roads. Commercial preparations, which may contain hazardous substances, may be used in testing and production operations and will be transported over the ROW and within the project area. These materials, which may contain hazardous substances, will be handled in the appropriate matter to minimize potential for leaks or spills to the environment. No RCRA hazardous wastes will be generated in well drilling or production operations. Exempt reserve pit contents will be buried on-site.

b. Drill cuttings and drilling fluids will be contained and buried in the reserve pit.

c. The reserve pit will be fenced around 3 sides during drilling. A sheep tight woven wire will be used on the bottom with 2 strands of barbed wire above it. The fourth side of the reserve pit will be fenced as soon as the rig leaves the location. The pit will be backfilled within 2 to 3 weeks following completion of drilling or when sufficient drying has occurred. Then topsoil will be replaced.

d. All trash will be picked up and disposed of on a daily basis. No trash or empty barrels will be placed in the reserve pit.

e. No oil, salt water or other noxious fluids will be produced during drilling and completion operations.

f. Drilling operations will normally be conducted 24 hours a day for approximately 6 days.

g. A portable, self-contained chemical toilet will be provided on location during drilling and completion operations. Upon completion of operations, or as required, the contents of the toilet holding tanks will be disposed of at an authorized sewage treatment and disposal facility. Disposal will be in accordance with the State of Wyoming, Carbon County and BLM requirements regarding sewage treatment and disposal.

h. Garbage and non-flammable waste materials will be contained in a portable dumpster or similar unit. Upon completion of operations, or as needed, the accumulated trash will be hauled off-site to an approved sanitary landfill. No trash will be placed in the reserve pit.

i. Immediately after removal of the drilling rig, all debris and other waste materials not contained will be cleaned up and removed from the well location. No potentially adverse materials or substances will be left on the location.

j. Any spills of oil, gas, salt water or any other potentially hazardous substance will be reported immediately to the BLM and other responsible parties, and will be mitigated immediately, as appropriate, through cleanup or removal to an approved disposal site.

k. Any produced water will be dealt with as addressed in the water management plan.

l. The reserve pit and drilling fluids contained in the pit will be allowed to dry. The pit will then be backfilled.

m. The operator and their contractors shall ensure that all use, production, storage, transport and disposal of hazardous and extremely hazardous materials associated with the drilling, completion and production of these wells will be in accordance with all applicable existing or hereafter promulgated federal, state and local government rules, regulations and guidelines. All project related activities involving hazardous materials will be conducted in a manner to minimize potential environmental impacts. A file will be maintained containing current Material Safety Data Sheets (MSDS) for all chemicals, compounds and/or substances which are used in the course of construction, drilling, completion and production operations.

8. ANCILLARY FACILITIES

Self-contained travel-type trailers may be used on-site during drilling operations. No facilities other than those described in this Master Surface Use Plan will be constructed to support the operations associated with the wells. No camps, airstrips or other facilities will be necessary.

9. WELLSITE LAYOUT

a. The well pad will occupy an area approximately 240' x 190'. The reserve pit dimensions will be 100' x 65' x 10' deep. Where possible, the rig will be located on level ground, or following the contour of the surface. When possible, the reserve pit will be constructed on the uphill side of location.

b. Cuts and fills on the location will be kept to a minimum where possible (other than the reserve pits). When possible, a small truck mounted rig will be utilized for drilling operations.

c. The top 6 inches of top soil (or maximum available) will be removed from the reserve pit area (and any other areas with surface disturbance) and stockpiled for future use in reclamation.

d. Sagebrush will be stockpiled separately from the topsoil material adjacent to the well pad exterior.

e. The operator will not push soil material and overburden over side slopes or into drainages. All soil material disturbed will be placed in an area where it can be retrieved and where it doesn't impede watershed and drainage flows.

f. A 20' undisturbed vegetative border will be maintained between the toe of fill on the pad and/or pit areas and the edge of adjacent drainages.

g. The reserve pit will be oriented to prevent collection of surface runoff.

h. Ditches will be constructed, where necessary, around the well pads to divert water away from the pad.

i. The reserve pit will be constructed with a minimum of one-half (½) the total depth below the original ground surface on the lowest point within the pit.

j. Only fresh water will be contained within the reserve pit. No liner will be necessary. If a liner is used, it will be cut off at ground level before backfilling takes place.

k. A complete copy of the approved APD will be at the drill site during construction of the roads and drillpad, the drilling of the well, and the completion of the well.

10. PLANS FOR RECLAMATION OF THE SURFACE

The following surface reclamation will be done as requested by the surface owner.

a. Should the well become productive, all disturbed areas not required for production operations and facilities will be reclaimed (partial reclamation) as soon as possible, but no longer than within 2 years from the date production facilities are completed. The reclaimed area will be recontoured and landscaped to approximate the original topography.

b. The reserve pit will be allowed to dry, backfilled and then the topsoil will be

put back. No depressions will be left that trap water or form ponds. The fluids and mud must be dry in the reserve pit before the pit area is recontoured. The operator will be responsible for recontouring any subsidence areas that develop as a result of closing a pit before it is completely dry.

c. After (1) recontouring all disturbed areas of the project to the original topography and (2) final grading and replacement of topsoil, the entire surface of the well site and access road shall be ripped to a depth of 18 to 24 inches on 18 to 24 inch centers. The operator will drill seed on the contour to a depth of 0.5 inch, followed by cultipaction to compact the seed bed and prevent soil and seed losses. To maintain quality and purity, certified seed with a minimum germination rate of 80% and a minimum purity of 90% will be used.

One of the following seed mixtures will be used depending on the type of vegetation at the site. The Dry Loamy/Sandy Seed mix will be used on grassy areas. The Mountain Shrub Seed mix will be used in areas with dense sagebrush cover.

DRY LOAMY/SANDY SITES	
Species of Seed	***Lbs. PLS***
Grasses	
Thickspike wheatgrass (Critana)	4
Western wheatgrass (Rosanna)	2
Indian ricegrass	2
Needleandthread	2
Bottlebrush squirreltail	2
Slender wheatgrass	2
Sand dropseed	0.5
Shrubs	

Rubber rabbitbrush	1
Big sagebrush	0.5
Gardner's saltbrush	1
Shadscale	1
Fourwing saltbush	1
Antelope bitterbrush	1
Common winterfat	1
Forbs	
Scarlet globemallow	1
Lewis' flax (Appar)	1

MOUNTAIN SHRUB SITES	
Species of Seed	***Lbs. PLS***
Grasses	
Blubunch wheatgrass	4
Slender wheatgrass	2
Basin wildrye	2
Green needlegrass	2
Western wheatgrass (Rosana)	2
Mountain Brome (Bromar)	2
Thickspike wheatgrass	2
Indian ricegrass	2
Shrubs	

Rubber rabbit brush	1
Wyoming big sagebrush	0.5
Antelope bitter brush	1
Snowberry	1
Serviceberry	1
Forbs	
Lewis flax (Appar)	1

d. Dry Hole - In the event of a dry hole, all equipment and debris will be removed from the location. Any improvements to the access road, such as culverts and gravel, will be removed. The drainages will be restored to their approximate original bank configuration and depth. Topsoil will be replaced over all cut areas. All disturbed areas will be seeded as indicated below. Such reclamation shall be completed no more than 1 year following drilling operations.

e. Seeding - All disturbed areas will be reclaimed by replacing topsoil, grading and seeding with a mixture agreed upon by the BLM and Merit. Seeding would occur during the spring months after ground frost, or in the fall prior to ground frost. Seed would be applied as directed by the BLM, either drilled, broadcast, or a combination thereof. Mulching may be required to insure seedling establishment.

f. The seed mix will be planted (subject to approval by the Bureau of Land Management) with a drill equipped with a depth regulator. The seed mix will be uniformly planted over the disturbed area. Where drilling is not possible, seed will be broadcast and the area will be racked or chained to cover the seed. Seeding will be repeated until a satisfactory stand is established as determined by the BLM.

g. All disturbed areas associated with well drilling and associated facilities (pipelines, access roads, etc.) will be seeded during the first fall or spring season following construction.

h. Fall seeding will be completed after September 15 and prior to ground frost. To be effective, the spring seeding will be done after the frost has left the ground and prior to May 15.

i. The operator will control noxious weeds on the location and along the access roads.

j. The operator will reshape abandoned access roads by pushing fill material back into the cuts.

k. All rehabilitation work, including seeding, will be completed as soon as feasible following plugging.

l. BLM will not release the performance bond until the areas have been successfully revegetated (evaluation will be made after the second growing season) and has met all other reclamation goals of the surface owner.

m. Waste materials will be disposed of as stated in #7 of this Surface Use Plan.

n. A Notice of Intent to Abandon and a Subsequent Report of Abandonment will be submitted for abandonment approval.

o. Please contact the Area Manager, Bureau of Land Management, Rawlins, Wyoming if there are any questions concerning the above rehabilitation stipulations (307/328-4200).

11. SURFACE OWNERSHIP

Wellsites - The surface of the interim development project area is entirely under federal ownership.

Roads - All roads are located on Federal surface.

12. OTHER INFORMATION

a. A Class III Cultural Resource Inventory of the proposed drillsites, access roads and pipelines has been completed by Pronghorn Archaeological Services. A copy of these reports are on file with the BLM, Rawlins Field Office. Additional Archeological work will be completed on the pipeline routes that have been re-located. These will be submitted under separate cover by Pronghorn Archeological Services.

b. If archaeological, historical or vertebrate fossil materials are discovered during the course of any construction activities, Merit will suspend all operations that further disturb such materials and immediately contact the BLM, Rawlins Field Office (307-328-4200). Operations in the area of discovery will not resume until written authorization to proceed has been issued by the BLM Authorized Officer.

c. Merit will be fully responsible for the actions of their subcontractors. A copy of the approved APD and the Conditions of Approval will be on location during drilling and completion operations.

d. A comprehensive water disposal plan is attached to this Master Surface Plan that addresses how produced water will be handled during the testing and production of the CBM wells.

e. "Sundry Notice and Report of Wells" (Form 3l60-5) will be filed for approval for all changes of plans and other operations in accordance with 32 CFR 3l64.

f. The operator shall be responsible for the prevention and suppression of fires on public lands caused by its employees, contractors or subcontractors. During conditions of extreme fire danger, surface use operations may be limited or suspended in specific areas.

g. All applicable local, state and/or federal laws, regulations, and/or statutes will be complied with.

13. LESSEE'S OR OPERATOR'S REPRESENTATIVE AND CERTIFICATION

Permit Matters	**Drilling & Completions Matters**
PERMITCO INC.	MERIT ENERGY COMPANY
14421 County Rd. 10	13727 Noel Road, Suite 500
Ft. Lupton, CO 80621	Dallas, TX 75240
Lisa L. Smith	John Stroud - Exploitation Manager
303/857-9999 (Office)	972/628-1566
303/857-0577 (Fax)	Mike Mercer - Engineering
	972/628-1550 (Office)
	972/960-1252 (Fax)
	972/740-2784 (Cell)

Baggs Wyoming Field Office
Merit Energy Company
P.O. Box 336
Baggs, Wyoming 82321
Don Baucum - Production Foreman
307/383-6794 (Office)
307/380-8300 (Cell)
307/383-6793 (Fax)

CERTIFICATION

I certify that Merit shall use its best efforts to conduct its approved operations in a manner that avoids adverse effects on any properties which are listed, or may be eligible for listing, in the National Register of Historic Places (NRHP). If historic or archaeological materials are uncovered during construction, the operator will immediately stop work that might further disturb such materials, and contact the authorized officer (or his/her representative) at the BLM Rawlins Field Office. Any paleontological resources or fossils discovered as a result of operations associated with these wells will be brought to the attention of the authorized officer or his/her representative immediately. All activities in the vicinity of such discoveries will be suspended until notified to proceed by the authorized officer.

Merit certifies that:

a. Merit has applied for a Permit to Appropriate Ground water from the Wyoming State Engineer's Office, concurrently with the Application for Permit to Drill.

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drill site and access route; that I am familiar with the conditions which currently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and that the work associated with the operations proposed herein will be performed by Merit Energy Company and its contractors and subcontractors in conformity with this plan and the terms and conditions under which it is approved.

This statement is subject to the provisions of 18 U.S.C. 1001 for the filing of a false statement.

September 19, 2003

Date

Lisa L. Smith - Permitco Inc.
Authorized Agent For:
MERIT ENERGY COMPANY

PIPELINE INFORMATION
Brown Cow POD

1. The type of pipeline is a gathering system.

2. The outside diameters (O.D.) of all pipe sizes is between 2 and 12 inches.

3. The anticipated production through the line is 5000 MCF per day.

4. The anticipated maximum test pressure is 200 psi.

5. The anticipated operating pressure is 100 psi.

6. The type of pipe is poly.

7. The method of coupling is fused.

8. Water and gas lines will be associated in same trench.

9. There are no other objects to be associated in same trench.

10. The total length of proposed pipelines is approximately 25,550 feet.

11. The width of the trench will range from 6 inches to 4 feet. The depth of the trench will be approximately 4 to 5 feet.

12. The depth of cover of the pipeline will be 4 to 5 feet.

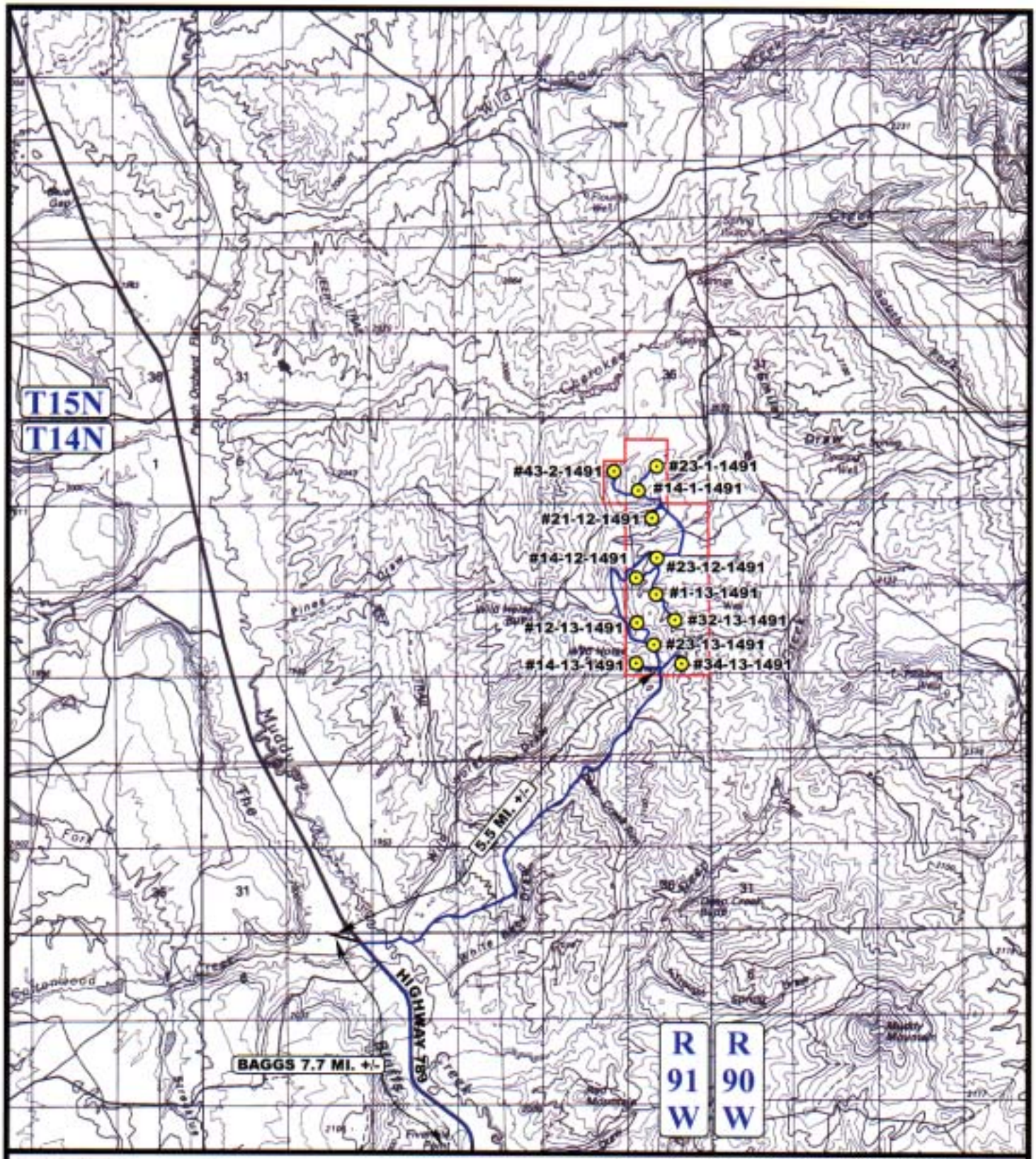
13. The method of entrenchment will be with a backhoe and/or a trenching machine.

14. The construction width needed for total surface disturbing activities is 15 to 20 feet.

15. The estimate of total acreage involving all surface disturbing activities is 11.7 acres.

16. T are no valves, sphere launchers, or other facilities associated with the proposed pipeline operation.

17. Reclamation procedures will include recontouring to original surface features, and reseeding as required by the BLM.



LEGEND:

PROPOSED LOCATION

PROPOSED POD #8 BOUNDARY

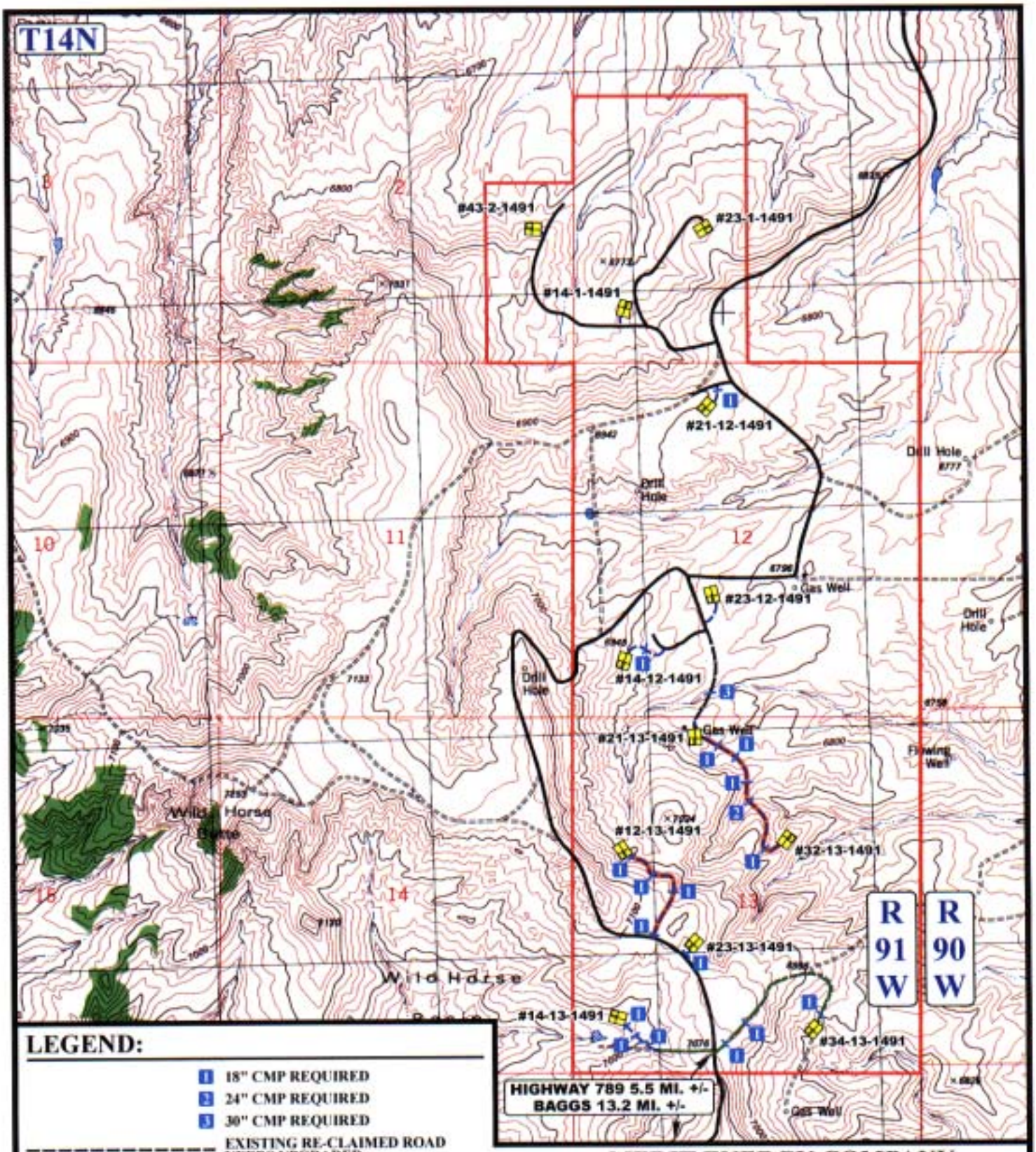
N

MERIT ENERGY COMPANY

BROWN COW FEDERAL POD
SECTIONS 1, 2, 12, & 13, T14N, R91W, 6th P.M.

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	09 MONTH	08 DAY	03 YEAR	A TOPO
SCALE: 1:100,000	DRAWN BY: P.M.	REVISED: 09-17-03		

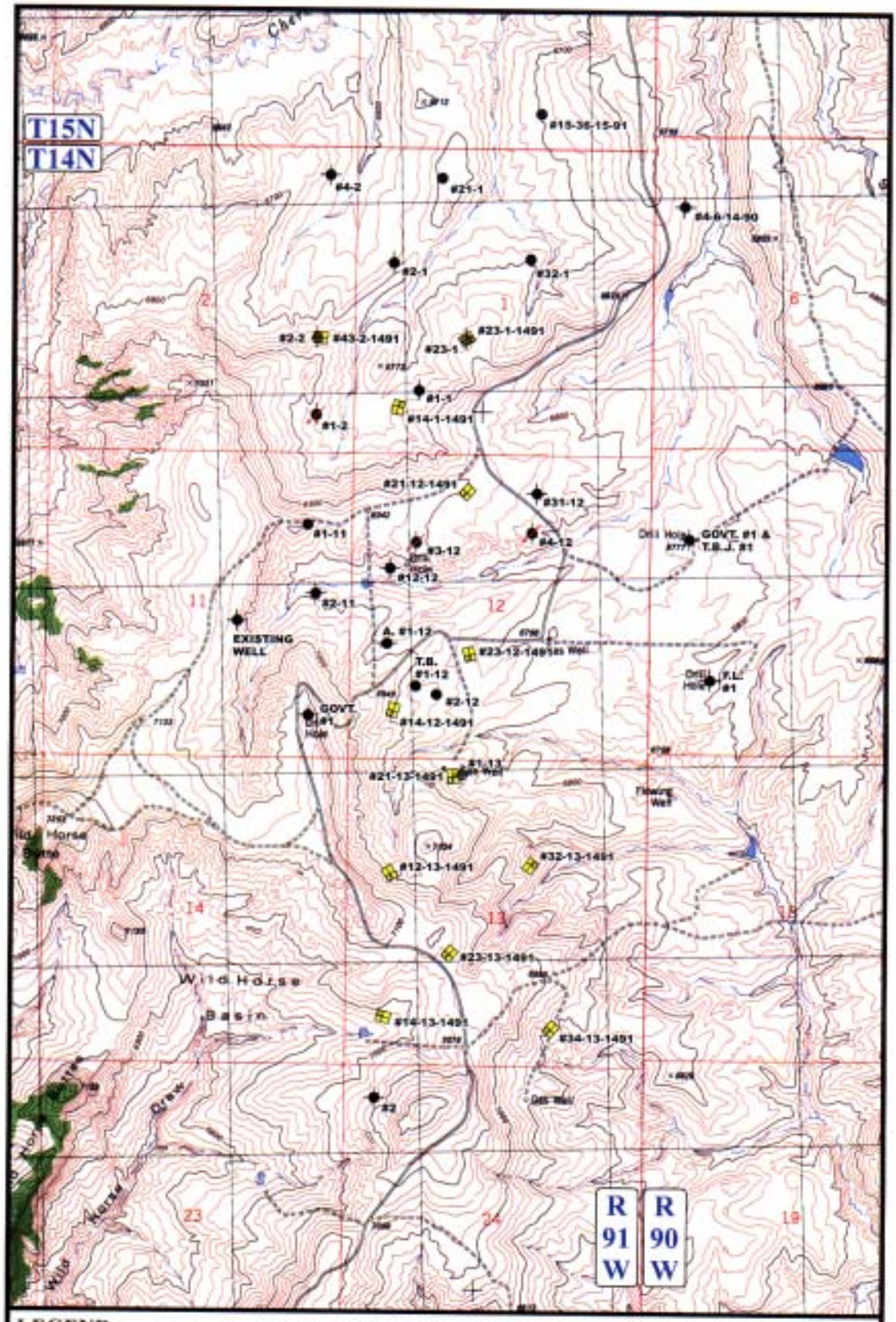


MERIT ENERGY COMPANY

BROWN COW FEDERAL POD
SECTIONS 1, 2, 12, & 13, T14N, R91W, 6th P.M.

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	09 MONTH	08 DAY	03 YEAR	B TOPO
SCALE: 1" = 2000'	DRAWN BY: P.M.	REVISED: 09-17-03		



LEGEND:

- PROPOSED WELLS
- PRODUCING WELLS
- SHUT IN WELLS
- PROPOSED DISPOSAL WELLS
- TEMPORARILY ABANDONED
- ABANDONED WELLS

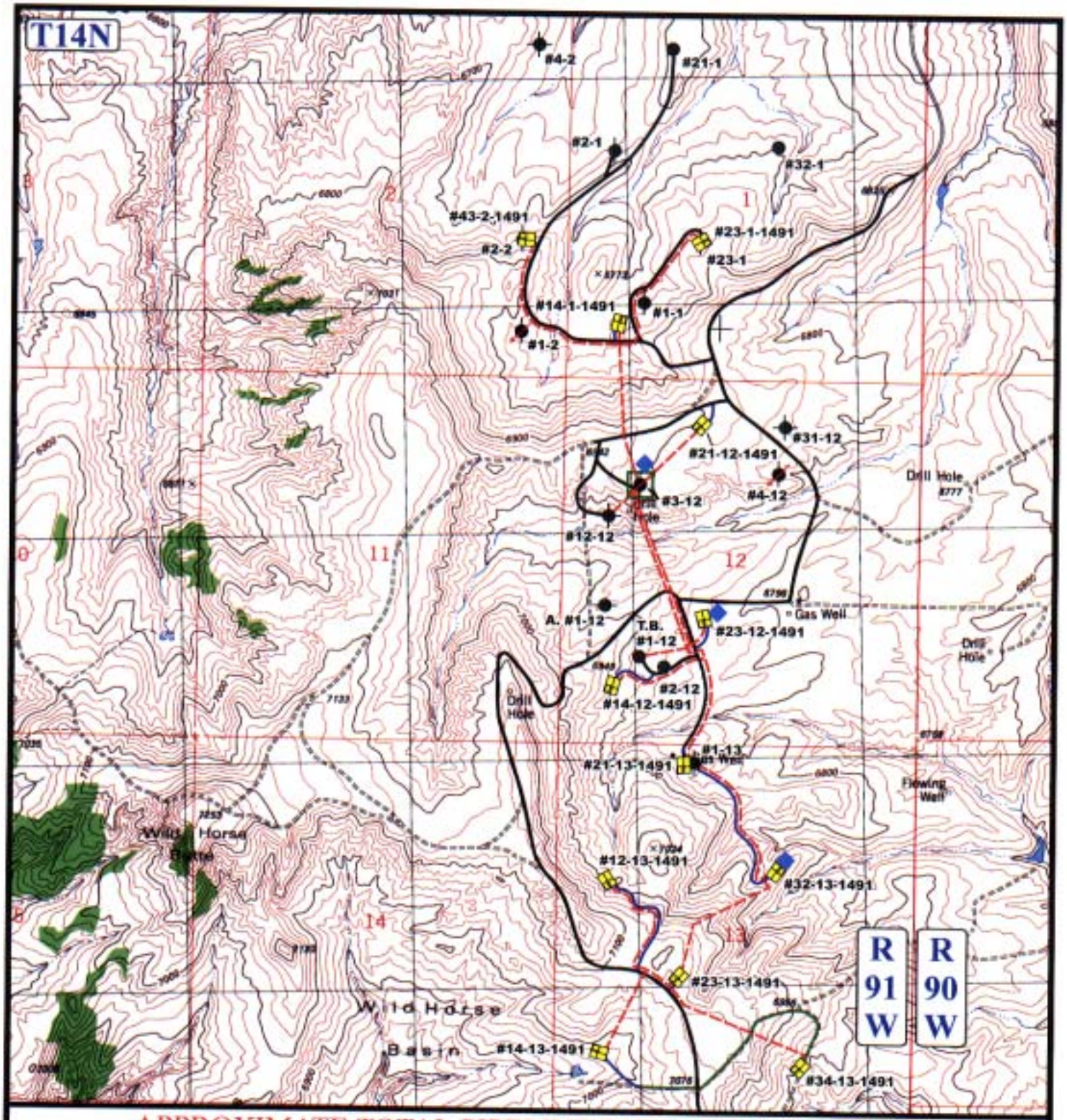
N

MERIT ENERGY COMPANY

BROWN COW FEDERAL POD
SECTIONS 1, 2, 12, & 13, T14N, R91W, 6th P.M.

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	09 MONTH	08 DAY	03 YEAR	C TOPO
SCALE: 1" = 2000'	DRAWN BY: P.M.	REVISED: 09-17-03		



APPROXIMATE TOTAL PIPELINE DISTANCE = 26,000' +/-

LEGEND:

- PROPOSED ACCESS ROAD
- EXISTING PIPELINE
- PROPOSED PIPELINE
- PROPOSED CENTRAL FACILITIES
- WATER TRANSFER FACILITY

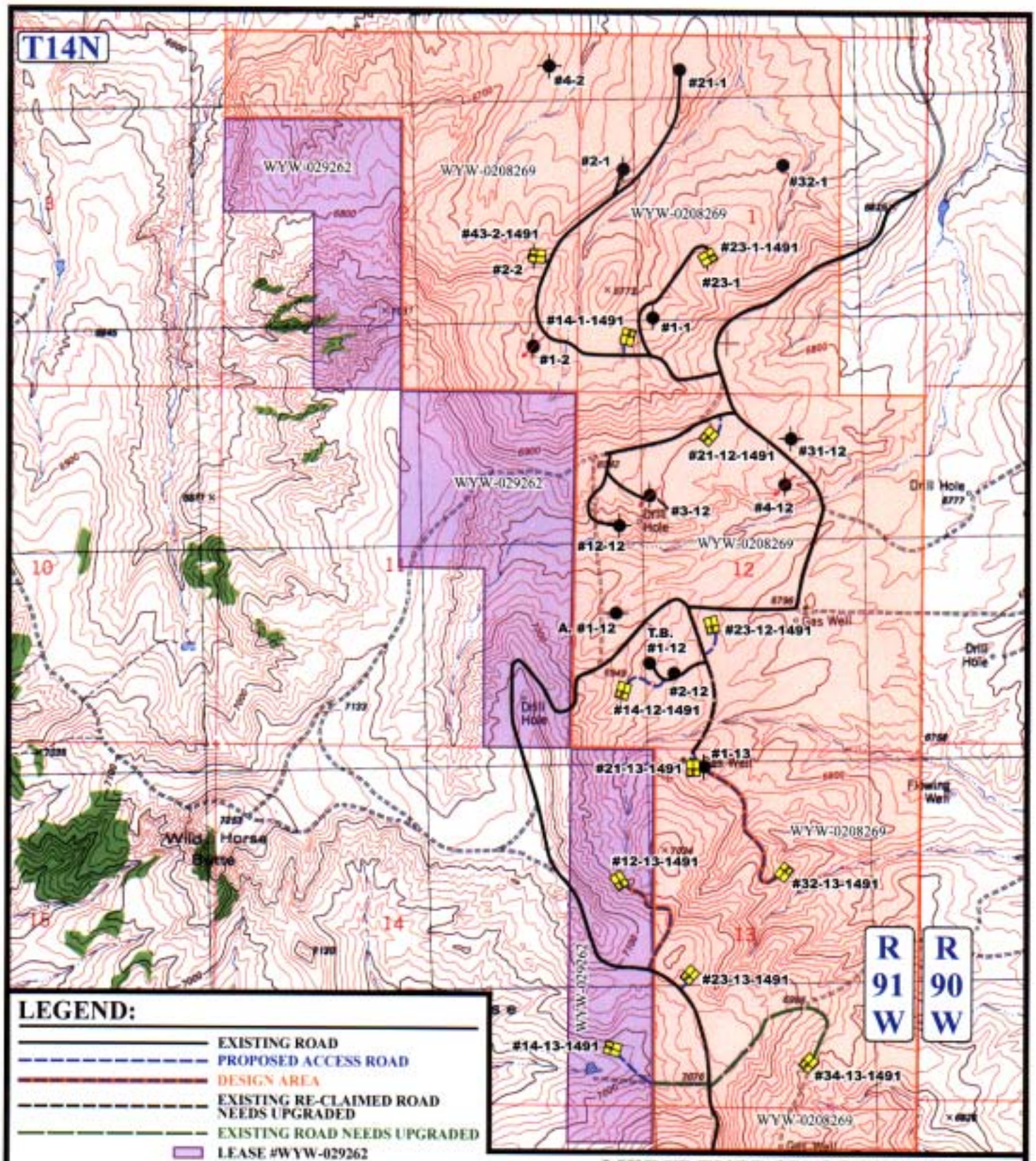
N

MERIT ENERGY COMPANY

BROWN COW FEDERAL POD
SECTIONS 1, 2, 12, & 13, T14N, R91W, 6th P.M.

UELS
Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	09 MONTH	08 DAY	03 YEAR	D TOPO
SCALE: 1" = 1000'	DRAWN BY: P.M.	REVISED: 09-17-03		



LEGEND:

- EXISTING ROAD
- PROPOSED ACCESS ROAD
- DESIGN AREA
- EXISTING RE-CLAIMED ROAD NEEDS UPGRADED
- EXISTING ROAD NEEDS UPGRADED
- LEASE #WYW-029262
- LEASE #WYW-0208269
- PROPOSED WELLS
- PRODUCING WELLS
- SHUT IN WELLS
- PROPOSED DISPOSAL WELLS
- TEMPORARILY ABANDONED
- ABANDONED WELLS

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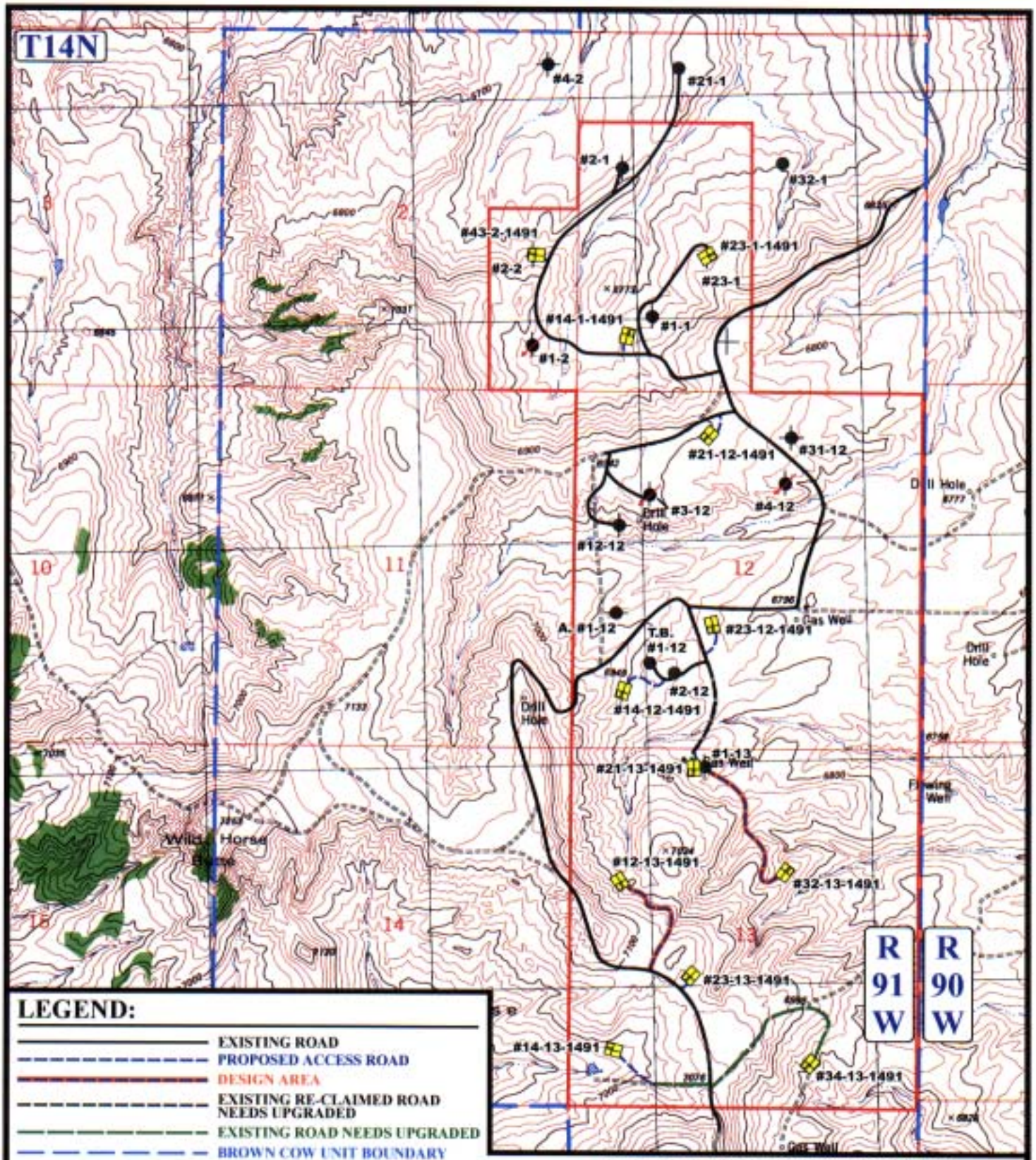
MERIT ENERGY COMPANY

BROWN COW FEDERAL POD
SECTIONS 1, 2, 12, & 13, T14N, R91W, 6th P.M.

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	09 MONTH	08 DAY	03 YEAR	E TOPO
SCALE: 1" = 2000'	DRAWN BY: P.M.	REVISED: 09-17-03		



LEGEND:

- EXISTING ROAD
- PROPOSED ACCESS ROAD
- DESIGN AREA
- EXISTING RE-CLAIMED ROAD NEEDS UPGRADED
- EXISTING ROAD NEEDS UPGRADED
- BROWN COW UNIT BOUNDARY
- PROPOSED POD #8 BOUNDARY

- PROPOSED WELLS
- PRODUCING WELLS
- SHUT IN WELLS
- PROPOSED DISPOSAL WELLS
- TEMPORARILY ABANDONED
- ABANDONED WELLS

N

MERIT ENERGY COMPANY

BROWN COW FEDERAL POD
SECTIONS 1, 2, 12, & 13, T14N, R91W, 6th P.M.

Uintah Engineering & Land Surveying
85 South 200 East Vernal, Utah 84078
(435) 789-1017 * FAX (435) 789-1813

TOPOGRAPHIC MAP	09 MONTH	08 DAY	03 YEAR	F TOPO
SCALE: 1" = 2000'	DRAWN BY: P.M.	REVISED: 09-17-03		

ONSHORE OIL & GAS ORDER NO. 1

Approval of Operations on Onshore
Federal and Indian Oil & Gas Leases

MASTER FIELD PERMIT

BROWN COW POD
Sections 1, 2, 12 and 13
T14N - R91W
Carbon County, Wyoming

Prepared For:

MERIT ENERGY COMPANY

By:

PERMITCO INC.
14421 County Road 10
Ft. Lupton, Colorado 80621
303/857-9999

Copies Sent To:

3 - BLM - Rawlins, WY
1 - Wyoming Oil & Gas Commission - Casper, WY
2 - Merit Energy Company - Dallas, TX
1 - Merit Energy Company - Baggs, WY

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Master Field Permit

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ONSHORE OIL & GAS ORDER NO. 1
Approval of Operations on Onshore
Federal and Indian Oil and Gas Leases

All lease and/or unit operations are to be conducted in such a manner that full compliance is made with the applicable laws, regulations (CFR 43, Part 3160) and the approved Application for Permit to Drill. All operations will be conducted in accordance with Onshore Order No. 2. The operator is considered fully responsible for the actions of his subcontractors. A copy of the approved APD must be on location during construction, drilling and completion operations.

Merit Energy Company proposes to drill a total of 12 wells within the Brown Cow POD which is located in T14N - 91W, approximately 8 miles north of Baggs, Wyoming, on the east side of Highway 789.

All wells are encompassed by two federal leases.

1. FORMATION TOPS

The estimated tops of important geologic markers are as follows:

Formation	*Depth*
Lewis Shale	Surface
Mesa Verde	645' – 1045'
Garden Gulch	649' – 1049'
A Series	904' – 1304'
Cow Creek	1043' – 1443'
Robertson	1106' – 1506'
Allen Ridge	1335' – 1735'
T.D.	1425' – 1825'

2. ANTICIPATED DEPTHS OF OIL, GAS, COAL AND OTHER MINERALS BEARING ZONES

The estimated depths at which the top and bottom of the anticipated water, oil, gas or other mineral bearing formations are expected to be encountered are as follows:

Substance	*Formation*	*Depth*
Fresh Water	Mesa Verde	0-T.D.
Coalbed Methane/Fresh Water	Mesa Verde	645'-T.D.

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesa Verde capable of producing fresh water, including the coal seams. Several coal seams may be tested for gas producing formations to total depth. Any shallow water zones encountered will be protected by bringing production casing and cement to surface.

3. MINIMUM BLOW OUT PREVENTOR (BOP) REQUIREMENTS - refer to attached BOP Schematics

a. The BOPE shall be closed whenever the well is unattended.

b. The BOPE shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.

c. Merit shall notify the Rawlins BLM office 24 hours in advance of BOPE tests.

d. BOP's will be tested to 1000 psi.

4. CASING AND CEMENTING PROGRAM

a. The operator proposes to test the potential of the Mesa Verde coals between +/- 645' and +/-1045' (or the total depth for methane production). A 12-1/2" hole will be drilled to 300 feet and 9-5/8", 32.3#, H-40 casing will be set. An 8-3/4" production hole will be drilled from surface to total depth and then 7", 20#, J-55 casing will be set. All casing will be new.

Purpose	*Interval*	*Hole Size*	*Casing Size*	*Weight*	*Grade*	*Type*	*New/Used*
Surface	0' to 300'	12-1/4"	9-5/8"	32.3#	H-40	ST&C	New

Purpose	*Interval*	*Hole Size*	*Casing Size*	*Weight*	*Grade*	*Type*	*New/Used*
Production	0-T.D.	9-7/8"	7"	20#	J-55	LT&C	New

b. The proposed casing and cementing program shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. All indications of usable water shall be reported.

c. All waiting on cement times shall be adequate to achieve a minimum of 500 psi compressive strength at the casing shoe prior to drilling out.

d. The surface casing will have centralizers on the bottom 3 joints of the casing, starting with the shoe joint.

e. The cement program will be as follows:

Surface (9-5/8")	*Type and Amount*
0' – 300' Top Of Cement @ Surface	Lead: Cement with approximately 158 sx, Class AG@ with 2% CaCl2, 0.25 pps Flocele. Yield: 1.15 cubic feet/sk. Weight: 13.0 ppg.
Production (7")	*Type and Amount*
0' – T.D. Top Of Cement @ Surface	Cement with approximately 250 sx Midcon II with 6% Salt, 2% Calseal, 2% EX1, 0.30% Versaset, 0.25 pps Flocele, 0.25 pps Kwik Seal. Yield 1.58 cubic feet per sack. Weight: 14.2 ppg.

f. The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

g. The above cement volumes are approximate and are calculated under the assumption that a gauge hole will be achieved. Actual cement volumes may vary due to variations in the actual hole gauge and will be determined by running a caliper log on the drilled hole.

h. Auxiliary equipment to be used is as follows:

1. Kelly cock

2. Bit float if deemed necessary.

5. MUD PROGRAM

a. The proposed circulating mediums to be employed in drilling are as follows:

Interval	*Mud Type*	*Mud Wt.*	*Visc.*	*F/L*
0 – 300'	Gel/Lime/Barite as needed	9-13 ppg	30-45	N/C
300' to T.D.	LSND/PHPA	9.2	38	<10 cc's

b. Visual monitoring from surface to T.D. The mud material will consist of bentonite, polymer, and drilling soap. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

6. TESTING, LOGGING AND CORING

The anticipated type and amount of testing, logging and coring are as follows:

a. No drill stem tests are anticipated.

b. The logging program will consist of the following:
Induction, GR, SP, Density, Neutron and Caliper - from surface to T.D.
Cement Bond Log - From 9-5/8" casing shoe to T.D.
Mud Logger - As needed.

7. ABNORMAL PRESSURES AND HYDROGEN SULFIDE GAS

a. The expected bottom hole pressure is 1000-1100 psi. Normal pressures are anticipated to T.D.

b. There is no history of hydrogen sulfide gas in the area and none is anticipated.

8. OTHER INFORMATION AND NOTIFICATION REQUIREMENTS

a. Anticipated Starting Dates:

Anticipated Commencement Date:	- October 15, 2003, or upon approval
Drilling Days:	- Approximately 6 Days Per Well
Completion Days:	- Approximately 4 Days Per Well
Testing Days:	- Approximately 5 Days Per Well

b. The following shall be entered on the driller's log:

1. Casing run, including size, grade, weight, and depth set;

2. How the pipe was cemented, including amount of cement, type, whether cement circulated, location of the cementing tools, etc.

3. Waiting on cement time for each casing string.

4. Casing pressure tests after cementing, including test pressures and results.

c. Notifications Requirements:

1. The spud date will be reported orally to the Authorized Officer 24 HOURS BEFORE SPUDDING, unless otherwise required in the site-specific conditions of approval.

2. Verbal notification shall be given to the Authorized Officer at least 24 hours before formation tests, BOP tests, running and cementing casing, and drilling over lease expiration dates.

3. A phone contact list will be provided by the Bureau of Land Management with the Conditions of Approval.

WATER MANAGEMENT PLAN

OPERATOR: Merit Energy Company (Merit)

Brown Cow Pod

Carbon County, Wyoming

The Brown Cow Pod is 1 of 9 pods that comprise the Atlantic Rim Coalbed Methane Interim Drilling Project. The Brown Cow Pod consists of 24 gas wells and related water disposal wells. This Water Management Plan will address all of the planned interim development wells located in T14N,R90W Sections 1, 2, 12, 13, 23, and 24, and T14N, R91W, Sections 18 and 19. Water injection wells will be used to dispose of water produced during testing and production of methane gas.

Before the injection wells are drilled and completed, water produced from CBM wells may be transported to nearby drilling locations and used to drill additional wells. Any produced water will be contained in the drilling reserve pit constructed on each well pad until the injection wells are completed. Once all wells have been drilled, water produced at the exploratory well sites would be gathered and transported to the injection wells for disposal, which would be permitted by all necessary agencies.

See attached diagrams of WSLFDOLQMFWRQZHOO and ZDWHUWUDQVHUIDFLOLW.

The injection well will be drilled, cased, cemented to surface and the Cherokee and/or Deep Creek sands will be tested to determine their suitability for water disposal. The estimated depths of these formations are 3200 ft. and 3400 ft. respectively.

Typically, a single injection well would be used for several gas wells. The number of producing gas wells per injection well will depend on the suitability of the Cherokee and Deep Creek sands and the amount of produced water from each gas well.

The source of the water to be disposed will be from the coal formations of the Mesaverde Group. Water will be transported from each gas well to the injection well by buried 2" poly pipe. Transfer pumping stations may need to be utilized in areas where elevation differences require supplemental pumping to transfer the produced water. A typical water transfer facility consists of a 400 bbl water tank with associated pump and piping.

To keep surface damage to a minimum, ditches will combine as many pipelines as possible (i.e. water, electricity, gas).

A typical water injection facility will consist of four 400 bbl water tanks, pump house, piping, and well house for the disposal well.

Both the Cherokee and Deep Creek formations are isolated above and below by competent shale barriers. These shales will prevent the initiation and propagation of fractures through overlying strata to any fresh water zones.