FINDING OF NO SIGNIFICANT IMPACT & DECISION RECORD
FOR
Black Diamond Energy, Inc.
Michelena POD (pending APD's)
ENVIRONMENTAL ASSESSMENT –WY-070-08-141

DECISION: Is to approve Alternative C as described in the attached Environmental Assessment (EA) and authorize Black Diamond Energy, Inc.'s Michelena POD (pending APD's) Coal Bed Natural Gas (CBNG) Plan of Development (POD) comprised of the following 9 Applications for Permit to Drill (APDs):

	Well Name	Well #	Qtr/Qtr	Section	TWP	RNG	Lease #
1	Michelena	21-9B	NENW	9	51	77	WYW127422
2	Michelena	21-9C	NENW	9	51	77	WYW127422
3	Michelena	21-9D	NENW	9	51	77	WYW127422
4	Michelena	34-9B	SWSE	9	51	77	WYW127422
5	Michelena	34-9C	SWSE	9	51	77	WYW127422
6	Michelena	34-9D	SWSE	9	51	77	WYW127422
7	Michelena	43-9B	NESE	9	51	77	WYW127422
8	Michelena	43-9C	NESE	9	51	77	WYW127422
9	Michelena	43-9D	NESE	9	51	77	WYW127422

This approval is subject to adherence with all of the operating plans and mitigation measures contained in the Master Surface Use Plan of Operations, Drilling Plan, Water Management Plan, and information in individual APDs. This approval is also subject to operator compliance with all mitigation and monitoring requirements contained within the Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS) approved April 30, 2003.

RATIONALE: The decision to authorize Alternative C, as described in the attached Environmental Assessment (EA), is based on the following:

1. The Operator, in their POD, has committed to:
    - Comply with all applicable Federal, State and Local laws and regulations.
    - Obtain the necessary permits from other agencies for the drilling, completion and production of these wells including water rights appropriations, the installation of water management facilities, water discharge permits, and relevant air quality permits.
    - Offer water well agreements to the owners of record for permitted water wells within ½ mile of a federal CBNG producing well in the POD.
    - Provide water analysis from a designated reference well in each coal zone.
2. The Operator has certified that a Surface Use Agreement has been reached with the Landowner(s).
3. Alternative C will not result in any undue or unnecessary environmental degradation.
4. It is in the public interest to approve these wells, as the leases are being drained of federal gas, resulting in a loss of revenue for the government.
5. Mitigation measures applied by the BLM will alleviate or minimize environmental impacts.

6. Alternative C is the environmentally-preferred Alternative.
7. The proposed action is in conformance with the PRB FEIS and the Approved Resource Management Plan for the Public Lands Administered by the Bureau of Land Management (BLM), Buffalo Field Office, April 2001.
8. The selected alternative incorporates components of the Wyoming Governor's Sage Grouse Implementation Team's "core population area" strategy and executive order and local research to provide appropriate protections for sage-grouse, while meeting the purpose and need for the Michelena project.
9. The selected alternative incorporates appropriate local sage-grouse research and the best available science from across the species' range in development of conditions of approval attached.

   Mitigating measures applied by the BLM will lessen environmental impacts.

   - Surface-disturbing activities will be restricted during sage-grouse breeding and nesting periods (March 1 to June 15) for wells: 43-9 B,C and D along with all associated access road and utility corridors within the NESE and NWSE of section 9, T51N/R77W.

FINDING OF NO SIGNIFICANT IMPACT: Based on the analysis of the potential environmental impacts, I have determined that NO significant impacts are expected from the implementation of Alternative C and, therefore, an environmental impact statement is not required.

In conformance with Appendix E, *Record of Decision, Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment* BLM Buffalo Field Office has initiated actions within the PRB FEIS analysis area in response to additional information regarding impacts to sage-grouse. These measures include:

1. Early initiation of a Resource Management Plan (RMP) revision, based on the evaluation of monitoring data generated under the mitigation monitoring and reporting plan (MMRP) in the PRB FEIS Record of Decision

2. Establishment of sage-grouse "focus" areas, encompassing approximately 1 million acres of sage-grouse habitat. These areas are managed under strict guidelines designed to preserve sage-grouse habitat for development of alternatives during the RMP process (Appendix 1).

3. Initiation of a population viability analysis in the Powder River Basin. This is a 24-month project involving the USGS, BLM Miles City Field Office, BLM Buffalo Field Office, and the University of Montana.

4. Development of alternatives that modify the proposed action to reflect the best available science in sage-grouse management.

5. Development of conditions of approval, specific to sage-grouse management, that incorporate some recommendations from recent research, the NE Local Sage-grouse Working Group, and the Petroleum Association of Wyoming.

The implementation of the selected alternative best meets the stated purpose and need for the proposed action. With the application of mitigating measures selected from alternatives C, sage-grouse population viability in the Powder River Basin will not be compromised due to the larger scope of planning actions and research initiated by the BLM, Buffalo Field Office.

ADMINISTRATIVE REVIEW AND APPEAL: Under BLM regulations, this decision is subject to administrative review in accordance with 43 CFR 3165. Any request for administrative review of this decision must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, P.O. Box 1828, Cheyenne, Wyoming 82003, no later than 20 business days after this Decision Record is received or considered to have been received.

Any party who is adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4.

Acting Field Manager: Bm T-Co Date: 8/13/2009

BUREAU OF LAND MANAGEMENT
BUFFALO FIELD OFFICE
ENVIRONMENTAL ASSESSMENT (EA)
FOR
Black Diamond Energy, Inc.
Michelena POD (pending APD's)
PLAN OF DEVELOPMENT
WY-070-08-141

INTRODUCTION

This site-specific analysis tiers into and incorporates by reference the information and analysis contained in the Powder River Basin Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS), #WY-070-02-065 (approved April 30, 2003), pursuant to 40 CFR 1508.28 and 1502.21. This document is available for review at the Buffalo Field Office. It also tiers into the original Michelena POD EA # WY-070-05-295 approved September 29, 2006. This project EA addresses site-specific resources and impacts that were not covered within the PRB FEIS or the original POD EA.

1. PURPOSE AND NEED

The purpose and need of the proposed action is to determine how and under what conditions, to allow Black Diamond to exercise lease rights granted by the United States to develop the oil and gas resources on federal leaseholds.

Development of the Michelena POD wells would return royalties to the federal Treasury as well as stimulate local economies.

The BLM recognizes the extraction of natural gas is essential to meeting the nation's future needs for energy. As a result, private exploration and development of federal gas reserves are integral to the agencies' oil and gas leasing programs under the authority of the Mineral Leasing Act of 1920, as amended, and the Federal Land Policy Management Act (FLPMA) of 1976. The oil and gas leasing program managed by BLM encourages the development of domestic oil and gas reserves and reduction of the U.S. dependence on foreign sources of energy.

This action responds to the goals and objectives outlined in the Resource Management Plan for the Public Lands Administered by the Bureau of Land Management (BLM), Buffalo Field Office, April 2001 and the Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment (PRB FEIS) approved April 30, 2003. This action helps move the Project Area toward desired conditions for mineral development with appropriate mitigation consistent with the goals, objectives and decisions outlined in these two documents.

1.1. Conformance with Applicable Land Use Plan and Other Environmental Assessments

The proposed action is in conformance with the terms and the conditions of the Approved Resource Management Plan for the Public Lands Administered by the Bureau of Land Management, Buffalo Field Office (BFO), April 2001 and the PRB FEIS, as required by 43 CFR 1610.5 The BFO RMP is currently under revision.

For the RMP revision, BFO established focus areas with rigorous interim protections in order to preserve "decision space" during the revision process. Outside the focus areas, BFO continues to apply appropriate, but far less rigorous, site-specific mitigating measures for high-quality sage-grouse habitat with well densities up to 80-acre spacing and may include site-specific mitigating measures suggested by

the best available science. Actions within BFO focus areas will be limited to impacts consistent with 640 acre spacing, and must have a plan of development that demonstrates that the proposal can be managed in a manner that effectively conserves sage-grouse habitats (in focus areas) affected by the proposal.

Though the Michelena POD does not occur within a core or focus area, seasonal sage-grouse habitat occurs throughout the project area.

These 9 wells, access road and utility corridor infrastructure are proposed Section 9, Township 51 North, Range 77 West and lie within the WY Game and Fish Department established Yearlong elk range for the Fortification Creek herd.

The BLM Buffalo Field Office issued a decision on September 9, 2006 in conjunction with Environmental Assessment #WY-070-EA05-295 to defer approval of these 9 APD's until completion of a cumulative effects analysis for the Fortification Creek elk herd. An Environmental Report: Coalbed Natural Gas Effects on the Fortification Creek Area Elk Herd, was completed in September 2007 (BLM 2007). Three APD's and associated infrastructure located outside the elk Yearlong boundary were authorized in WY-070-EA05-295.

On August 20, 2007, the BFO published in the Federal Register (FR) a Notice of Intent (NOI) to amend the 1985 Buffalo Resource Management Plan (RMP) with regard to decisions made in the Fortification Creek Planning Area (FCPA) (72 FR 46511). According to the NOI the BFO, through the plan amendment process will evaluate; 1) management guidance in the FCPA; 2) designation of an Area of Critical Environmental Concern (ACEC) in the FCPA; and 3) a potential land exchange with the State of Wyoming to consolidate ownership and facilitate management of the FCPA.

The Michelena proposal was considered in relation to the analysis and planning issues being addressed in the RMP amendment. The nine proposed wells are outside the proposed ACEC; therefore there will be no effect to any potential decision to manage a portion of the FCPA as an ACEC.

Because of the peripheral nature of this action relative primarily to elk and its habitat, to the actions being considered in the amendment, it was determined that this action would have little effect upon that process and therefore could proceed through analysis.

2. ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1. Alternative A - No Action

A No Action Alternative was considered in the PRB FEIS, Volume 1, pages 2-54 through 2-62. This alternative would consist of no new federal wells. 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 lease lands, "subject to the terms and conditions incorporated in the lease." Thus, under this alternative, the operator's proposal would be denied.

2.2. Alternative B - Proposed Action

Proposed Action Title/Type: Black Diamond Energy, Inc.'s Michelena Plan of Development (POD) for 9 coal bed natural gas well Applications for Permit to Drill (APDs) and associated infrastructure.

Proposed Well Information: There are 9 wells proposed within this POD, the wells are vertical bores proposed on an 80 acre spacing pattern with 3 wells per location. The locations are identified as 21-9, 34-9 and 43-9. Three coal seams are being targeted from each location (the Upper Canyon, Werner and Kennedy) with a well for each coal seam. Proposed well house dimensions are approximately 6 ft wide x 6 ft length x 5 ft height. Well house color is Covert Green, selected to blend with the surrounding vegetation. Wells are located as follows:

	Well Name	Well #	Qtr/Qtr	Section	TWP	RNG	Lease #
1	Michelena	21-9B	NENW	9	51	77	WYW127422
2	Michelena	21-9C	NENW	9	51	77	WYW127422
3	Michelena	21-9D	NENW	9	51	77	WYW127422
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7	Michelena	43-9B	NESE	9	51	77	WYW127422
8	Michelena	43-9C	NESE	9	51	77	WYW127422
9	Michelena	43-9D	NESE	9	51	77	WYW127422

County: Johnson

Applicant: Black Diamond Energy, Inc.

Surface Owners: Juaquin Michelena

Project Description:
The proposed action involves the following:

- Drilling of 9 total federal CBM wells in Upper Canyon, Werner, and Kennedy coal zones. Well depths will vary dependent on the target coal zone as follows:
    - Upper Canyon – 1,216 to 1,298 feet
    - Werner – 1,358 to 1,418 feet
    - Kennedy – 1,707 to 1,765 feet

- Drilling and construction activities are anticipated to be completed within two years, the term of an APD. Drilling and construction occurs year-round in the PRB. Weather may cause delays lasting several days but rarely do delays last multiple weeks. Timing limitations in the form of Conditions of Approval and/or agreements with surface owners may impose longer temporal restrictions on portions of this POD, but rarely do these restrictions affect an entire POD.

- Well metering shall be accomplished by a combination of telemetry and well visitation. Metering would entail multiple visits per month to each well frequency to be determined by individual well maintenance needs. A minimum of 1 visit per week is anticipated to comply with state and federal regulations.

- A Water Management Plan (WMP) that involves the following infrastructure and strategy: 1 existing discharge point and 1 existing off-channel pit within the Upper Powder River primary watershed. Water will be treated at an existing EMIT water treatment facility and discharged into the Upper Powder River in accordance with WYPDES permit# WY0051934.
  All produced CBNG water will be piped directly to an existing EMITS water treatment facility located in Section 20, Township 51N, Range 77W. Once the water is treated it will be discharged directly into the Powder River or to an existing impoundment located in Section 17, Township 51N, Range 77W.

- An unimproved and improved road network.

- An existing above ground power line network.

- A buried gas, water and power line network. Existing third party compression facility(s).

For a detailed description of design features, construction practices and water management strategies associated with the proposed action, refer to the Master Surface Use Plan (MSUP), Drilling Plan and WMP in the POD and individual APDs. Also see the subject POD and/or APDs for maps showing the proposed well locations and associated facilities described above. More information on CBNG well drilling, production and standard practices is also available in the PRB FEIS, Volume 1, pages 2-9 through 2-40 (January 2003).

Implementation of committed mitigation measures contained in the MSUP, Drilling Program and WMP, in addition to the Standard COA contained in the PRB FEIS Record of Decision Appendix A, are incorporated and analyzed in this alternative.

Additionally, the Operator, in their POD, has committed to:

1. Comply with all applicable Federal, State and Local laws and regulations.
2. Obtain the necessary permits for the drilling, completion and production of these wells including water rights appropriations, the installation of water management facilities, water discharge permits, and relevant air quality permits.
3. Offer water well agreements to the owners of record for permitted water wells within ½ mile of a federal CBNG producing well in the POD
4. Provide water analysis from a designated reference well in each coal zone.

The Operator has certified that a Surface Use Agreement has been reached with the Landowners.

2.3. Alternative C – Modified Proposed Action

Alternative C represents a modification of Alternative B based on the operator and BLM working cooperatively to reduce environmental impacts. The description of Alternative C is the same as Alternative B with the addition of the project modifications identified by BLM and the operator following the initial project proposal (Alternative B). At the on-sites, all areas of proposed surface disturbance were inspected to insure that the project would meet BLM multiple use objectives to conserve natural resources while allowing for the extraction of Federal minerals. In some cases, access roads were re-routed, and well locations, pipelines, discharge points and other water management control structures were moved, modified, mitigated or dropped from further consideration to alleviate environmental impacts. Alternatives to the different aspects of the proposed action are always considered and applied as pre-approval changes, site specific mitigation and/or Conditions of Approval (COAs), if they will alleviate environmental effects of the operator's proposal. The specific changes identified for the Michelena POD (pending APD's) are listed below under 2.3.1:

2.3.1. Changes as a result of the on-sites

Well name	Well #'s	Comments
MICHELENA	21-9B,C,D	The constructed pad design was withdrawn by the operator. The new access route described on the final project maps will be used.
MICHELENA	34-9B,C,D	The proposed location was on a 15% slope with shallow sandy soils. The wells were moved to a location 175 feet down slope where side slope is reduced and a constructed pad is not required. The reserve pits need to be lined. The access is an existing 2-track on sandy soil that will require upgrading to an improved template design in as required by the BLM to ensure safe all weather use, establish drainage and to prevent erosion. The proposed corridor to the location from the 43-9 location was withdrawn due to 500' segment down 25% slope in shallow sandy soils to the location. The corridor will follow the existing 2-track access. The low-water channel crossing at Taylor Draw required engineered design.
MICHELENA	43-9B,C,D	The wells were moved SE approximately 500' to the south side ofTaylor Draw eliminating approximately a mile of engineered access road erosive soils. The 43-9 designed access road was withdrawn by the operator. The access to the new location will be improved template as required by the BLM to ensure safe all weather use, establish drainage and to prevent erosion. The new location will not require a constructed pad. The reserve pits need to be lined. The low-water channel crossing at Taylor Draw required engineered design. The new site is preferred for Visual Resource Management.

2.3.2. Programmatic mitigation measures identified in the PRB FEIS ROD

Programmatic mitigation measures are those, determined through analysis, which may be appropriate to apply at the time of APD approval if site specific conditions warrant. These mitigation measures can be applied by BLM, as determined necessary at the site-specific NEPA APD stage, as COAs and will be in addition to stipulations applied at the time of lease issuance and any standard COA.

2.3.2.1. Groundwater

1. In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ has developed and revised a guidance document, “Compliance Monitoring and sighting Requirements for Unlined Impoundments Containing Coalbed Methane Produced Water” (September, 2006) which can be accessed on their website. For all WYPDES permits the BLM will require that operators comply with the latest DEQ standards and monitoring guidance.

2.3.2.2. Surface Water

1. Channel Crossings:
   a) Channel crossings by road and pipelines will be constructed perpendicular to flow. Culverts will be installed at appropriate locations for streams and channels crossed by roads as specified in the BLM Manual 9112-Bridges and Major Culverts and Manual 9113-Roads. Streams will be crossed perpendicular to flow, where possible, and all stream crossing structures will be designed to carry the 25-year discharge event or other capacities as directed by the BLM.
   b) Channel crossings by pipelines will be constructed so that the pipe is buried at least four feet below the channel bottom.
2. Low water crossings will be constructed at original streambed elevation in a manner that will prevent any blockage or restriction of the existing channel. Material removed will be stockpiled for use in reclamation of the crossings.
3. Concerns regarding the quality of the discharged CBNG water on downstream irrigation use may

require operators to increase the amount of storage of CBNG water during the irrigation months and allow more surface discharge during the non-irrigation months.

2.3.2.3. Soils

1. The Companies, on a case by case basis depending upon water and soil characteristics, will test sediments deposited in impoundments before reclaiming the impoundments. Tests will include the standard suite of cations, ions, and nutrients that will be monitored in surface water testing and any trace metals found in the CBNG discharges at concentrations exceeding detectable limits.

2.3.2.4. Wildlife

1. For any surface-disturbing activities proposed in sagebrush shrublands, the Companies will conduct clearance surveys for sage grouse breeding activity during the sage grouse's breeding season before initiating the activities. The surveys must encompass all sagebrush shrublands within 0.5 mile of the proposed activities.

2.3.2.5. Threatened, Endangered, or Sensitive Species

2.3.2.5.1. Bald Eagle

1. Additional mitigation measures may be necessary if the site-specific project is determined by a BLM biologist to have adverse effects to bald eagles or their habitat.

2.3.2.5.2. Black-footed Ferret

1. Prairie dog colonies will be avoided wherever possible.

2. If any black-footed ferrets are located, the USFWS will be consulted. Absolutely no disturbance will be allowed within prairie dog colonies inhabited by black-footed ferrets.

3. Additional mitigation measure may be necessary if the site-specific project is determined by a BLM biologist to have adverse effects to black-footed ferrets or their habitat. In the event that a mountain plover is located during construction or operation, the USFWS' Wyoming Field Office (307-772-2374) and the USFWS' Law Enforcement Office (307-261-6365) will be notified within 24 hours.

2.3.2.5.3. Mountain Plover

1. A mountain plover nesting survey shall be conducted following U.S. Fish and Wildlife Service protocol within occupied black-tailed prairie dog colonies prior to permit authorization.
   Outside of occupied black-tailed prairie dog colonies, a mountain plover nesting survey following U.S. Fish and Wildlife Service protocol is encouraged prior to construction initiation, as project modifications can be made if necessary to protect nesting plovers and natural gas production. If requested in writing, then authorization may be granted for construction activities to occur between August 1 and March 15, outside the mountain plover breeding season. A mountain plover nesting survey following U.S. Fish and Wildlife Service protocol shall be conducted during the first available survey period (May 1 – June 15). Additional measures such as monitoring and activity restrictions may be applied if mountain plovers are documented.

2. A disturbance-free buffer zone of 0.25 mile will be established around all occupied mountain plover nesting habitat between March 15 and July 31.

3. Project-related features that encourage or enhance the hunting efficiency of predators of mountain plover will not be constructed within ¼ mile of occupied mountain plover nesting habitat.

4. Construction of ancillary facilities (for example, compressor stations, processing plants) will not be located within ½ mile of known nesting areas. The threats of vehicle collision to adult plovers and their broods will be minimized, especially within breeding aggregation areas.

5. Work schedules and shift changes will be set to avoid the periods from 30 minutes before to 30 minutes after sunrise and sunset during June and July, when mountain plovers and other wildlife are most active.

6. Creation of hunting perches or nest sites for avian predators within 0.5 mile of identified nesting areas will be avoided by burying power lines, using the lowest possible structures for fences and other structures and by incorporating perch-inhibiting devices into their design.

7. Reclamation of areas of previously suitable mountain plover habitat will include the seeding of vegetation to produce suitable habitat for mountain plover.

2.3.2.6. Visual Resources

1. The Companies will mount lights at compressor stations and other facilities on a pole or building and direct them downward to illuminate key areas within the facility while minimizing the amount of light projected outside the facility.

2.3.2.7. Air Quality

During construction, emissions of particulate matter from well pad and resource road construction will be minimized by application of water, or other dust suppressants, with at least 50 percent control efficiency. Roads and well locations constructed on soils susceptible to wind erosion could be appropriately surfaced or otherwise stabilized to reduce the amount of fugitive dust generated by traffic or other activities, and dust inhibitors (surfacing materials, non-saline dust suppressants, and water) could be used as necessary on unpaved collector, local and resource roads that present a fugitive dust problem. The use of chemical dust suppressants on BLM surface will require prior approval from the BLM authorized officer.

2.3.3. Site specific mitigation measures

General

1. All changes made at the onsite will be followed. See Table 2.3.1 Changes as a result of the onsite above; the operator has agreed to incorporate theses changes into the plan of development.

2. All permanent above-ground structures (e.g., production equipment, tanks, etc.) not subject to safety requirements will be painted to blend with the natural color of the landscape. The paint used will be a color which simulates “Standard Environmental Colors.” The color selected for the Michelena POD is Covert Green, (18-0617 TPX).

3. The operator will drill seed on the contour to a depth of 0.5 inch, followed by cultipaction to compact the seedbed, preventing soil and seed losses. To maintain quality and purity, the current years tested, certified seed with a minimum germination rate of 80% and a minimum purity of 90% will be used. On BLM surface or in lieu of a different specific mix desired by the surface owner, use the following:

Seed Mix - 10-14" Precipitation Zone for a Shallow Loamy Ecological Site

Species	**% in Mix**	Lbs PLS*
Western Wheatgrass (Pascopyrum smithii)	50	4.2
Bluebunch wheatgrass (Pseudoroegneria spicata ssp. Spicata)	35	6
Prairie coneflower (Ratibida columnifera)	5	0.6
White or purple prairie clover (Dalea candidum, purpureum)	5	0.6
Rocky Mountain beeplant (Cleome serrulata) /or ***American vetch***(Vicia americana)	5	0.6
Chapter 2 Totals	**100%**	**12 lbs/acre**

This is a recommended seed mix based on the native plant species listed in the NRCS Ecological Site descriptions, U.W. College of Ag. and seed market availability.

Surface Use

1. The operator will maintain drilling operations within a 250 foot by 150 foot work area for those locations where a constructed pad is not approved as designed including the following well locations: 21-9-5177 , 34-9-5177 and 43-9-5177.

2. The operator is required to line the reserve pits at the 43-9-5177B,C,D location due to the proximity of the location to a headwall within Taylor Draw.

3. The following well location and associated access road/corridor in the project area have been identified to have limited reclamation potential that will require disturbed areas to be stabilized (stabilization efforts may include mulching, matting, soil amendments, etc.) in a manner which eliminates accelerated erosion until a self-perpetuating native plant community has stabilized the site in accordance with the Wyoming Reclamation Policy. Stabilization efforts shall be finished within 30 days of the initiation of construction activities for the following well locations and the associated access roads:
    - 34-9-5177B,C,D

4. Top soil will be segregated for all excavation including the entire disturbance area for excavated areas for minor rig leveling, reserve pits, spot upgrades and utility trenches. Segregation will not be required for trenches installed with wheel trenchers.

5. The operator will follow the guidance provided in the Wyoming Policy on Reclamation (Instruction Memorandum No. WY-2009-022). The Policy can be found on the web at: www.blm.gov/style/medialib/blm/wy/resources/efoia/IMs/2009.Par.54664.File.dat/wy2009-022.pdf

6. Provide 4" of aggregate where grades exceed 8%.

7. The culvert locations will be staked prior to construction. The culvert invert grade and finished road grade will be clearly indicated on the stakes. Culverts will be installed on natural ground, or on a designed flow line of a ditch. The minimum cover over culverts will be 12" or one-half the diameter

whichever is greater. Drainage laterals in the form of culverts or waterbars shall be placed according to the following spacing:

Grade	Drainage Spacing
2-4%	310 ft
5-8%	260 ft
9-12%	200 ft
12-16%	150 ft

Wildlife

Burrowing Owls

The following conditions will alleviate impacts to burrowing owls:

No surface disturbing activity shall occur within 0.25 miles of all identified prairie dog colonies from April 15 to August 31, annually, prior to a burrowing owl nest occupancy survey for the current breeding season. A 0.25 mile buffer will be applied if a burrowing owl nest is identified. This condition will be implemented on an annual basis for the duration of surface disturbing activities within the prairie dog town(s). This timing limitation will be in effect unless surveys determine the nest(s) to be inactive. This timing limitation will affect the following:

Township/Range	Section	Wells and Infrastructure
T51N/R77W	9	**Wells:** 21-9 B,C,D and associated access road & utility corridor.

Mountain Plover

The following conditions will alleviate impacts to mountain plovers:

1. A mountain plover nesting survey is required in suitable habitat prior to commencement of surface disturbing activities in the following areas: North half Section 9

   Mountain plover nesting surveys shall be conducted by a biologist following the most current USFWS Mountain Plover Survey Guidelines (the survey period is May 1-June 15). All survey results must be submitted in writing to the BFO and approved prior to initiation of surface disturbing activities.

   a. No surface disturbing activities are permitted in the suitable habitat area listed above, from March 15-July 31, unless a mountain plover nesting survey has been conducted during the current breeding season. This timing limitation will be in effect unless surveys determine no plovers are present. This timing limitation will affect the following:

Township/Range	Section	Wells and Infrastructure
T51N/R77W	9	**Wells:** 21-9 B,C,D and associated access road & utility corridor.

   b. If occupied mountain plover habitat is identified, then a seasonal disturbance-free buffer of ¼ mile shall be maintained between March 15 and July 31. If no mountain plover observations are identified, then surface disturbing activities may be permitted within suitable habitat until the following breeding season (March 15).

   c. No dogs will be permitted at work sites to reduce the potential for harassment of mountain plovers.

Raptors
The following conditions will alleviate impacts to raptors:

1. No surface disturbing activity shall occur from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season. Surveys to document nest occupancy shall be conducted by a biologist following BLM protocol, between April 15 and June 30. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface disturbing activities. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a 0.5 mile timing buffer will be implemented. The timing buffer restricts surface disturbing activities within 0.5 mile of occupied raptor nests from February 1 to July 31.
2. If an undocumented raptor nest is located during project construction or operation, the Buffalo Field Office (307-684-1100) shall be notified within 24 hours.
3. Well metering, maintenance and other site visits within 0.5 miles of raptor nests should be minimized as much as possible during the breeding season (February 1 – July 31).

Sage Grouse
The following conditions will alleviate impacts to sage-grouse:

1. No surface disturbing activities are permitted within identified sage grouse nesting habitat between March 1 and June 15. This condition will be implemented on an annual basis for the duration of surface disturbing activities. This timing limitation will affect the following:

Township/Range	Section	Wells and Infrastructure
T51N/R77W	9	Wells: 43-9 B,C,D All associated access road and utility corridor within the NESE and NWSE of this section.

   a. Sage-grouse lek survey(s) shall be conducted annually. The required sage-grouse survey will be conducted by a biologist following the most current WGFD protocol. All survey results shall be submitted in writing to a Buffalo BLM biologist. and approved prior to surface disturbing activities.
   b. Well metering, maintenance and other site visits within identified sage-grouse nesting habitat should be minimized as much as possible during the breeding, nesting and brood rearing seasons (March 1– June 15).
2. Maximum speed on all operator-constructed and maintained roads will not exceed 10 miles per hour within identified sage-grouse nesting habitat. This will affect all roads located within the areas listed in the table above.

Sharp-tailed Grouse
The following conditions will alleviate impacts to sharp-tailed grouse:

1. No surface disturbing activities are permitted between April 1 and May 31, prior to completion of a grouse lek survey. This condition will be implemented on an annual basis for the duration of surface disturbing activities.
   a. If an active lek is identified during the survey, the 0.64 mile timing restriction (April 1-May 31) will be applied and surface disturbing activities will not be permitted until after the nesting season. If surveys indicate that the identified lek is inactive during the current breeding season, surface disturbing activities may be permitted within the 0.5 mile buffer until the following breeding season (April 1). The required sharp-tailed grouse survey will be conducted by a biologist following WGFD protocol. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface disturbing activities.
2. Creation of raptor hunting perches will be avoided within 0.64 miles of documented sharp-tailed grouse lek sites. Perch inhibitors will be installed to deter avian predators from preying on sage grouse.

Bald Eagles

1. No surface disturbing activity shall occur within one mile of bald eagle habitat (Powder River) annually from November 1 through April 1 (CM9), prior to a winter roost survey or from February 1 through August 15 (CM8) prior to a nesting survey. This applies to the *ENTIRE* Michelena POD.
    a. If a roost is identified and construction has not been completed, a year round disturbance-free buffer zone of 0.5 will be established for all bald eagle winter roost sites. A seasonal minimum disturbance-free buffer zone of 1-mile will be established for all bald eagle roost sites (November 1 - April 1).
    b. If a nest is identified and construction has not been completed, a minimum disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) would be established year round for all bald eagle nests. A seasonal minimum disturbance-free buffer zone of 1-mile will be established for all bald eagle nest sites (February 1 - August 15).
    c. Additional mitigation measures may be necessary if the site-specific project is determined by a Bureau biologist to have an adverse affect to bald eagles or their habitat.

Elk

1. The operator will provide BLM with a proposed work schedule at the pre-construction meeting and a work summary report, due by the 12th of each month. The report shall summarize the work activities from the previous month, what activities were conducted, where the work was conducted, when the work was conducted, and any elk observations shall be recorded. The report shall also include the proposed activity schedule for the next month. The summary report shall be compared with the elk monitoring data to evaluate cause and affect relationships.
2. No surface disturbing or disruptive activity shall occur within the identified elk parturition range May 1 to June 30 annually.

Township/Range	Section	Wells and Infrastructure
51/77	9	Wells: 43-9 B,C,D and 34-9 B,C,D and ALL associated access road & utility corridor within the SE ¼ of this section.

2.4. Alternatives Considered but Eliminated from Detailed Analysis

Neither Black Diamond Energy nor the BLM was able to develop an additional alternative that would meet the purpose and need while being technically and economically feasible. Alternatives considered, but eventually discarded included employing horizontal or directional drilling methods from locations outside the FCPA. These methods were eliminated from detailed analysis as non-vertical drilling has not been proven to be technically or economically feasible for Powder River Basin CBNG development; in addition a suitable non-vertical well location was not available as nearly all of lease WYW127422 is located within the FCPA.

Consideration was given to following the proposed phased development strategy recommended as the Preferred Alternative in the RMP Amendment for the FCPA (described below). This would be a deferment of development until the plan amendment was authorized. One of the primary reasons for not considering this alternative was because there are producing CBNG wells in the area and there is the potential that drainage of the lease area and loss of the CBNG resource could occur prior to the time of approval. Therefore purpose and need could not be met.

2.5. Summary of Alternatives

A summary of the infrastructure currently existing within the POD area (Alternative A), the infrastructure originally proposed by the operator (Alternative B), and the infrastructure within the BLM/operator modified proposal (Alternative C) are presented in Table 2.5.

Table 2.5 Summary of the Alternatives

Facility	Alternative A (No Action) Existing Number or Miles	Alternative B (Original Proposal) Proposed Number or Miles	Alternative C (Environmental Alt.) Revised Number or Miles
Total CBNG Wells	48	9	9
Total Locations	20	3	3
Nonconstructed Pads	NA	0	3
Slotted Pads	NA	0	0
Constructed Pads	NA	3	0
Conventional Wells	0	0	0
Gather/Metering Facilities	0	0	0
Compressors	0	0	0
Monitor Wells	6	0	0
Impoundments			
On-channel	2	0	0
Off-channel	2	0	0
Water Discharge Points	3	0	0
Treatment Facilities	1	0	0
Improved Roads			
No Corridor	0	0	0
With Corridor	0	0	0.9
2-Track Roads			
No Corridor	0.12	0	0
With Corridor	1.16	0.12	0.12
Buried Utilities			
No Corridor	0.45	0.45	0.45
With Corridor	0.33	1.36	0.33
Overhead Powerlines	5.11	0	0
Communication Sites	0	0	0
Staging/Storage Areas	2	0	0
Other Disturbance	NA	NA	NA
Acres of Disturbance	27.8	12.56	8.39

3. DESCRIPTION OF AFFECTED ENVIRONMENT

This section describes the environment that would be affected by implementation of the Alternatives described in Section 2. Aspects of the affected environment described in this section focus on the relevant major issues.

Applications to drill were received on July 16, 2005. Field inspections of the proposed Michelena POD (pending APD's) CBNG project were conducted initially on 7/12/2006 and revisited again 4/8/2008 by the following:

Representing BLM;

- Jim Verplancke, Natural Resource Specialist/ Wildlife Biologist
- Diane Adams, GIS Specialist/VRM Coordinator

Representing Black Diamond Energy, Inc.;

- Carlisle Arno, Black Diamond Energy
- Clint- Black Diamond Energy
- Red Luken, Black Diamond Energy
- Dan Cosmicky Black Diamond Energy
- Jason Sutton, Grouse Mountain Consultants

Representing the private surface owners;

- Juaquin Michelena

This section describes the environment that would be affected by implementation of the Alternatives described in Section 2. Aspects of the affected environment described in this section focus on the relevant major issues. Certain critical environmental components require analysis under BLM policy. These items are presented below in Table 3.1.

Table 3.1 - Critical elements requiring mandatory evaluation are presented below.

Mandatory Item	Potentially Impacted	No Impact	Not Present On Site	BLM Evaluator
Threatened and Endangered Species	X			Jim Verplancke
Floodplains		X		Jim Verplancke
Wilderness Values			X	Jim Verplancke
ACECs			X	Jim Verplancke
Water Resources	X			Jim Verplancke
Air Quality		X		Jim Verplancke
Cultural or Historical Values			X	Clint Crago
Prime or Unique Farmlands			X	Jim Verplancke
Wild & Scenic Rivers			X	Jim Verplancke
Wetland/Riparian		X		Jim Verplancke
Native American Religious Concerns			X	Clint Crago
Hazardous Wastes or Solids		X		Jim Verplancke
Invasive, Nonnative Species	X			Jim Verplancke
Environmental Justice		X		Jim Verplancke

3.1. Fortification Creek Planning Area

The 3 proposed CBNG locations are located on private surface within the Fortification Creek Planning Area (FCPA). The area has been recognized to contain important resource values since the late 1970's when the BLM Buffalo Field Office established a Management Framework Plan for the Field Office area. The area was recognized again in the 1980 Buffalo Resource Area Oil and Gas EA and the Fortification Creek Oil and Gas Surface Protection Plan completed in 1982. The 1985 Buffalo Resource Management Plan (RMP) incorporated decisions from both of those documents. Important resources in the area

include elk crucial winter and calving habitat, high visual quality, a wilderness study area, steep slopes with erosive soils, and significant cultural, historic, and or paleontological values. The Buffalo RMP decisions relevant to the FCPA include:

- No overhead power on BLM administered surface lands
- The following lease stipulations may apply:
  - Controlled Surface Use – Surface occupancy or use within the Fortification Creek area will be restricted or prohibited unless the operator and surface managing agency arrive at an acceptable plan for mitigation of anticipated impacts. This may include development, operations and maintenance of facilities.
    In particular for elk:
  - Timing limitation - To preclude new surface disturbing activity within crucial elk winter range, which could cause increased stress to and/or displacement of animals during the critical time period (November 15 to April 30).
  - Timing limitation – To preclude new surface disturbing activities within elk calving areas, which could cause increased stress to and/or displacement of animals during the critical time period (May 1 to June 30).
  - All other lease stipulations that may apply.
- Class III visual resource management objectives

3.2. Minerals

Development of this project would have effects on the local, state, and national economies. Based on the estimates in the PRBEIS, the drilling of the 9 proposed wells in the Michelena POD will generate approximately 2.5 billion cubic feet of gas (BCFG) per well, over the life of the project. Actual revenue from this amount of gas is difficult to calculate, as there are several variables contributing to the price of gas at any given time. Regardless of the actual dollar amount, the royalties from the gas produced in the Michelena POD would have wide-ranging benefit. The federal government collects 12.5% of the royalties from all federal wells, which helps offset the costs of maintaining the federal agencies that oversee permitting. In addition to generating federal income, approximately 49% of the royalties from the wells would return to the State of Wyoming. This revenue from mineral development has contributed to Wyoming's strong economy for the past several years, allowing for improvements in state funded programs such as infrastructure and education. The development of the project would also provide revenue locally by employing an array of workers, both directly and indirectly. People would be employed to build the roads and project infrastructure, drill the wells, and maintain and monitor the project area. The large pool of individuals employed to work on the project would also have the secondary effect of increased demand for goods and services from nearby communities, primarily those of Gillette and Buffalo.

Currently there are 126 existing CBNG wells with one mile of the Michelena project area. Of the existing wells 100 are non-federal, 16 are State and 10 are federal wells.

Table 3.2 FCPA Mineral and Surface Ownership in acres

	Surface	**Mineral**
BLM	44,416	83,000
Private and State	48,138	14,834

3.3. Topographic Characteristics of Project Area

The Michelena POD is within the Powder River Basin (PRB) which lies within the Missouri Plateau of the northern Great Plains ecological region (Kuchler, 1964; Bailey, 1976). The dominant physiographic character of the uplands is one of a gently rolling prairie occasionally punctuated by prominent, non-eroded buttes and ridges. The entire project area is within the Turner Draw watershed tributary of the Upper Powder River. The Turner Draw watershed lies on both sides of the main stem Upper Powder River with tributaries Kinney Draw on the west side and Taylor Draw on the east side of the river. These

tributaries are immediately adjoined by steeply eroded "draws" and "breaks" (i.e., ridges and canyons) surrounding subordinate ephemeral or intermittent streams in the drainage bottoms, several miles distant from the Powder River main stem. Typical of the Powder River Breaks, many slopes are steep ranging from 15% to more than 25%. Hillsides are terraced, and hilltops are generally at uniform elevations. The Upper Powder River valley within this area has relatively wide (i.e., 1-2 miles), flat floors with terraced floodplains. Elevations within the project area range from 3,500 to 4,200 feet above sea level.

The regional climate is mid-latitude, interior continental, with relatively long, cold winters and relatively short, warm-hot summers and distinct spring and fall shoulder seasons. The summer growing season (frost free) typically ranges from 95-130 days (avg = 120 days) between late May and mid-September, with considerable daily variation and occasional cool periods. On the plains, average daily temperatures typically range from 5-10 (low) and 30-35 (high) degrees Fahrenheit in mid-winter, and between 55-60 (low) and 80-85 (high) degrees Fahrenheit in mid-summer. The regional climate is considered semi-arid, and typically, total annual precipitation ranges from 10-14 inches, with most of that coming as rain between May and September. Snowfall varies from year-to-year, but it is common to have continuous snow cover for a period of 60 days or more in a "normal" winter. Annual prevailing winds are from the southwest, but local conditions vary. Arctic air masses with strong winds commonly occur during the winter months, and air masses from the Gulf of Mexico sometimes influence summer weather conditions.

3.4. Vegetation & Soils

Vegetation within the Michelena POD is predominately sagebrush-steppe and juniper woodlands. However, multiple plant communities are present and can be distinguished on the landscape.

The major vegetation communities in the project area include sagebrush grasslands (65%), cottonwood riparian (20%), and agriculture (15%). Native vegetation in the upland areas include big-sagebrush, blue bunch wheatgrass, needleandthread, threadleaf sedge, and blue gramma. The river bottoms and valley floor are characterized by the presence of riparian gallery forests featuring an overstory of cottonwoods (*Populus sp.*). Willows, salt cedar and Russian olive are also found along the Powder River riparian belt. (Arcadis 2006). Lowland areas along ephemeral stream channels are predominately vegetated by grasses and forbs. Common species include Kentucky bluegrass, western wheatgrass, green needlegrass, and silver sagebrush.

The steep sloped (often 45E-60E) ridges and benches in the “breaks” are typically a shallow clay loam clay with a high sand component, sometimes capped with sandstone outcrops and are usually only sparsely vegetated. Typical shrubby vegetation of these clay/shale ridges include: Wyoming big sagebrush, skunkbush, rabbitbrush (*Chrysothamnus sp.*), saltbush (*Atriplex sp.*), greasewood (*Sarcobatus sp.*), and sometimes various species of juniper (*Juniperus sp.*) (Judd, 1939; Whitman and Hanson, 1939; and Brown, 1971).

Fragile watersheds and highly erodible soils were noted as resource values in the FCPA. The soils vary from primarily loamy to very sandy throughout the Michelena project area. Soils differ with topographic location, slope and elevation. Topsoil depths to be salvaged for reclamation range from 0-4 inches on ridges to 20-60 inches in bottomland. Erosion potential varies from high to moderate depending on the soil type, vegetative cover and slope. Reclamation potential of soils also varies throughout the project area.

The main soil limitations in the project area include: depth to bedrock, low organic matter content, and high erosion potential especially in areas of steep slopes. Many of the soils and landforms of this area present distinct challenges for development. Approximately 11 percent of the area within the boundary of the proposed action contains soil mapping units with a named component identified as having poor reclamation potential and reclamation challenging and possibly unachievable. The proponent planned their project and the BLM made further recommendations during the onsite to avoid those areas where

possible. Disturbances approved within these areas require the programmatic/standard COA's be complimented with a site specific performance based reclamation related COA. Soils within the project area were identified from the *North Johnson County Survey Area, Wyoming (WY719), North Campbell County Survey Area, Wyoming (WY705) and South Campbell County Survey Area, Wyoming (WY605).* The soil survey was performed by the Natural Resource Conservation Service according to National Cooperative Soil Survey standards. Pertinent information for analysis was obtained from the published soil survey and the National Soils Information System (NASIS) database for the area.

3.5. Invasive Species

The following state-listed noxious weeds and/or weed species of concern infestations were discovered by a search of inventory databases on the Wyoming Energy Resource Information Clearinghouse (WERIC) web site (www.weric.info):

- Russian knapweed
- leafy spurge
- salt cedar
- Russian olive

The WERIC database was created cooperatively by the University of Wyoming, BLM and county Weed and Pest offices. Additionally, the operator documented the following weed species during subsequent field investigations:

- Canada thistle

The state-listed noxious weeds are listed in PRB FEIS Table 3-21 (p. 3-104) and the Weed Species of Concern are listed in Table 3-22 (p. 3-105.

3.6. Wildlife

Several resources were consulted to identify wildlife species that may occur in the proposed project area. Resources that were consulted include the wildlife database compiled and managed by the BLM Buffalo Field Office (BFO) wildlife biologists, the PRB FEIS, the Wyoming Game and Fish Department (WGFD) big game and sage-grouse habitat maps, and the Wyoming Natural Diversity Database (WYNDD).

A habitat assessment and wildlife inventory surveys were performed by Arcadis (2006, 2007) and Real West Natural Resource Consulting (RWNRC, 2005). Real West Natural Resource Consulting and Arcadis performed surveys for bald eagles, mountain plover, sharp-tailed grouse, greater sage-grouse, raptor nests, and prairie dog colonies according to Powder River Basin Interagency Working Group (PRBIWG) accepted protocol in 2004, 2005 and 2006. Surveys were conducted for Ute ladies'-tresses orchid by RWNRC in 2004. PRB IWG accepted protocol is available on the CBM Clearinghouse website (www.cbmclearinghouse.info).
A BLM biologist conducted field visits on July 12, 2006 and April 3, 2008. During this time, the biologist reviewed the wildlife survey information for accuracy, evaluated impacts to wildlife resources, and provided project modification recommendations where wildlife issues arose.

Wildlife species common to the habitat types present are identified in the PRB FEIS (pg. 3-114). Species that have been identified in the project area or that have been noted as being of special importance are described below.

3.6.1. Big Game

Big game species expected to be within the project area include elk, mule deer, white-tailed deer, and pronghorn. Pronghorn antelope and mule deer were observed throughout the area. The WGFD has determined that the project area contains Yearlong range for pronghorn antelope, Yearlong and Winter Yearlong range for mule deer, Yearlong range for white-tailed deer, and Yearlong and Parturition range for elk.

Winter-Yearlong use is when a population or a portion of a population of animals makes general use of the documented suitable habitat sites within this range on a year-round basis. During the winter months there is a significant influx of additional animals into the area from other seasonal ranges. **Yearlong** use is when a population of animals makes general use of suitable documented habitat sites within the range on a year round basis. Animals may leave the area under severe conditions. **Parturition Areas** are documented birthing areas commonly used by females. It includes calving areas, fawning areas, and lambing grounds. These areas may be used as nurseries by some big game species.

Populations of pronghorn antelope, mule deer, white-tailed deer and elk within their respective hunt areas are above WGFD objectives. Big game range maps are available in the PRB FEIS (3-119-143), the project file, and from the WGFD.

3.6.1.1. Elk

Elk occurred in the Fortification Creek area historically. Currently there are an estimated 230 elk in the Fortification herd. The WGFD population objective for the herd is 150.

In 1992 a 2.5 year study of the Fortification elk herd was initiated by the WGFD in cooperation with the BLM and area landowners, with the radio collaring of 17 cow elk. Data from this study allowed better delineation of the elk ranges. In 2005, a second study was initiated and 26 elk were collared. These studies indicate high use of ponderosa pine, juniper, and draw habitats by the elk. The 2005 study verified the seasonal ranges identified in the 1990's with 99% of collar locations falling within the yearlong range (BLM 2007). The data collected from both studies document the following elk observations surrounding the project area from 1992-1995 and 2005-2008.

Table 3.3 Individual Elk Observations within 1.0 miles of the Michelena Project Area

Date	Legal location	UTM's (NAD83)	Distance From Project Area
10/19/2005	SESE Sec.20, T51N/R77N	408045E/4914076N	0.6 miles
1/13/2006	NWNW Sec.27, T51N/R77N	410745E/4913504N	1.0 miles
5/15/2008	SESE Sec.27, T51N/R77N	4112070E/4916452N	0.9 miles
6/4/08	SWNE Sec.15, T51N/R77N	411943E/4916747N	0.8 miles
6/5/2008	SWNE Sec.15, T51N/R77N	411923E/49167637N	0.8 miles

Studies of radio telemetered elk from the Fortification Creek herd in the early 1990's showed some elk ranging out of the Fortification Creek area as far north as Montana. More recent studies of radio telemetered elk (26 of a herd roughly 230) from the Fortification Creek herd have shown that some animals (between 15-20% of the collared animals) have been at least seasonally observed east of Wild Horse Creek and the FCPA, on the west side of the Powder River, south along the Kinney Divide, and occasionally as far north as Sonnette, Montana, although the Fortification Creek Planning Area itself remains the core use area for the vast majority of this herd (Laird 2005). Some elk from this population have moved out of the Fortification Creek area and pioneered new, small, local populations in surrounding areas in recent years, although these bands are currently not officially recognized as "herds" by the Wyoming Game and Fish Department. The long distance range use extensions to Montana in the north are probably reflective of relative habitat continuity along the Powder River Breaks. All of these

observations support the fact that elk are a wide ranging species, and will naturally move around to some degree from their core habitat at least seasonally, and in some instances, on a permanent basis (BLM 2006).

Prairie elk herds, such as the Fortification Creek herd, while not uncommon, are somewhat unique in the sense that this type of non-mountainous range does not provide a great deal of security for the animals, and these populations are generally quite vulnerable to disturbance. There are other prairie elk herds in this region (e.g., Tisdale Mtn. portion of the Powder River herd, Pine Ridge herd, Rochelle Hills herd, Custer N.F. herd across the Montana border, etc.), but wherever these prairie elk herds are found they are usually locally prized and often protected by the local and regional residents (BLM, 2006).

As proposed, the Michelena Draw project area encompasses 520 acres of elk Yearlong range and 350 acres of elk Parturition range. The previously developed portion of the Michelena project encompasses an additional 1900 acres and lies outside of designated elk ranges but within the FCPA.

The productivity of a big game herd is often used as an indicator of the overall health and welfare of a population. Relatively high herd productivity is closely associated with good nutritional resources resulting from a desirable forage/range condition, as well as variables such as slope, aspect, elevation, distance to road, distance to shrub cover, and habitat diversity (Sawyer et al. 2007). Blood samples taken from 36 adult cow elk in late March 2008 showed a greater than 90 percent pregnancy rate. Pre-hunt productivity estimates indicate the Fortification Creek herd health is good to excellent (BLM 2007a).

The Fortification Creek elk herd is currently hunted. The herd is subjected to the increased human activity (wells, roads, weeds, and human presence) associated with the energy development that has occurred in the FCPA in the recent past. Road density has been positively correlated with reduced habitat effectiveness (Lyon 1983). The current population of elk in the FCPA is stable and productive. In 2007, WGFD increase the number of hunting licenses (cow/calf licenses increased from 35 to 75). However, license numbers offered are tied directly to available access through private land and the willingness of landowners to allow hunters access. The Fortification Creek elk harvest in 2007 consisted of 15 bulls (13 adult, 2 spikes), 26 cows, and 1 calf for a total of 42 animals harvested (O'Brien 2008). Longer-term trends are tied to forage and habitat availability.
Radio-telemetry studies were conducted on the Fortification Creek elk herd in the early 1990s and in 2005 (BLM 2001a). Results of these studies indicate that the FCPA elk are actively selecting areas away from existing natural gas wells and roads. Radio-collared elk avoided available habitat that was within 1.7 miles of well sites and within 0.5 mile of roads. Based on analyses of road density, topography, and vegetation in combination with radio monitoring, it appears that the FCPA elk are choosing to occupy the WSA and other isolated areas of effective habitat to avoid the current level of mineral development in the area.

Because access to water is an important component of elk habitat, this availability of water could influence trends observed in the elk population. Permitted water wells provide a valuable water source for the herd. The Taylor Draw #2 stock water well, a free flowing well is located approximately 400 feet from the 43-9-5177 B,C,D location proposed under Alternative B. Ground water drawdown from CBNG development could impact these wells. Produced water associated with CBNG development could also increase the available water supply.

3.6.1.2. Mule Deer

The project area is part of the Powder River mule deer herd unit #319. The 2006 population was 52,716 and the 2007 population was estimated at 56,400. The population objective for the Powder River herd unit is 52,000 (WGFD 2007). The mule deer population is above WGFD objective. Winter and Yearlong seasonal ranges as designated by the WGFD are present within the project area.

3.6.1.3. White-tailed Deer

The white-tailed deer herd unit #303 lies through the project area along the banks of the Powder River. This population is not currently WGFD is not managing this population with a population objective. The herd unit provides Yearlong range to white-tailed deer.

3.6.1.4. Pronghorn

Pronghorn antelope within the project area belong to the Gillette herd unit #351. There was a population of 18,530 in 2006, and the 2007 population was estimated at 20,400. The population objective for the Gillette herd unit is 11,000 (WGFD 2007). The pronghorn antelope population is above WGFD objective. The WGFD has designated the entire project area as Winter/Yearlong for pronghorn.

3.6.2. Aquatics

The project area is located within the Turner and Kinney Draws of the Powder River watershed. Turner and Kinney Draws are ephemeral streams, which flow mostly in response to precipitation and snowmelt (RWNRC 2005). The Powder River is a perennial stream. All produced CBNG water will be piped directly to an existing EMITS water treatment facility located in Section 20, Township 51N, Range 77W. Once the water is treated it will be discharged directly into the Powder River or to an existing impoundment located in Section 17, Township 51N, Range 77W.

The Powder River is one of the last free-flowing prairie stream ecosystems left in the United States, with existing flows, turbidity, and water quality within historic ranges. The Powder River supports an intact native fish community including several rare or declining species. These species have evolved life history strategies that allow them to survive in extreme conditions (Hubert 1993). Native fish species include sauger, shovelnose sturgeon, goldeye, plains minnow, sand shiner, flathead chub, river carpsucker, sturgeon chub, western silvery minnow, channel catfish, fathead minnow, longnose dace, mountain sucker, shorthead redhorse, longnose sucker, stonecat, white sucker and others. Six of these are designated by the WGFD as either Native Species Status (NSS) 1, 2, or 3 species. Species in these designations are considered to be species of concern, in need of more immediate management attention, and more likely to be petitioned for listing under the Endangered Species Act.

NSS1 species (sturgeon chub and western silvery minnow) are those that are physically isolated and/or exist at extremely low densities throughout their range, and habitat conditions are declining or vulnerable. NSS2 species (goldeye, shovelnose sturgeon, and sauger) are physically isolated and/or exist at extremely low densities throughout their range, and habitat conditions appear to be stable. NSS3 species (plains minnow) are widely distributed throughout their native range and appear stable; however, habitats are declining or vulnerable. For these species, the WGFD has been directed by the Wyoming Game and Fish Commission to recommend that no loss of habitat function occur. Some modification of the habitat may occur, provided that habitat function is maintained (i.e., the location, essential features, and species supported are unchanged).

The sturgeon chub was petitioned for listing under the Endangered Species Act in 2000. The sturgeon chub is a small minnow native to WY and is known to occur only in the Powder River and in one location on Crazy Woman Creek. The sturgeon chub requires large, free-flowing rivers characterized by swift flows, high variable flow regimes, braided channels, high turbidity, and sand/gravel substrates. On April

18, 2001, the U.S. Fish and Wildlife Service determined that the listing was not warranted, due to the sturgeon chub population being more abundant and better distributed throughout their range than previously believed.

Amphibian and reptile species occur throughout the Basin, but there is little recorded baseline information available about them. Confluence Consulting, Inc. identified the following species present within the Clear Creek and Powder River watersheds: Woodhouse's toad, northern leopard frog, gopher snake, and garter snake (2004). Because sampling at the upper two sites on Clear Creek occurred late in the season, seasonality may have influenced the lack of reptiles and amphibians observed at these sites.

3.6.3. Migratory Birds

A wide variety of migratory birds may be found in the proposed project area at some point throughout the year. Migratory birds are those that migrate for the purpose of breeding and foraging at some point in the calendar year. Many species that are of high management concern use shrub-steppe and shortgrass prairie areas for their primary breeding habitats (Saab and Rich 1997). Migratory bird species of management concern that may occur in the project area are listed in the PRB FEIS (3-151). Species observed by RWNRC, Arcadis, and/or the BLM biologist include western meadowlark, killdeer, mallard duck, blue-winged teal, Canada goose, and bald eagle.

3.6.4. Raptors

Raptors species expected to occur in suitable habitats within the project area include northern harrier, golden eagle, red-tailed hawk, Swainson's hawk, ferruginous hawk, American kestrel, prairie falcon, short-eared owl, great horned owl, bald eagle, rough-legged hawk, merlin, Cooper's hawk, northern goshawk, long-eared owl, and burrowing owl. Most raptor species nest in a variety of habitats including but not limited to; native and non-native grasslands, agricultural lands, live and dead trees, cliff faces, rock outcrops, and tree cavities.

Six raptor nest sites were identified by Arcadis (2007), Big Horn Environmental Consultants (2008) and BLM within 0.5 mile of the project area, of these, 2 nests were active in 2007 and 2008.

Table 3.4 Documented raptor nests within the Michelena POD project area.

BLM ID	Species	UTMs	Legal	Substrate	Year	Status	Condition
3676	Red-tailed Hawk	408975E 4917402N	SESE Sec. 8 T51N/T77W	Cottonwood Tree	2008 2007 2006 2005 2004	Active Active Active Inactive Inactive	Good
3347	Unknown Raptor	409986E 4917930N	NWSE Sec. 9 T51N/R77W	Juniper	2008 2007 2006 2005 2004	Gone Inactive Active Unknown Inactive	Gone
552	Golden Eagle	410143E 4916480N	SWNE Sec. 16 T51N/R77W	Cottonwood Tree	2008 2007 2006 2000	Inactive Active Inactive Active/ Failed	Fair
2028	Red-tailed Hawk	408898E 4914929N	SENE Sec. 20 T51N/R77W	Cottonwood Tree	2008 2007 2006 2004 2003	Active Active Active Active Active	Excellent
4152	Unknown Raptor	409986E 4917930N	NWSE Sec. 9 T51N/R77W	Cottonwood Tree	2008 2007 2006	Inactive Dilapidated	Remnant
6256	Unknown Raptor	408402E 4914465N	SWSE Sec. 20 T51N/R77W	Cottonwood Tree	2008	Inactive	Good

3.6.5. Threatened and Endangered and Sensitive Species

3.6.5.1. Threatened and Endangered Species

Within the BLM Buffalo Field Office there are two species that are Threatened or Endangered under the Endangered Species Act.

3.6.5.1.1. Black-footed ferret

The USFWS listed the black-footed ferret as Endangered on March 11, 1967. Active reintroduction efforts have reestablished populations in Mexico, Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming. In 2004, the WGFD identified six prairie dog complexes (Arvada, Sheridan, Pleasantdale, Four Corners, Linch, Kaycee, and, Thunder Basin National Grasslands) partially or wholly within the BLM Buffalo Field Office administrative area as potential black-footed ferret reintroduction sites (Grenier et al. 2004).

This nocturnal predator is closely associated with prairie dogs, depending almost entirely upon them for its food. The ferret also uses old prairie dog burrows for dens. Current science indicates that a black-footed ferret population requires at least 1,000 acres of black-tailed prairie dog colonies for survival (USFWS 1989).

The WGFD believes the combined effects of poisoning and Sylvatic plague on black-tailed prairie dogs have greatly reduced the likelihood of a black-footed ferret population persisting east of the Big Horn Mountains (Grenier 2003). The U.S. Fish and Wildlife Service has also concluded that black-tailed prairie

dog colonies within Wyoming are unlikely to be inhabited by black-footed ferrets (Kelly 2004).

Arcadis and BLM identified 3 active prairie dog towns within the project area. The towns are located in Sections 4, 9 and 17 as described below in Table 3.5 totaling 125.8 acres in size. See Table 3.5.

One black-tailed prairie dog colony has been identified within 1.5 km (0.9 mile) of the other 3 towns within the project area. This colony is located SE section 16, T51N/R77W and is approximately 16.7 acres. The project area is located approximately 3.5 miles from the Arvada complex, the nearest potential reintroduction area. The prairie dog towns within and surrounding the Michelena POD are of insufficient size to support ferrets; therefore black-footed ferret habitat is not present within the Michelena POD area.

3.6.5.1.2. Ute Ladies'-Tresses Orchid

Ute ladies'-tresses orchid (ULT) is listed as Threatened under the Endangered Species Act. It is extremely rare and occurs in moist, sub-irrigated or seasonally flooded soils at elevations between 1,780 and 6,800 feet above sea level. Habitat includes wet meadows, abandoned stream channels, valley bottoms, gravel bars, and near lakes or perennial streams that become inundated during large precipitation events. Wyoming Natural Diversity Database model predicts undocumented populations may be present particularly within southern Campbell and northern Converse Counties. In Wyoming, ULT blooms from early August to early September, with fruits produced in mid August to September (Fertig 2000).

Prior to 2005, only four orchid populations had been documented within Wyoming. Five additional sites were located in 2005 and one in 2006 (Heidel pers. Comm.). The new locations were in the same drainages as the original populations, with two on the same tributary and within a few miles of an original location. Drainages with documented orchid populations include Wind Creek and Antelope Creek in northern Converse County, Bear Creek in northern Laramie and southern Goshen Counties, Horse Creek in Laramie County, and Niobrara River in Niobrara County.

The project area is located within the Turner and Kinney Draws of the Powder River watershed. Turner and Kinney Draws are ephemeral streams, which flow mostly in response to precipitation and snowmelt (EMATS 2005). The Powder River is a perennial stream. All produced CBNG water will be piped directly to an existing EMITS water treatment facility located in Section 20, Township 51N, Range 77W. Once the water is treated it will be discharged directly into the Powder River or to an existing impoundment located in Section 17, Township 51N, Range 77W. Real West Natural Resource Consulting identified potential ULT habitat within the project area along the sandy and gravel banks of the Powder River however no ULT were observed by RWNRC (2005) or Arcadis (2006) when conducting ULT survey and the likelihood of a viable seed source existing in the local area is low. Black Diamond does not propose surface disturbing activities within the areas of potential habitat. Suitable orchid habitat while present within the Michelena POD project area shall not be impacted by the proposed infrastructure.

3.6.5.2. Sensitive Species

BLM Wyoming has prepared a list of sensitive species to focus species management efforts towards maintaining habitats under a multiple use mandate. Two habitat types – prairie dog colonies and sagebrush ecosystems – are the most common within the Powder River Basin and contain habitat components required in the life cycle of several sensitive species. The species associated with these ecosystems are described below in general terms. Those species within the Powder River Basin that were once listed or candidates for listing under the Endangered Species Act of 1973 and remain BLM Wyoming sensitive species are also described in more detail in this section. The authority for this policy and guidance comes from the Endangered Species Act of 1973, as amended; Title II of the Sikes Act, as amended; the Federal Land Policy and Management Act (FLPMA) of 1976; and the Department Manual 235.1.1A.

3.6.5.2.1. Prairie dog colony obligates

Prairie dog colonies create habitat for many species of wildlife (King 1955, Reading et al. 1989). Agnew (1986) found that bird species diversity and rodent abundance were higher on prairie dog towns than on mixed grass prairie sites. Several studies (Agnew 1986, Clark 1982, Campbell and Clark 1981 and Reading et al. 1989) suggest that species richness increases with colony size and regional colony density. Prairie dog colonies attract many insectivorous and carnivorous birds and mammals because of the concentration of prey species (Clark 1982, Agnew 1986, Agnew 1988).

In South Dakota, forty percent of the wildlife taxa (134 vertebrate species) are associated with prairie dog colonies (Agnew 1983, Apa 1985, McCracken et al. 1985, Agnew 1986, Uresk and Sharps 1986, Deisch et al. 1989). Of those species regularly associated with prairie dog colonies, six are on the Wyoming BLM sensitive species list: swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), and long-billed curlew (*Numenius americanus*). These species were not observed within the project area.

3.6.5.2.2. Sagebrush obligates

Sagebrush ecosystems support a variety of species. Sagebrush obligates are animals that cannot survive without sagebrush and its associated perennial grasses and forbs; in other words, species requiring sagebrush for some part of their life cycle. Sagebrush obligates within the Powder River Basin, listed as sensitive species by BLM Wyoming include greater sage-grouse, Brewer's sparrow, sage thrasher, and sage sparrow. Sage sparrows, Brewer’s sparrows, and sage thrashers all require sagebrush for nesting, with nests typically located within or under the sagebrush canopy. Sage thrashers usually nest in tall dense clumps of sagebrush within areas having some bare ground for foraging. Sage sparrows prefer large continuous stands of sagebrush, and Brewer’s sparrows are associated closely with sagebrush habitats having abundant scattered shrubs and short grass (Paige and Ritter 1999). Other sagebrush obligate species include sagebrush vole, pronghorn antelope, and sagebrush lizard. Species observed by RWNRC, Acadis and BLM include pronghorn antelope.

3.6.5.2.3. Bald Eagle

On February 14, 1978, the bald eagle was federally listed as Endangered. On August 8, 2007, the bald eagle was removed from the Endangered Species list. The bald eagle remains under the protection of the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. In order to avoid violation of these laws and uphold the BLM’s commitment to avoid any future listing of this species, all conservation measures and terms and conditions identified in the Powder River Basin Oil and Gas Project Biological Opinion (WY07F0075) (USFWS 2007) shall continue to be complied with.

Bald eagle nesting habitat is generally found in areas that support large mature trees. Eagles typically will build their nests in the crown of mature trees that are close to a reliable prey source. This species feeds primarily on fish, waterfowl, and carrion. In more arid environments, such as the Powder River Basin, prairie dogs, ground squirrels, and lagomorphs (hares and rabbits) can make up the primary prey base. The diets of wintering bald eagles are often more varied. In addition to prairie dogs, ground squirrels, and lagomorphs, carcasses of domestic sheep and big game may provide a significant food source in some areas. Historically, sheep carcasses from large domestic sheep ranches provided a reliable winter food source within the Powder River Basin (Patterson and Anderson 1985). Today, few large sheep operations remain in the Powder River Basin. Wintering bald eagles may congregate in roosting areas generally made up of several large trees clumped together in stands of large ponderosa pine, along wooded riparian corridors, or in isolated groups. Bald eagles often share these roost sites with golden eagles as well.

The Michelena project area is suitable for bald eagle roosting and nesting habitat. The Powder River, a perennial river with mature cottonwoods, is located less than 0.5 miles west of the proposed wells and infrastructure.

There are no known bald eagle nests within one mile of the Michelena POD. Table 3.5 below show the bald eagle winter roost survey results from 2004 to 2008. The number and frequency of bald eagle during the winter roost season indicates consistent winter use by roosting bald eagle within the Michelena project area. The area supports a variety of prey sources for bald eagles including fish, waterfowl, small mammals, and upland birds.

Table 3.5 2004-2008 Bald Eagle Winter observations within one mile of the Michelena project area.

DATE	TIME	Bald Eagle Total	Location		BEHAVIOR
			UTM East	UTM North	
1/6/2004	15:37	1	409880	4916396	Perched
1/26/2005	PM	1	409538	4916147	Flying
12/22/2005	8:51	1	408048	4914842	Perched
12/5/2006	n/a	1	409232	4920898	Perched
12/5/2006	n/a	1	409671	4916719	Perched
12/5/2006	n/a	2	408576	4914441	Perched
12/12/2006	n/a	2	408132	4914107	Perched
12/18/2006	n/a	2	408664	4918829	Perched
12/26/2006	n/a	1	408790	4918685	Perched
12/26/2006	n/a	1	408909	4915125	Perched
12/26/2006	n/a	1	409781	4916779	Perched
12/26/2006	n/a	2	408814	4914409	Perched
12/27/2006	n/a	1	409448	4916100	Flying
12/27/2006	9:52	1	408411	4914838	Perched
1/4/2007	n/a	1	409198	4915652	Perched
1/4/2007	n/a	1	409551	4916068	Perched
1/5/2007	n/a	2	408073	4916768	Perched
1/12/2007	8:18	1	408711	4914709	Perched
1/12/2007	8:15	1	408987	4914944	Perched
1/12/2007	8:22	1	409168	4917173	Perched
1/12/2007	8:20	1	409800	4915723	Perched
1/13/2007	10:21	1	407117	4913876	Perched
1/13/2007	10:27	1	407154	4917018	Perched
1/16/2007	8:17	1	407594	4913698	Perched
1/16/2007	8:21	1	408644	4918724	Perched
1/16/2007	8:18	1	408993	4914925	Perched
1/16/2007	8:20	1	409842	4916680	Perched
1/16/2007	8:19	2	409754	4915930	Perched
1/23/2007	8:26	1	408638	4917525	Perched
1/23/2007	8:24	1	409211	4917388	Perched
1/23/2007	8:22	1	409790	4915934	Perched
1/23/2007	8:28	2	409094	4920012	Perched

DATE	TIME	Bald Eagle Total	Location		BEHAVIOR
			UTM East	UTM North	
1/29/2007	PM	1	408832	4918569	Perched
1/31/2007	16:53	1	407581	4913478	Perched
1/31/2007	16:54	1	408734	4914586	Perched
1/31/2007	16:55	2	409419	4916145	Perched
2/13/2007	17:08	1	409516	4916874	Perched
2/13/2007	17:08	2	409901	4915447	Perched
2/13/2007	17:08	5	409783	4915658	Perched
2/13/2007	17:06	1	408742	4918583	Perched
2/19/2007	PM	1	408879	4918474	Perched
2/19/2007	PM	1	409138	4917320	Perched
12/3/2007	805	1	408448	4914618	Perched
12/3/2007	800	1	409652	4916789	Perched
12/13/2007	750	1	408415	4914505	Perched
12/13/2007	747	2	408899	4918652	Perched
12/14/2007	807	1	409823	4916826	Perched
12/14/2007	807	1	409917	4915638	Perched
12/14/2007	805	3	408450	4914280	Perched
12/17/2007	748	1	407449	4913692	Perched
12/17/2007	749	1	408831	4915005	Perched
12/17/2007	750	1	408876	4918890	Perched
12/17/2007	750	1	409275	4914934	Perched
12/17/2007	750	1	409537	4916331	Perched
12/17/2007	750	2	409537	4916331	Perched
12/18/2007	n/a	1	408794	4918679	Perched
12/18/2007	n/a	1	409134	4915042	Perched
12/28/2007	n/a	1	408586	4919505	Perched
12/28/2007	n/a	1	408578	4919360	Perched
12/28/2007	n/a	1	408574	4918458	Perched
1/8/2008	n/a	1	408710	4918527	Perched
1/12/2008	920	1	407123	4913910	Perched
1/12/2008	931	1	408129	4919184	Perched
1/12/2008	937	1	408425	4919188	Perched
1/12/2008	940	1	408434	4920018	Perched
2/7/2008	n/a	1	409565	4916204	Perched
2/22/2008	n/a	1	407501	4914582	Perched
2/22/2008	n/a	1	408263	4920748	Perched
2/22/2008	n/a	1	408236	4920748	Perched
12/1/2008	715	1	407685	4913472	Perched
12/1/2008	716	1	408976	4914845	Perched

DATE	TIME	Bald Eagle Total	Location		BEHAVIOR
			UTM East	UTM North	
12/10/2008	1615	1	408625	4918712	Perched
12/10/2008	1615	2	409350	4916774	Perched

3.6.5.2.4. Black-tailed prairie dog

The black-tailed prairie dog was added to the list of Candidate species for federal listing on February 4, 2000 (USFWS 2000). On August 12, 2004, the U.S. Fish and Wildlife Service removed the black-tailed prairie dog's Candidate status. BLM Wyoming considers prairie dogs as a sensitive species and continues to afford this species the protections described in the PRB FEIS. The black-tailed prairie dog is a diurnal rodent inhabiting prairie and desert grasslands of the Great Plains.

Due to human-caused factors, black-tailed prairie dog populations are now highly fragmented, and isolated (Miller 1994). Most colonies are small and subject to potential extirpation due to inbreeding, population fluctuations, and other problems, such as landowner poisoning and disease that affect long term population viability (Primack 1993, Meffe and Carroll 1994, Noss and Cooperrider 1994).

The black-tailed prairie dog is considered common in Wyoming, although its abundance fluctuates with activity levels of Sylvatic plague and the extent of control efforts by landowners. Comparisons between 2001 and 1994 Digital Ortho Quads indicated that black-tailed prairie dog acreage remained stable. However, aerial surveys conducted in 2003 to determine the status of known colonies indicated that a significant portion (approximately 47%) of the prairie dog acreage was impacted by Sylvatic plague and/or control efforts (Grenier 2004).

Arcadis and BLM identified 3 active prairie dog colonies within the project area. The colonies are located in Sections 4, 9 and 17 as described below in Table 3.6 totaling 125.8 acres in size.

Table 3.6 Black-tailed Prairie Dog Colony location within the Michelena POD

	Legal Location	Acres
1	SW Sec. 4, T51N/R77W	6.1
2	SE Sec. 17, T51N/R77W	23.5
3	NE Sec. 9, T51N/R77W	87.8
	Total Acres	**125.8**

3.6.5.2.5. Burrowing owl

The burrowing owl is a small, long-legged owl found throughout open landscapes of North and South America. Burrowing owls can be found in grasslands, rangelands, agricultural areas, deserts, or any dry open area with low vegetation where abandoned burrows dug by mammals such as ground squirrels (*Spermophilus spp*.), prairie dogs (*Cynomys spp.),* and badgers (*Taxidea taxus*) are available. Black-tailed prairie dog colonies provide the primary habitat for burrowing owls (Klute et al. 2003).

The western burrowing owl has declined significantly throughout its North American range. Current population estimates for the United States are not well known but trend data suggest significant declines (McDonald et al. 2004). The last official population estimate placed them at less than 10,000 breeding pairs. The majority of the states within the owl's range have recognized that western burrowing owl populations are declining. It is listed as a sensitive species by the BLM throughout the west and by the USDAFS. Primary threats across the North American range of the burrowing owl are habitat loss and fragmentation primarily due to intensive agricultural and urban development, and habitat degradation due to declines in populations of colonial burrowing mammals (Klute et al. 2003).

Burrowing owl nesting habitat consists of open areas with mammal burrows. Individual burrowing owls have moderate to high site fidelity to breeding areas and even to particular nest burrows (Klute et al. 2003).

The BLM BFO databases and the survey information provided by Arcadis indicate there are no known burrowing owl nests within the project area or within 0.25 mile of the Michelena POD project.

3.6.5.2.6. Grouse

3.6.5.2.6.1. Greater sage-grouse

The greater sage-grouse is listed as a sensitive species by BLM (Wyoming). In recent years, several petitions have been submitted to the USFWS to list greater sage-grouse as Threatened or Endangered. On January 12th, 2005, the USFWS issued a decision that the listing of the greater sage-grouse was "not warranted" following a Status Review. The decision document supporting this outcome noted the need to continue or expand all conservation efforts to conserve sage-grouse. In 2007, the U.S. District Court remanded that decision, stating that the USFWS' decision-making process was flawed and ordered the USFWS to conduct a new Status Review as a result of a lawsuit and questions surrounding the 2005 review (Winmill Decision Case No. CV-06-277-E-BLW, December 2007).

Greater sage-grouse are found in prairie, sagebrush shrublands, other shrublands, wet meadows, and agricultural areas; they depend upon substantial sagebrush stands for nesting and winter survival (BLM 2003). The Michelena project area is suited for sage-grouse breeding, nesting, and wintering grounds. Habitats within the Michelena project area include stands of sagebrush grasslands scattered throughout the project area and have potential to support sage-grouse throughout the year. Draws and tributaries within the project area may provide brood rearing and late summer habitat. The nearest known leks are over four miles west of the project area.

Sagebrush patches in the mid-range canopy cover (15-25%; Connelly et al. 2000) are present throughout the project area. Sections 4, 8, 9, & 20 contain patches of sagebrush and moderate topography. Approximately 16.9 percent of the project area meets seasonal habitat requirements and are large enough to meet the landscape scale requirements of the bird (BLM 2008). Sage-grouse habitat models indicate that the project area contains approximately 730 acres of high quality sage-grouse nesting habitat and 130 acres high quality sage-grouse wintering habitat (Walker et al. 2007). Survey conducted by Arcadis in 2006 failed to identify diagnostic sign i.e. feathers, droppings, or fecal castes in the area. During subsequent onsite inspections in 2006 and 2008 by the BLM biologists, no sage-grouse or sign was observed. BLM records identified 4 sage-grouse leks within 4 miles of the project area. The 4-mile distance was recommended by the State wildlife agencies' ad hoc committee for consideration of oil and gas development effects to nesting habitat (WGFD 2008). These four lek sites are identified below (Table 3.7).

Table 3.7 Sage-grouse leks surrounding the Michelena POD project area.

Lek Name	Legal Location	Occupancy and Activity Status in (year) (Peak Males)	Distance From Project Area
Kinney Draw I	SESE Sec. 4 T51N/R78W	2008 – 15 2007 – 0 2006 – 6 2005 – 36 2004 - 0	4.0 miles

Lek Name	Legal Location	Occupancy and Activity Status in (year) (Peak Males)	Distance From Project Area
Kinney Draw II	NWSW Sec.10 T51N/R78W	2008 – 50 2007 – 68 2006 – 55 2005 – 35 2004 - 7	3.8 miles
Kinney Draw III	SWNW Sec.11 T51N/R78W	2008 – 6 2007 – 10 2006-21	2.9 miles
Nurse Draw	SWNW Sec. 3 T51N/R78W	2008 – 2 2007 – 0 2006-32	3.8 miles

The 2003 PRB EIS significance threshold and population viability assumptions are based on the analysis that sufficient functioning habitat for sage grouse will remain to support population viability within the project area. In early 2008, BFO staff identified, based on the recent studies, sage-grouse protection in the 2003 Powder River Basin Final Environmental Impact Statement (PRB FEIS) and the 1985 Buffalo RMP may not be adequate to protect the species in the Basin.

The BFO has taken several steps to consider the evolving information on impacts to sage-grouse which could result from development activities on federal lands. These steps include:

- February 2008: BFO consolidates research and data to identify high-quality sage-grouse habitat in the basin. BFO, in conjunction with the University of Montana, developed models indicating "high-quality" habitat using topographic and vegetative criteria and habitat selection by radio-collared birds to identify areas with high potential for use by nesting/wintering birds. The models are divided into habitat categories of 1 through 5, with 5 being "excellent" habitat. The 4 and 5 of category habitats are considered "high-quality".

- March, 2008: BFO, Wyoming State Office (WYSO) and WO establish the need for a Resource Management Plan (RMP) approach to evaluate impacts to sage-grouse and habitat; RMP amendment or revision discussed. Decision to begin a RMP revision is approved two years ahead of original schedule.

- May 28, 2008: BFO conducts public meeting to present habitat information developed through research in the Powder River Basin. BFO solicits additional information from the public and interested energy development companies to refine sage-grouse habitat maps. Objective is to establish areas of interim management for sage-grouse to preserve “decision space” during the RMP process.

- August 13, 2008: BFO releases “Guidance for general management actions during BFO Resource Management Plan Revision” and a map identifying the “focus areas”. The guidance contains criteria for any proposed development in focus areas (Appendix 1). For fluid minerals, this guidance includes the following requirement; “The proponent will be asked to demonstrate that the proposal can be managed in a manner that effectively conserves sage-grouse habitats (in focus areas) affected by the proposal.” The guidance also states that “Efforts will be made to assure that the impacts of surface disturbing projects will be consistent with a well pad density of 640 acres.”

Efforts to minimize impacts to high-quality sage-grouse habitats outside the focus areas will be far less restrictive, with well densities up to 80-acre spacing, but may include site-specific mitigating measures suggested by the best available science.

- Concurrent with BFO efforts, on August 1, 2008, the Governor of the State of Wyoming issued an Executive Order (EO 2008-2) mandating special management for all lands within sage-grouse "core population areas." Lands for special management were identified by the Wyoming Governor's Sage-Grouse Implementation Team, and generally follow the boundaries of the majority of the focus areas identified by the BFO. This team also recommended stipulations to be placed on development activities on state lands to ensure existing habitat function is maintained within those areas. EO 2008-2 also identifies objectives outside of core areas, "…development scenarios should be designed and managed to maintain populations, habitats and essential migration routes outside core population areas."

- August 13, 2008 – Present: BFO crafts updated impacts assessment to be included in all project analysis affecting sage-grouse habitat. This analysis includes research conducted in the Powder River Basin and other sage-grouse research published since the 2003 PRB EIS ROD. Analysis explicitly tied impacts to the impacts accepted under the 2003 ROD.

- October 1, 2008: BFO officially begins the RMP revision. This process was accelerated by two years to more rapidly assess impacts to sage-grouse.

- April 14, 2009: BFO/WYSO enters into agreement with University of Montana and the Miles City FO to conduct a population viability analysis in the PRB. Emphasis will be on the adequacy of BFO focus areas for maintenance of a persistent sage-grouse population. Information gathered will be used in developing alternatives for the RMP revision.

- May, 2009: The Wyoming Game and Fish Department releases, " Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats", which further describes management objectives for sage-grouse outside core areas; "Non-core areas should not be construed as "sacrifice areas" since this conservation strategy requires habitat connectivity and movement between populations in core areas. The goal in non-core areas is to maintain habitat conditions that will sustain at least a 50% probability of lek persistence over the long term."

3.6.5.2.6.2. Sharp-tailed grouse

Sharp-tailed grouse inhabit short and mixed-grass prairie, sagebrush shrublands, woodland edges, and river canyons. In Wyoming, this species is found where grasslands are intermixed with shrublands, especially wooded draws, shrubby riparian area, and wet meadows.

The Michelena POD project area has the potential to support sharp-tailed grouse during most of the year. The mosaic of grasslands and sagebrush-grasslands could provide habitat from April through October. Cottonwoods and junipers could provide buds and berries, respectively, to sustain grouse through the winter. There are no known sharp-tailed grouse leks within the project area or 1 mile outside the project boundary.

3.6.5.2.7. Mountain plover

The mountain plover was proposed for listing in 1999 (USFWS). In 2003, the USFWS withdrew a proposal to list the Mountain Plover as a Threatened species, stating that the population was larger than had been thought and was no longer declining. Mountain plovers, which are a BLM sensitive species, are typically associated with high, dry, short grass prairies (BLM 2003). Mountain plover nesting habitat is often associated with heavily grazed areas such as prairie dog colonies and livestock pastures.

Suitable mountain plover habitat is present within the Michelena project area. Arcadis and BLM identified 3 active prairie dog colonies within the project area. The colonies are located in Sections 4, 9 and 17 as described below in Table 3.5 totaling 125.8 acres in size. No mountain plover have been observed in the area during surveys dating back to 2005 (Arcadias 2005)

3.7. West Nile Virus

West Nile virus (WNv) is a mosquito-borne disease that can cause encephalitis or brain infection. Mosquitoes spread this virus after they feed on infected birds and then bite people, other birds, and animals. WNv is not spread by person-to-person contact, and there is no evidence that people can get the virus by handling infected animals.

Since its discovery in 1999 in New York, WNv has become firmly established and spread across the United States. Birds are the natural vector host and serve not only to amplify the virus, but to spread it.

Though less than 1% of mosquitoes are infected with WNv, they still are very effective in transmitting the virus to humans, horses, and wildlife. *Culex tarsalis* appears to be the most common mosquito to vector, WNv.

The human health issues related to WNv are well documented and continue to escalate. Historic data collected by the CDC and published by the USGS at www.westnilemaps.usgs.gov are summarized below. Reported data from the Powder River Basin (PRB) includes Campbell, Sheridan and Johnson counties.

Table 3.8 Historical West Nile Virus Information

Year	Total WY Human Cases	Human Cases PRB	Veterinary Cases PRB	Bird Cases PRB
2001	0	0	0	0
2002	2	0	15	3
2003	392	85	46	25
2004	10	3	3	5
2005	12	4	6	3
2006	65	0	2	2
2007*	155	22	Unk	1
2008*	10	0	0	0

*Wyoming Department of Health Records

Human cases of WNv in Wyoming occur primarily in the late summer or early fall. There is some evidence that the incidence of WNv tapers off over several years after a peak following initial outbreak (Litzel and Mooney, personal conversations). If this is the case, occurrences in Wyoming are likely to increase over the next few years, followed by a gradual decline in the number of reported cases.

Although most of the attention has been focused on human health issues, WNv has had an impact on vertebrate wildlife populations. At a recent conference at the Smithsonian Environmental Research Center, scientists disclosed WNv had been detected in 157 bird species, horses, 16 other mammals, and alligators (Marra et al 2003). In the eastern US, avian populations have incurred very high mortality, particularly crows, jays and related species. Raptor species also appear to be highly susceptible to WNv. During 2003, 36 raptors were documented to have died from WNv in Wyoming including golden eagle, red-tailed hawk, ferruginous hawk, American kestrel, Cooper's hawk, northern goshawk, great-horned owl, prairie falcon, and Swainson's hawk (Cornish et al. 2003). Actual mortality is likely to be greater. Population impacts of WNv on raptors are unknown at present. The Wyoming State Vet Lab determined 22 sage-grouse in one study project (90% of the study birds), succumbed to WNv in the PRB in 2003. While birds infected with WNv have many of the same symptoms as infected humans, they appear to be more sensitive to the virus (Rinkes 2003).

Mosquitoes can potentially breed in any standing water that lasts more than four days. In the Powder River Basin, there is generally increased surface water availability associated with CBNG development. This increase in potential mosquito breeding habitat provides opportunities for mosquito populations to increase. Preliminary research conducted in the Powder River Basin indicates WNv mosquito vectors were notably more abundant on a developed CBNG site than two similar undeveloped sites (Walker et al. 2003). Reducing the population of mosquitoes, especially species that are apparently involved with bird-to-bird transmission of WNv, such as *Culex tarsalis*, can help to reduce or eliminate the presence of virus in a given geographical area (APHIS 2002). The most important step any property owner can take to control such mosquito populations is to remove all potential man-made sources of standing water in which mosquitoes might breed (APHIS 2002).

The most common pesticide treatment is to place larvicidal briquettes in small standing water pools along drainages or every 100 feet along the shoreline of reservoirs and ponds. It is generally accepted that it is not necessary to place the briquettes in the main water body because wave action prevents this environment from being optimum mosquito breeding habitat. Follow-up treatment of adult mosquitoes with malathion may be needed every 3 to 4 days to control adults following application of larvicide (Mooney, personal conversation). These treatment methods seem to be effective when focused on specific target areas, especially near communities, however they have not been applied over large areas nor have they been used to treat a wide range of potential mosquito breeding habitat such as that associated with CBNG development.

The WDEQ and the Wyoming Department of Health sent a letter to CBNG operators on June 30, 2004. The letter encouraged people employed in occupations that require extended periods of outdoor labor, be provided educational material by their employers about WNv to reduce the risk of WNv transmission. The letter encouraged companies to contact either local Weed and Pest Districts or the Wyoming Department of Health for surface water treatment options.

3.8. Water Resources

The project area is within the Turner Draw watershed, tributary to the Upper Powder River system. Taylor Draw and Kinney Draw and the unnamed tributaries of the watershed are ephemeral streams that flow mostly in response to precipitation and snow melt. Mean annual flow and peak stream flow estimates for the WMP were determined using the basin-characteristics method for the plains region as described by Lowham (1998). Annual flow was estimated at 13.52 acre feet per year. Peak stream flow for a 2-year event was calculated to 7.73 cfs per square mile. The area of the Turner watershed is 65.4 square miles. The average annual precipitation for this area is approximately 13 inches, as derived from the studies presented by the USDA, 20-year average for the Arvada, WY rain gauge. More than half of the annual precipitation occurs during the growing season, with April, May and June being wettest months.

3.9. Groundwater

WDEQ water quality parameters for groundwater classifications (Chapter 8 – Quality Standards for Wyoming Groundwater) define the following limits for TDS: 500 mg/l TDS for Drinking Water (Class I), 2000 mg/l for Agricultural Use (Class II) and 5000 mg/l for Livestock Use (Class III).

The ROD includes a Monitoring, Mitigation and Reporting Plan (MMRP). The objective of the plan is to monitor those elements of the analysis where there was limited information available during the preparation of the EIS. The MMRP called for the use of adaptive management where changes could be made based on monitoring data collected during implementation.

Specifically relative to groundwater, the plan identified the following (PRB FEIS ROD page E-4):

- The effects of infiltrated waters on the water quality of existing shallow groundwater aquifers are not well documented at this time;
- Potential impacts will be highly variable depending upon local geologic and hydrologic conditions;
- It may be necessary to conduct investigations at representative sites around the basin to quantify these impacts;
- Provide site specific guidance on the placement and design of CBM impoundments, and;
- Shallow groundwater wells would be installed and monitored where necessary.

The BLM has installed shallow groundwater monitoring wells at five impoundment locations throughout the PRB to assess ground-water quality changes due to infiltration of CBNG produced water. The most intensively monitored site has a battery of nineteen wells which have been installed and monitored jointly by the BLM and USGS since August, 2003. Water quality data has been sampled from these wells on a regular basis. That impoundment lies atop approximately 30 feet of unconsolidated deposits (silts and sands) which overlie non-uniform bedrock on a side ephemeral tributary to Beaver Creek and is approximately one and one-half miles from the Powder River. Baseline investigations showed water in two sand zones, the first was at a depth of 55 feet and the second was at a depth of 110 feet. The two water bearing zones were separated by a fifty-foot thick shale layer. The water quality of the two water bearing zones fell in the WDEQ Class III and Class I classifications respectively. Preliminary results from this sampling indicate increasing levels of TDS and other inorganic constituents over a six month period resulting in changes from the initial WDEQ classifications.

The on-going shallow groundwater impoundment monitoring at four other impoundment locations are less intensive and consist of batteries of between 4 and 6 wells. Preliminary data from two of these other sites also are showing an increasing TDS level as water infiltrates while two other sites are not.

A search of the Wyoming State Engineer Office (WSEO) Ground Water Rights Database for this area showed 24 registered stock and domestic water wells within one mile of the POD boundary with depths ranging from 370 to 940 feet. The Taylor Draw #2 stock water well, a free flowing well is located approximately 400 feet from the 43-9-5177 B,C,D location proposed under Alternative B. Water flow rate from this well was not recorded. Please see Exhibit 1 of the WMP for location of water wells within a one mile radius of the project area. For additional information on water, please refer to the PRB FEIS (January 2003), Chapter 3, Affected Environment pages 3-1 through 3-36 (groundwater).

3.9.1. Surface Water

The project area is within the Turner Draw watershed which is tributary to the Upper Powder River primary watershed. Most of the drainages in the area are ephemeral (flowing only in response to a precipitation event or snow melt) to intermittent (flowing only at certain times of the year when it receives water from alluvial groundwater, springs, or other surface source – PRB FEIS Chapter 9 Glossary). The channels are primarily well vegetated grassy swales, without defined bed and bank.

The PRB FEIS presents the historic mean Electrical Conductivity (EC, in μmhos/cm) and Sodium Adsorption Ratio (SAR) by watershed at selected United States Geological Survey (USGS) Gauging Stations in Table 3-11 (PRB FEIS page 3-49). These water quality parameters "illustrate the variability in ambient EC and SAR in streams within the Michelena POD. The representative stream water quality is used in the impact analysis presented in Chapter 4 as the baseline for evaluating potential impacts to water quality and existing uses from future discharges of CBM produced water of varying chemical composition to surface drainages within the Project Area" (PRB FEIS page 3-48). For the Upper Powder River, the EC ranges from 1,797 at Maximum monthly flow to 3,400 at Low monthly flow and the SAR ranges from 4.76 at Maximum monthly flow to 7.83 at Low monthly flow. These values were determined at the USGS station located at Arvada, Wyoming (PRB FEIS page 3-49).

No natural springs were identified by the operator within a one mile radius of the Michelena POD boundary.

For more information regarding surface water, please refer to the PRB FEIS Chapter 3 Affected Environment pages 3-36 through 3-56.

3.10. Cultural Resources

A previously reviewed and accepted Class III cultural resource inventory (BFO # 70050207) adequately covered the proposed project area. No cultural resources were discovered within the area of potential effect.

3.11. Area of Critical Environmental Concern

In the late 1990's a portion of the FCPA was proposed (through petition) as an Area of Critical Environmental Concern (ACEC). The BLM verified that the proposed ACEC met the relevance and importance criteria in the 2003 Powder River Basin EIS but a final decision on ACEC designation was deferred for future planning analysis. The ROD for that EIS states, "When APDs are received that encompass these areas, mitigation measures will be reevaluated and/or additional site-specific mitigation would be implemented to ensure protection of values for meeting relevance and importance criteria." The closest proposed Michelena well is approximately 3.27 miles from the proposed ACEC.

3.12. Visual Resource Management

The FCSMA is designated as a visual Class III resource. The objective for Class III is to provide for management activities that may contrast with the basic landscape elements, but remain subordinate to the existing landscape character.

Key Observation Point(s) (KOPs) for this project area include the two ranch headquarters along the main access into the project area. The Michelena House is on the west side the Powder River and the original Taylor Ranch house is on the east side of the River. The Powder River Road was considered as a possible KOP but it is an average of 1 ½ miles from the project area, thus the project is not very visible from the county road.

The project area vegetation is mostly sagebrush and grass on the edge of the Powder River Breaks. The terrain is hilly. The three proposed well sites are obscured from view from the KOPs by topographic features. Most roads to the sites are existing. Views from the KOPs toward the project area include power lines, fences, roads, and buildings. These are visible and noticeable but, with the exception of the large power line, not dominant. A couple of the structures are CBNG facilities.

3.13. Recreation

There is no legal public access to any of the POD area. Land owners have allowed limited public access upon request. The Fortification Creek area has been popular with the hunting public because of the limited access and therefore potential for trophy elk and deer.

4. ENVIRONMENTAL CONSEQUENCES

Changes to the proposed action (Alternative B) decreased environmental consequences and resulted in development of Alternative C as the preferred alternative. Therefore consequences of Alternative B are not discussed and only the environmental consequences of Alternative C are described below.

4.1. Minerals

No negative effects to the mineral resource are anticipated from the selection of Alternative C.

4.2. Vegetation & Soils Direct and Indirect Effects

The effects to soils resulting from well pad, access roads and pipeline construction include:

- Mixing of horizons – occurs where construction on roads, pipelines or other activities take place. Mixing may result in removal or relocation of organic matter and nutrients to depths where it would be unavailable for vegetative use. Soils which are more susceptible to wind and water erosion may be moved to the surface. Soil structure may be destroyed, which may impact infiltration rates. Less desirable inorganic compounds such as carbonates, salts or weathered materials may be relocated and have a negative impact on revegetation. This drastically disturbed site may change the ecological integrity of the site and the success of the recommended seed mix.
- Loss of soil vegetation cover, biologic crusts, organic matter and productivity. With expedient reclamation, productivity and stability should be regained in the shortest time frame.
- Soil erosion would also affect soil health and productivity. Erosion rates are site specific and are dependent on soil, climate, topography and cover.
- Soil compaction – the collapse of soil pores results in decreased infiltration and increased erosion potential. Factors affecting compaction include soil texture, moisture, organic matter, clay content and type, pressure exerted, and the number of passes by vehicle traffic or machinery. Compaction may be remediated by plowing or ripping.
- Modification of hill slope hydrology.
- An important component of soils in Wyoming's semiarid rangelands, especially in the Wyoming big sagebrush cover type, are biological soil crusts, or cryptogamic soils that occupy ground area not covered with vascular plants. Biological soil crusts are predominantly composed of cyanobacteria, green and brown algae, mosses and lichens. They are important in maintaining soil stability, controlling erosion, fixing nitrogen, providing nutrients to vascular plants, increasing precipitation infiltration rates, and providing suitable seed beds (BLM 2003). They are adapted to growing in severe climates; however, they take many years to develop (20 to 100) and can be easily disturbed or destroyed by surface disturbances associated with construction activities.

There are road sections that, due to the lack of reclamation potential, the BLM recommended relocating to more desirable locations. Some of the proposed roads follow existing primitive roadways used for ranch access. The following well location and associated access road/corridor in the project area has limited reclamation potential that will require disturbed areas to be stabilized (stabilization efforts may include mulching, matting, soil amendments, etc.) in a manner which eliminates accelerated erosion until a self-perpetuating native plant community has stabilized the site in accordance with the Wyoming Reclamation Policy. Stabilization efforts shall be finished within 30 days of the initiation of construction activities for the following well location and the associated access roads:

- 34-9-5177B,C,D

Impacts to vegetation and soils from surface disturbance will be reduced, by following the operator's plans and BLM applied mitigation. Three locations are proposed with 3 wells at each location. The operator and the BLM agree that no constructed well pads are needed at the 3 proposed locations. Surface disturbance associated with the drilling of the 9 wells would involve digging-out of rig wheel wells (for leveling drill rig on minor slopes), reserve pit construction (estimated approximate size of 25 x 40 feet), and compaction (from vehicles driving/parking at the drill site). Estimated disturbance associated with these 3 well locations would involve approximately 0.5 acre/location for 1.5 total acres.

Approximately 0.85 miles of improved roads would be constructed to provide access to the well locations. Approximately 0.1 miles of new and existing two-track trails would be utilized to access well sites. The proposed pipelines (gas and water) have been located in "disturbance corridors." Disturbance corridors involve the combining of 2 or more utility lines (water, gas, power) in a common trench, usually along access routes. This practice results in less surface disturbance and overall environmental impacts. Approximately 0.78 miles of pipeline would be constructed outside of corridors. Expedient reclamation of disturbed land with stockpiled topsoil, proper seedbed preparation techniques, and appropriate seed

mixes, along with utilization of erosion control measures (e.g., waterbars, water wings, culverts, rip-rap, gabions etc.) would ensure land productivity/stability is regained and maximized.

Proposed stream crossings, including culverts and fords (low water crossings) are shown on the MSUP and the WMP maps (see the POD). These structures would be constructed in accordance with sound, engineering practices and BLM standards.

The PRB FEIS made predictions regarding the potential impact of produced water to the various soil types found throughout the Basin, in addition to physical disturbance effects. "Government soil experts state that SAR values of 13 or more cause potentially irreversible changes to soil structure, especially in clayey soil types, that reduce permeability for infiltration of rainfall and surface water flows, restrict root growth, limit permeability of gases and moisture, and make tillage difficult." (PRB FEIS page 4-144).

Table 4.1 summarizes the proposed surface disturbance.

Table 4.1 - SUMMARY OF DISTURBANCE

Facility	Number of Miles	Factor	Acreage of Disturbance	Duration of Disturbance
Nonconstructed Pad	3	0.5/acre	1.5	Long Term
Gather/Metering Facilities	0	Site Specific	0.0	Long Term
Screw Compressors	0	Site Specific	0.0	Long Term
Monitor Wells	Existing	0.1/acre	0.0	Long Term
Impoundments	1 Existing			Long Term
On-channel	0	Site Specific	0.0	
Off-channel	0	Site Specific	0.0	
Water Discharge Points	1 Existing	Site Specific or	0.0	
Channel Disturbance				
Headcut Mitigation*	0.0	Site Specific	0.0	
Channel Modification	0.0	Site Specific	0.0	
Improved Roads				
No Corridor	0.0		0	Long Term
With Corridor	0.85	50' Width	5.45	
2-Track Roads				Long Term
No Corridor	0.0	15' Width	0	
With Corridor	0.12	40' Width	0.58	
Pipelines				Short Term
No Corridor	0.45	25' Width	1.36	
With Corridor	0.33		1.00	
Buried Power Cable No Corridor	0.0	12' Width or Site Specific	0.0	Short Term
Overhead Powerlines	0.0	15' Width	0.0	Long Term

The designation of the duration of disturbance is defined in the PRB FEIS (pg 4-1 and 4-151). "For this

EIS, short-term effects are defined as occurring during the construction and drilling/completion phases. Long-term effects are caused by construction and operations that would remain longer".

4.2.1. Wetland/Riparian

Effects to wetlands/riparian areas from this federal action are not anticipated. The WMP for the Michelena POD is for storage of CBNG produced water in an off-channel pit, Michelena 002, and discharge of treated water to the Upper Powder River. These facilities are existing and were observed by BLM to be in sound operating condition. The operator has committed to monitoring for impact downstream of the discharge point (DP 42-20) as well as below the impoundment and reports made available to the BLM authorizing officer upon request.

4.3. Wildlife

4.3.1. Big Game Direct and Indirect Effects

Big game in the area including; elk, mule deer, and pronghorn antelope, can be expected to respond in similar fashion. The most important difference between the elk herd and deer or antelope herds is that the elk are an isolated herd, in effect an island population. Under Alternative C, Yearlong and Parturition ranges for elk and pronghorn antelope and Winter/Yearlong range for mule deer, will be directly disturbed by the construction of wells, pipelines, and roads resulting in habitat loss. Table 4.1 summarized the proposed activities associated with the development of the Michelena POD; items identified as long term disturbance would result in direct habitat loss. Short-term disturbances will also result in direct habitat loss as vegetative cover is removed. Short term disturbances may provide some habitat value as these areas are reclaimed and native vegetation becomes established. However, they may also increase vehicular collision when adjacent to roads.

Direct habitat loss occurs when required life-sustaining conditions are lost (i.e., through removal of vegetation or draining a pond). Removal of vegetation affects wildlife by reducing the extent or quality of habitat in terms of food, cover, and structure for nesting and other uses. These impacts are relatively simple to quantify by comparing the amount of habitat lost to the amount preserved. For example, removal of vegetation during construction of a road or well pad essentially strips the affected area of any wildlife value. While closure and reclamation of temporarily disturbed areas can eventually restore lost habitat values, the disturbance may have a long duration (20 or more years for a well) or require years or decades for recovery of predisturbance structure and function (pipeline corridors or reclaimed roads). For the purposes of this analysis the impact of direct habitat loss is dwarfed by effective habitat loss (see below). As a consequence, many of the impacts will be evaluated in terms of effective habitat loss (BLM 2007).

In addition to the direct habitat loss, big game would likely be displaced from the project area during drilling and construction. A study in central Wyoming reported that mineral drilling activities displaced mule deer by more than 0.5 miles (Hiatt and Baker 1981). The WGFD indicates a well density of eight wells per section creates a high level of impact for big game and that avoidance zones around mineral facilities overlap creating contiguous avoidance areas (WGFD 2004). A multi-year study on the Pinedale Anticline suggests not only do mule deer avoid mineral activities, but after three years of drilling activity the deer have not become accustomed to the disturbance (Madson 2005).

Indirect disturbance from human activity is probably the largest potential impact from the proposed action. The PRB FEIS used "habitat effectiveness" (the degree to which habitat features fulfill specific habitat functions; the degree to which a species or population is able to continue using a habitat for a specific function) in an attempt to assess the effect of human disturbance. The BFO modeled effective elk habitat based on 80 acre well distribution (8 wells/section) and 0.5 mile or line-of-sight displacement. Development at this scale resulted in no effective big-game habitat. The development proposed in Alternative C increases the well density to 8 wells/section and will displace elk and mule deer that may preclude their use of effective habitat within the Michelena project area. Anecdotal observations within

Fortification Creek suggest elk displacement from human activities is greater than one half-mile, possibly three-quarters of a mile or greater (Roberts, pers comm.). A desert elk study researching elk response to oil and gas development in the Jack Morrow Hills area of southwestern Wyoming, indicated elk avoided areas within 2 kilometers (1 1/4 miles) of active roads (Powell 2003). According to the study, elk are likely to reoccupy areas with oil and gas development during the production phase but only 50% or less of the original population. Alternative C will result in indirect loss of elk yearlong and calving habitats, pronghorn yearlong range, and mule deer winter/yearlong range.

Big game animals are expected to return to the project area following construction; however, populations will likely be lower than prior to project implementation as the human activities associated with operation and maintenance continue to displace big game. Mule deer are more sensitive to operation and maintenance activities than pronghorn, and, as the Pinedale Anticline study suggests, mule deer do not readily habituate. A study in North Dakota stated "Although the population (mule deer) had over seven years to habituate to oil and gas activities, avoidance of roads and facilities was determined to be long term and chronic" (Lustig 2003). Deer have even been documented to avoid dirt roads that were used only by 4-wheel drive vehicles, trail bikes, and hikers (Jalkotzy et al. 1997).

4.3.2. Habitat Effectiveness

Disturbance from human activity is the largest potential impact from the foreseeable development. The result is a de facto loss of habitat, because avoided areas meet no survival needs. The amount of habitat actually available to wildlife is called effective habitat, and reductions in the amount of effective habitat can greatly exceed any direct habitat loss. Also important is security habitat, a subset of effective habitat, defined as a place to escape from disturbance. Security habitat is typically defined in patches of a minimum size. Effective loss of habitat can occur as a result of habitat modification, habitat fragmentation, disturbance, and interference with movement. These impacts to habitat reduce the ability of the habitat to provide the basic needs of the wildlife in question. Habitat modification, or changes in habitat, are generally less obvious than losses of habitat but can be significant.

Habitat fragmentation is increasingly recognized as an important impact on wildlife. Impacts of habitat fragmentation relate to the loss of large habitat blocks and the increased percentage of "edge" on smaller blocks as compared to larger blocks. Roads can cause habitat fragmentation, and hence loss of effective habitat, because many species exhibit a decline in use of areas adjacent to roads.

Disturbance impacts occur when some type of activity, typically of human origin, causes animals to shift their activity or alter their behavior. Disturbance impacts generally overlap with habitat fragmentation, because many of the more common and important types of fragmentation (i.e., roads) also include increased levels of human activity.

Conversely, some species and populations adapt to disturbance. This effect, called habituation, is very difficult to predict with a species such as elk. Some populations appear to habituate, such as in Yellowstone National Park, and yet others do not and continue to be stressed and move away from human disturbance, as appears to be the case for the Fortification Creek herd. Elk habituate in areas where activity is predictable and non-lethal. Hunted populations show fewer tendencies to habituate, which appears to be the case in Fortification Creek herd (BLM 2007).

Disturbance is a key factor in effective habitat loss, and typically exceeds the more obvious direct habitat loss. For example, Reed et al. (1996) estimated that the effective habitat loss because of roads was 2.5 to 3.5 times as great as actual habitat loss. In the Fortification Creek Area, the behavior of 26 elk collared in 2005 by BLM and WGFD was monitored (BLM 2007a, WGFD 2007a). These elk avoided areas within 1.7 miles of oil, natural gas, and CBNG wells and 0.5 miles of roads. A study in the Jack Morrow Hills reported elk avoidance distances of 1.73 miles from roads and 1.24 miles from oil and gas activity (Powell 2003, Sawyer et al. 2007).

The FEIS states that CBNG development in the Powder River Basin would cause a decrease in habitat effectiveness for elk, which may result in decreased population.

4.3.3. Effects to Elk

Operation and maintenance activities within the POD will increase the traffic on road segments within the FCPA as much as 2 vehicle trips per day on existing roads within designated elk ranges.

Population reductions could result from the impacts described above. If the elk population is reduced too low, then additional adverse impacts to the population could occur. In 2007, BLM modeled the response of the Fortification Creek elk herd to oil and Gas development. This cumulative effects analysis concluded that a population reduction of 10% below the herd objective could compromise the viability of the herd. Small populations are subject to genetic inbreeding, and stochastic events such as fires, severe winter, disease, and drought that make them intrinsically more vulnerable to extinction (Soule 1986). Populations that are isolated, like the Fortification elk herd, are more sensitive to these internal (genetic) and external (stochastic) elements. Although limited, there is some interchange with other elk populations. This interchange is probably sufficient to prevent genetic problems within the Fortification Creek elk herd at the current management objective. If the population drops low enough, then stochastic events could threaten the Fortification Creek herd viability.

Anticipated changes in elk population numbers are difficult, if not impossible, to predict. In addition to elk numbers, useful and measurable metrics include effective habitat and security habitat. BLM has indicated that loss of habitat, effective habitat, or security habitat would serve to evaluate management actions, and these are the metrics used in the present analysis.

4.3.3.1. Cumulative Impacts

Cumulative impacts to wildlife resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). CBNG development on non-Federal mineral estate in the FCPA as well as development on all mineral estate in adjacent areas would result in cumulative impacts to wildlife. Almost all non-Federal mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southwestern third of FCPA. Currently there are approximately 217 producing gas wells on non-Federal mineral estate in the FCPA. Many leases are not fully developed in other parts of the FCPA.

Changes in native vegetation and big-game winter range, and/or other habitat changes would be expected. Increased development, recreational use, and human interaction would have impacts to wildlife regardless of management actions taken in the FCPA. The anticipated increase in recreational use and/or other vehicle-related disturbance offsite, because of continued human population growth, may further add to adverse impacts. The combined impact of smaller-scale impacts may become disproportionately large and result in population declines especially if small-scale impacts accumulate across large areas. .

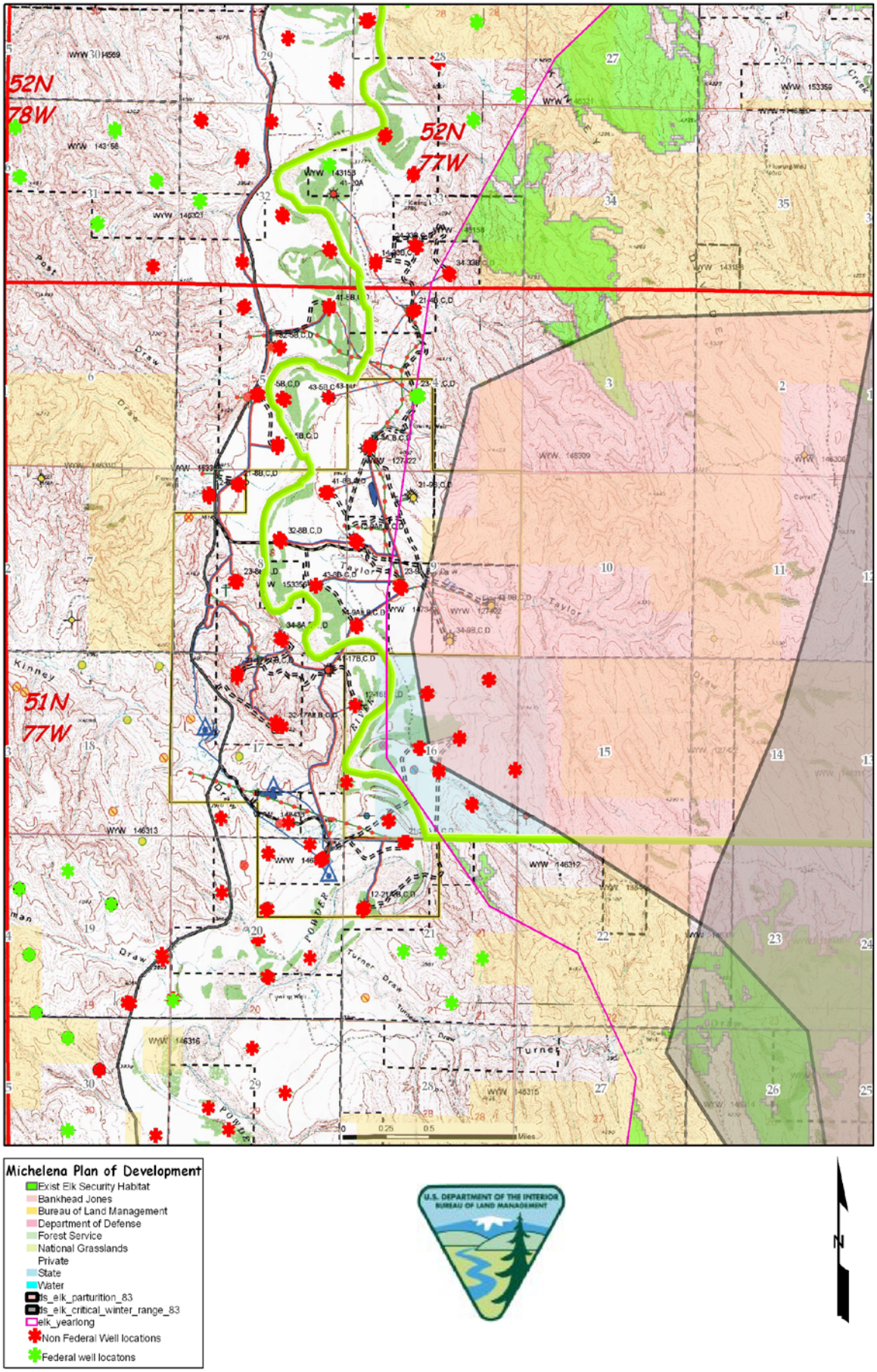
Elk would be impacted by CBNG roads and development on non-Federal mineral estate in the FCPA and all development outside of the FCPA. The impacts of this disturbance would include forcing elk into security habitats within the FCPA, forcing elk to move to other areas possibly as far north as Montana, reduced calving, and mortality.

Winter big game diets are sub-maintenance, meaning they lose weight and body condition as the winter progresses. Survival below the maintenance level requires behavior that emphasizes energy conservation.

Canfield et al. (1999) pointed out that forced activity caused by human disturbance exacts an energetic disadvantage, while inactivity provides an energetic advantage for animals. Geist (1978) further defined effects of human disturbance in terms of increased metabolism, which could result in illness, decreased reproduction, and even death.

Reclamation activities that occur within big game habitats during the spring will likely displace elk cows and calves due to the human presence in the area. This may cause reduced survival rate of cows and calves that must expend increased energies to avoid such activities.

Figure 4.1. Michelena POD in relation to Elk Ranges and Existing Oil & Gas Wells



The Fortification Creek elk herd population, as a whole, has been holding relatively steady to slightly declining and above management objective levels for several years. Determining the reaction of elk in the Fortification Creek area is difficult but based on the results of research focusing on the effects of mineral development to elk,potential cumulative effects of CBNG development to this species will be considered in terms of a likelihood, or probability. For this reason, the following 3 impact scenarios are offered:

Scenario #1 – Mass Abandonment of the Entire Fortification Creek Area (Least probable)

As with most big game species, elk are very traditional animals in the sense of their habitat use and affinities, and once accustomed to a home range and territory, tend to cling closely to it. Therefore, it is unlikely the herd would "pick-up-stakes" in mass, abandon their Fortification Creek home, and move to another area as a result of CBNG activities. Furthermore, even if the herd was so inclined, there are no closely surrounding habitats to move to that are not already occupied, or are not currently being impacted by other CBNG activities. Therefore, this scenario is deemed improbable.

Scenario #2 – Complete Habituation to CBNG Activities (Possible, but unlikely)

Elk are very wary and quite mobile animals (i.e., capable of ranging widely) who do not generally habituate as easily to human presence and activities as deer and antelope. They take "flight" easily whenever a threatening presence is perceived, although they can become accustomed to humans in non-threatening situations. However, hunted populations of elk are very suspicious of humans and nervous, and tend to take "flight" easily. The Fortification Creek herd is hunted, and is "flighty", as has been observed first hand. Recent field observations of elk in the Fortification Creek area have shown these elk to be on the move from as far as ¾ of a mile away as soon as humans are spotted. In this "breaks" type of habitat, the typical elk response is to move to a location placing some topographical barrier (e.g., ridge) between them and the human disturbance. Johnson and Lockman (1979) observed that elk actively avoided oil field development activities in southwestern Wyoming mountain habitats, and Ward (1979), in a study observing heart rates in elk, found increased heart rate activity in elk in close proximity to human traffic on roads. Powell (2003) found active avoidance of oil and gas development activities in the Jack Morrow Hills desert elk herd of southwestern Wyoming. All of the above cited studies involve hunted elk herds, and all of these studies strongly suggest that total habituation of Fortification Creek elk to CBNG development is possible, but unlikely.

Scenario #3 – Reduced Herd Residing in Fortification Creek (Most Probable)

Because of their affinity for the Fortification Creek area and their wary nature, the most probable scenario for elk response to the proposed CBNG development is for the herd to stay in the Fortification Creek area and attempt to avoid the CBNG activities, at least during the development stage. During the peak of development as proposed, road and facility construction and human activity is apt to be taking place on most of the ridges and drainages in the Fortification Creek SMA. The elk population is necessarily expected to be stressed and impacted almost continuously during the development phase. This level of impact will likely ease during the field production phase.

Elk have been shown to avoid disturbance by distances of upwards of 1.25 miles from active oil and gas wells (Gussey 1986; Powell 2003; WGFD 2000), upwards of 2.4 miles from construction of drill sites (Hayden-Wing Associates 1990), and upwards of 1.25 miles from major roads (Powell 2003). Disturbance was also avoided or reduced by topographic visual barriers between the source of disturbance and the elk (Irwin and Gillin 1984; Ward 1986; Olson 1981; Kuck et al. 1985; Van Dyke and Klein 1996). This disturbance is usually temporary in nature, however, and some studies have shown that elk returned to the area of disturbance once the source of disturbance and human presence was gone (Gussey 1986; WGFD 2000), albeit at 50 percent of previous levels in forested environments (Hayden-Wing

Associates 1990). Studies particular to oil and gas activities have shown that elk tolerate some level of operating wells and associated facilities as long as human presence is absent or cover is available in the vicinity of the well site (Gusey 1986; Beak Consultants 1979; Bennington et al. 1982; Hayden-Wing Associates 1990).

Van Dyke and Klein (1996) found that elk showed no shift in home range between the pre and post drilling of a single oil well with all roads closed to other traffic and remote monitoring during sensitive periods (winter and parturition). However, they shifted their use of core areas out of view of the drill pad during both periods, there was increased intensity of use in core areas after drilling, and there was a slightly reduced use of total home range. Van Dyke and Klein concluded that if drilling occupied a relatively small amount of home range, elk were able to compensate by shifting areas of use.

While some habituation may occur over time, regardless, a reduction in the elk population should be expected - possibly as large as 1/3 of the current population. In an attempt to quantify this actual impact to the elk population, the recent and current collared elk studies were examined as a "benchmark reference" for gauging impacts. Of 26 collared elk in the current elk monitoring studies, four (4) of these animals (about 15%) have been observed to routinely venture outside the Fortification Creek area, though most of them (3 of 4 = 75%) seasonally return. Expanded to the whole herd population, we would expect about 35 of the existing 230 head to venture outside the Fortification Creek area, at least occasionally. When monitoring the impacts of development on the elk population, it would be a concern if:

1. the current population trend, about 3% population decrease per year, were to precipitously decline (i.e., rapid rate increase)
2. the overall total herd population were to drop below an estimated 135 animals (about 59% of the current population)
3. the rate of elk ventures outside the Fortification Creek area were to drastically increase above 15% of the herd, and/or …
4. the nature (i.e., longevity) of elk ventures outside the Fortification Creek area were to shift from mostly seasonal to mostly permanent

Another factor must be considered - when populations are reduced to near viability threshold levels, their small size can be an impact in itself. Small populations are subject to genetic inbreeding, and stochastic events such as fires, severe winter, disease, drought, etc. that make them intrinsically more vulnerable to extinction (Soule 1986). Populations that are isolated, like the Fortification elk herd, are more sensitive to these internal (genetic) and external (stochastic) elements. In isolated populations, due to a closed gene pool with no gene immigration, deleterious genes can become more prevalent through time. While gene pool isolation may be a possibility in the Fortification Creek herd, it is currently thought that there is enough interbreeding and genetic interchange with surrounding elk herds that this occurrence is a low likelihood (Jahnke, 2006). Stochastic events such as fires or severe winter storms can remove individuals from populations. In populations that are small in number and isolated, such events are magnified because there are proportionally fewer animals left with no potential for immigration into the population.

From a habitat standpoint, the water drawdown for gas production could conceivably dry up some of the existing springs seeps and/ or free flowing wells in the area that the elk currently depend on as a free water source, thereby degrading the existing habitat. According to the Michelena water management plan and Wyoming State Engineer’s Office 5 free flowing wells exist within ½ mile of the 9 proposed federal CBNG wells. The Rose Pasture well is located SWSW section 4, T51N/R77W ; School Section #1 is located SENW section 16, T51N/R77W and the Taylor Draw #2, #3 & #4 wells are located NESE section 9, T51N/R77W approximately 350 feet west of the 43-9-5177 well location. This particular impact might be off-set by the creation of quality "free-water" sources (e.g., ponds, wells, etc.) for drinking (BLM 2006).

CBNG development fragments habitats through placement of linear facilities such as roads and pipelines. The impacts from fragmentation can vary depending on the use of the feature. For example, a road used daily would displace elk by reducing habitat effectiveness as well as fragmenting habitat. The placement of linear elements can also act as vectors routes for invasive plant species (e.g., Japanese brome and leafy spurge) that can reduce the forage value of the area by out competing native plants, and in the case of brome, increase the potential for wildfire.

Indirect disturbance from human activity is probably the largest potential impact from the proposed action. The PRB FEIS used "habitat effectiveness" - the degree to which habitat features fulfill specific habitat functions; the degree to which a species or population is able to continue using a habitat for a specific function - in an attempt to assess the effect of human disturbance on elk populations. For elk, the habitat effectiveness of areas within 0.5 miles of an active area such as a road or well would be reduced.

In an attempt to quantify the loss, both actual and functional, of crucial elk habitat (i.e., crucial winter range and parturition areas) in the Fortification Creek area resulting from CBNG development, a geographic information system (GIS) model was prepared to portray the physiogeographic and elk habitat data. A couple of key assumptions were used in the development of the model: 1.) the ability of elk to see CBNG development activities within a certain distance (1/2 mile and 1 ¼ mile) resulted in the non-use/lost functionality (i.e., lack of security) of the intervening habitat; 2.) secure elk habitat was defined as those blocks of contiguous habitat >250 acres in size that would be unaffected by CBNG activities; and 3.) the presence of gas field roads and well pads (excluding the WSA) would be the parameter of measurement for development. The analysis was refined to include only areas that were visible from 4 feet above the ground at 5 meter intervals along roads and well pads, instead of a blanket ½ mile buffer. To test a range of development scenarios for the model, a run was made for both a 1 well/ section (i.e., 640 acre) and a 8 well/ section (i.e., 80 acre) surface facility spacing. The following statistics summarize the outcome of the habitat effectiveness analysis:

- Overall crucial elk range (crucial winter range and parturition areas) acreage for the Fortification Creek herd = 71,755 acres.
- Effective habitat at a 1 well/section surface spacing with a ½ mile displacement factor = 41,288 acres (58%). [Effective habitat includes slivers of habitat >250 acres in size]
- Security habitat at a 1 well/section surface spacing with a ½ mile displacement factor = 36,195acres (51%).

Certainly, the CBNG development impact on crucial elk habitat, either through actual habitat loss, or through habitat degradation and fragmentation (i.e., loss of functionality) can be expected. The context of this EA's impact analysis is focused on the effects to the Fortification Creek elk herd, from the implementation of this proposed action. The intensity of this action is based upon assumed response of the Fortification elk herd to the proposed level of CBNG activity. The actual response of the herd to the proposed development is highly uncertain. These assumptions are based on existing studies and GIS analysis. To the best of our knowledge, no actual cause-and-effect studies of the impacts of CBNG development have been conducted on elk in the Powder River Basin. Even with these undefined risk factors, there is a very strong probability the Fortification Creek CBNG development proposals will create a collective level of significant impact on the Fortification Creek elk herd.

Since a large share of the Fortification Creek elk herd occurs within the boundaries of the Fortification Creek evaluation area, and most of this area has not yet experienced CBNG development, the proposed Fortification Creek oil and gas activity will likely set a precedent for future development within delineated elk ranges in the Fortification Creek area.

Approximately 330 acres of critical winter range and 490 acres of yearlong range falls within the Michelena POD. The 2007 Cumulative Effects Analysis did not identify effective elk habitat or elk security habitat within the project area therefore it is not likely that the 9 wells and associated roads and infrastructure will result in a measurable effect on the Fortification Creek elk herd.

Mitigation

A condition of approval has been applied to provide a timing limitation stipulation for elk during calving season within the identified Parturition Range. This should allow elk to calve within the project area without being disturbed human activity during the drilling and construction phase of the development. However this timing limitation stipulation does not apply to the maintenance and monitoring of wells during the calving season. Human disturbance related to maintenance and monitoring during the calving season is likely to displace elk from their maternal calving grounds.

Additionally the operator will be required to submit a monthly work report that in conjunction with monitoring the collared elk will enable elk responses to be evaluated for possible adaptive management alternatives development.

BLM's goal is to minimize impacts to wildlife and their habitat. Through management decisions we become more conscious of the mechanisms driving shifts in wildlife behavior and habitat selection, and further understand the resulting effects of these behavioral shifts on fitness. Consequently, to properly mitigate the impacts of energy development on wildlife we must accrue knowledge of direct and indirect disturbances associated with energy development. These understandings will assist in creating more efficient conservation and management plans while still meeting energy demands. Beginning June 2009, the BLM in conjunction with the University of Wyoming has initiated a study to identify levels of direct and indirect disturbances that influence habitat selection by elk in the Fortification Creek Area (FCA). These findings will be documented in quarterly reports and along with the monthly work reports will facilitate adaptive management to minimize direct and indirect impacts on elk habitat selection.

4.3.4. Aquatics Direct and Indirect Effects

Black Diamond Energy Corporation expects that the initial discharge from the Kennedy, Upper Canyon, and Werner formation will be in the range of 288 gallons per minute (gpm). Water production may be restricted to maintain water balance for the project. Typically water production declines within the first 3 years of production, resulting in a reduction of water discharge within the next five years. It is anticipated that running water will only be seen at discharge points into the reservoir or the Powder River. (EMATS 2005).

Effects to aquatics was analyzed in detail under the 2006 Environmental Assessment WY-070-05-295.

4.3.4.1. Aquatics Cumulative effects

WDEQ is aware of the concerns about the effects of water quality and flows relative to discharge of water directly into the Powder River. They are taking a conservative approach to permitting until more information can be obtained. Long term water quality and flow monitoring, that would be required in the NPDES permit, would ensure that effluent limitations are met. Under permitted conditions, it is not anticipated that existing downstream water uses would be affected.

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, page 4-247.

4.4. Change in Water Quality

Fish and amphibian species have evolved and adapted to existing conditions. Changes in water quality may have detrimental impacts on the native aquatic fauna. Major information gaps for these species

include feeding habits, reproduction, specific habitat preference (pools, riffles, runs, backwaters, side channels, or a combination), and seasonal habitat use, therefore, it is difficult to fully understand how changes in water quality may affect native aquatic fauna.

The WGFD initiated a detailed fish and amphibian survey of the main-stem Powder River in 2004 to determine baseline species composition and distribution in the Basin. In accordance with the PRB FEIS, a monitoring plan was establish by the PRB Interagency Working Group. The plan calls for baseline data collection over a three year period which is intended to provide information relative to the effects upon the aquatic biota of CBNG water.

Changes in the conductivity and sodium absorption ratio may occur as increased flows move sediment from channel bottoms and potentially increase erosion of floodplains. Confluence Consulting, Inc. reported high salinities and electrical conductivities, possibly due to CBNG water, for the Spotted Horse drainage in their report on the Powder River (2004). This report indicated that CBNG discharges could affect native species in the drainage. See Section 3.5.2 of this EA for water quality information associated with this project.

4.5. Change in Water Quantity

Native fauna in the Powder River drainage have evolved and adapted to a dynamic hydrography with high sediment loads. Changes in this flow regime (i.e., perennial flows) may seriously impact native fauna by altering their use of historical habitats for spawning, rearing, and reproduction. Alterations that impact channel morphology is an issue, and may have impacts to the aquatic biota due to changes in sediment loads, loss of habitat, and possible disruption of migration movements due to barriers created by culverts and/or head cuts.

It is difficult to assess, due to limited information, what effects this discharge may have upon the aquatic biota in the Powder River system. The increase in flow resulting from the discharge of project CBNG water would be more noticeable during the late summer months or winter months when the mean monthly flow is smaller than during the remainder of the year. The flow attributable to project produced water is very small relative to storm flows. Peak flow estimates for the river range from 3,560 cfs for a two year storm event to 18,065 cfs for a 100-year storm event. Addition of the produced water would facilitate beneficial uses such as livestock supply and irrigation supply during the late summer and winter months when the naturally occurring flow is diminished.

The volume of water permitted for direct discharge is based upon the water quality effects related to irrigation downstream in Montana. The flow rate is permitted to mimic seasonal highs and lows and adjusted accordingly.

4.5.1. Migratory Birds Direct and Indirect Effects

Disturbance of the habitat types within the project area is likely to impact migratory birds. Native habitats are being lost directly with the construction of wells, roads, and pipelines. Prompt re-vegetation of short-term disturbance areas should reduce habitat loss impacts. Human activities likely displace migratory birds farther than simply the physical habitat disturbance. Drilling and construction noise can be troublesome for songbirds by interfering with the males' ability to attract mates and defend territory, and the ability to recognize calls from conspecifics (BLM 2003).

Habitat fragmentation results in more than just a quantitative loss in the total area of habitat available; the remaining habitat area is also qualitatively altered (Temple and Wilcox 1986). Ingelfinger (2004) identified that the density of breeding Brewer's sparrows declined by 36% and breeding sage sparrows declined by 57% within 100 m of dirt roads within a natural gas field. Effects occurred along roads with light traffic volume (<12 vehicles per day). The increasing density of roads constructed in developing natural gas fields exacerbated the problem creating substantial areas of impact where indirect habitat

losses (displacement) were much greater than the direct physical habitat losses. Reclamation and other CBNG activities that occur in the spring may be detrimental to migratory bird survival.

Those species that are edge-sensitive will be displaced further away from vegetative edges due to increased human activity, causing otherwise suitable habitat to be abandoned. If the interior habitat is at carrying capacity, then birds displaced from the edges will have no place to relocate. One consequence of habitat fragmentation is a geometric increase in the proportion of the remaining habitat that is near edges (Temple 1986). In severely fragmented habitats, all of the remaining habitat may be so close to edges that no interior habitat remains (Temple and Cary 1988). Over time, this will lead to a loss of interior habitat species in favor of edge habitat species. Other migratory bird species that utilize the disturbed areas for nesting may be disrupted by the human activity and nests may be destroyed by equipment.

Migratory bird species within the Powder River Basin nest in the spring and early summer and are vulnerable to the same affects as sage-grouse and raptor species. Though no timing restrictions are typically applied specifically to protect migratory bird breeding or nesting, where sage-grouse or raptor nesting timing limitations are applied, nesting migratory birds are also protected. Where these timing limitations are not applied and migratory bird species are nesting, migratory birds remain vulnerable. Additional direct and indirect effects to migratory birds are discussed in the PRB FEIS (4-231-235).

4.5.1.1. Migratory Birds Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, Page 4-235.

4.5.2. Raptors Direct and Indirect Effects

Human activities in close proximity to active raptor nests may interfere with nest productivity. Romin and Muck (1999) indicate that activities within 0.5 miles of a nest are prone to cause adverse impacts to nesting raptors. If mineral activities occur during nesting, they could be sufficient to cause adult birds to remain away from the nest and their chicks for the duration of the activities. This absence can lead to overheating or chilling of eggs or chicks. Prolonged disturbance can also lead to the abandonment of the nest by the adults. Both actions can result in egg or chick mortality. In addition, routine human activities near these nests can draw increased predator activity to the area and increase nest predation.

The presence of overhead power lines may impact foraging raptors. Raptors forage opportunistically throughout the Powder River Basin. Power poles provide attractive perch sites in areas where mature trees and other natural perches are lacking. From May 2003, through December 28, 2006, Service Law Enforcement salvage records for northeast Wyoming identified that 156 raptors, including 1 bald eagle, 93 golden eagles, 1 unidentified eagle, 27 hawks, 30 owls and 4 unidentified raptors were electrocuted on power poles within the Powder River Basin Oil and Gas Project area (USFWS 2006a). Of the 156 raptors electrocuted 31 were at power poles that are considered new construction (post 1996 construction standards). Additionally, two golden eagles and a Cooper’s hawk were killed in apparent mid span collisions with powerlines (USFWS 2006a). Power lines not constructed to APLIC suggestions pose an electrocution hazard for eagles and other raptors perching on them; the Service has developed additional specifications improving upon the APLIC suggestions. Constructing power lines to the APLIC suggestions and Service standards minimizes but does not eliminate electrocution risk.

To reduce the risk of decreased productivity or nest failure, the BLM BFO requires a one-half mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructure requiring human visitation to be located greater than one-quarter mile from occupied raptor nests.

The BLM database, RWNRC, and Arcadis identified 6 raptor nests within 0.5 miles of the project area. See Table 3.4.

4.5.2.1. Raptors Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, page 4-221.

4.5.3. Threatened and Endangered and Sensitive Species

Potential project effects on Threatened and Endangered Species were analyzed and a summary is provided in Table 4.2 Threatened and Endangered Species potentially affected by the proposed project area are further discussed following the table.

4.5.3.1. Threatened and Endangered Species

Table 4.2 Summary of Threatened and Endangered Species Habitat and Project Effects.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Endangered				
Black-footed ferret (Mustela nigripes)	Black-tailed prairie dog colonies or complexes > 1,000 acres.	NP	NE	Suitable habitat of insufficient size.
Threatened				
Ute ladies'-tresses orchid (Spiranthes diluvialis)	Riparian areas with permanent water	NS	NE	Potential habitat present, infrastructure avoids habitat .

Presence
K Known, documented observation within project area.
S Habitat suitable and species suspected, to occur within the project area.
NS Habitat suitable but species is not suspected to occur within the project area.
NP Habitat not present and species unlikely to occur within the project area.

Project Effects
LAA Likely to adversely affect
NE No Effect.
NLAA May Affect, not likely to adversely effect individuals or habitat.

4.5.3.1.1. Black-Footed Ferret Direct and Indirect Effects

Arcadis and BLM identified 3 active prairie dog colonies within the project area. The colonies are located in Sections 4, 9 and 17 as described below in Table 3.5 totaling 125.8 acres in size. One black-tailed prairie dog colony has been identified within 1.5 km (0.9 mile) of the other 3 towns within the project area.

Because the black-tailed prairie dog colonies within and adjacent to the Michelena POD project area are of insufficient size for supporting ferrets and are isolated from larger prairie dog complexes, implementation of the proposed development will have "***no effect***" on the black-footed ferret.

4.5.3.1.2. Ute Ladies'-Tresses Orchid Direct and Indirect Effects

The Ute ladies'-tresses orchid is threatened by energy developments, noxious weeds, and water developments. Prolonged idle conditions in the absence of disturbance (flooding, grazing, mowing) may

be a threat just as repeated mowing and grazing during flowering may lead to decline (Hazlett 1996, 1997, Heidel 2007). Heavy equipment used in energy development construction could dig up plants. Invasive weeds transplanted by vehicle and foot traffic in habitat could outcompete this fragile species. Restricting work from areas of Ute ladies'-tresses orchid habitat reduces these impacts.

Suitable habitat for Ute ladies'-tresses orchid is present along the Powder River. Real West conducted surveys in 2004 and did not identify orchids. No populations of Ute ladies'-tresses orchid are known within the project area. Wells and infrastructure are proposed in upland areas. The direct discharge of treated water from the EMITS facility may create suitable habitat. Implementation of the proposed coal bed natural gas project should have "*no effect*" on the Ute ladies'- tresses orchid as the project was designed to avoid suitable habitat**.**

4.5.3.2. Sensitive Species Direct and Indirect Effects

BLM will take necessary actions to meet the policies set forth in sensitive species policy (BLM Manual 6840). BLM Manual 6840.22Astates: "The BLM should obtain and use the best available information deemed necessary to evaluate the status of special status species in areas affected by land use plans or other proposed actions and to develop sound conservation practices. Implementation-level planning should consider all site-specific methods and procedures which are needed to bring the species and their habitats to the condition under which the provisions of the ESA are not necessary, current listings under special status species categories are no longer necessary, and future listings under special status species categories would not be necessary."

4.5.3.2.1. Prairie dog colony obligates

Wells, roads, pipelines and other infrastructure associated with energy development constructed within prairie dog colonies will directly remove habitat for prairie dog colony obligate species. Activities that disturb these species could lead to temporary or even long-term or permanent abandonment. Direct loss of species may also occur from vehicle traffic. Continued loss of prairie dog habitat and active prairie dog towns will result in the decline of numerous sensitive species in the short grass prairie ecosystem.

4.5.3.2.2. Sagebrush obligates

Shrubland and grassland birds are declining faster than any other group of species in North America (Knick et al. 2003). In Wyoming, existing oil and gas wells are located primarily in landscapes dominated by sagebrush, causing direct loss of this habitat. Associated road networks, pipelines, and powerline transmission corridors also influence vegetation dynamics by fragmenting habitats or by creating soil conditions facilitating the spread of invasive species (Braun 1998, Gelbard and Belnap 2003). Density of sagebrush-obligate birds within 100 m of roads constructed for natural gas development in Wyoming was 50% lower than at greater distances (Ingelfinger 2001). Increased numbers of corvids and raptors associated with powerlines (Steenhof et al. 1993, Knight and Kawashima 1993, Vander Haegen et al. 2002) increases the potential predation impact on sage-grouse and other sagebrush-breeding birds (Knick et al. 2003)

Fragmentation of shrubsteppe habitat is a major disruption that has consequences for sagebrush-obligate species (Braun et al. 1976; Rotenberry & Wiens 1980a). In fragmented habitats, suitable habitat area remains only as a remnants surrounded by unusable environments (Urban and Shugart 1984; Fahrig & Paloheimo 1988). Populations of sagebrush-obligate species decline because areas of suitable habitat decrease (Temple & Cary 1988), because of lower reproduction, and/or because of higher mortality in remaining habitats (Robinson 1992; Porneluzi et al. 1993). Fragmentation of shrubsteppe has the further

potential to affect the conservation of shrub-obligate species because of the permanence of disturbance (Knick and Rotenberry 1995). Several decades are required to reestablish ecologically functioning mature sagebrush communities. Due to this, sagebrush obligate species may not return even after habitat

reestablishment.

Table 4.3 Summary of Sensitive Species Habitat and Project Effects.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Amphibians				
Northern leopard frog (Rana pipiens)	Beaver ponds, permanent water in plains and foothills	S	MIIH	Additional water will affect existing waterways.
Spotted frog (Ranus pretiosa)	Mountain ponds, sloughs, small streams	NP	NI	Prairie not mountain habitat.
Birds				
Baird's sparrow (Ammodramus bairdii)	Grasslands, weedy fields	S	MIIH	Sagebrush cover will be affected.
Bald eagle (Haliaeetus leucocephalus)	Mature forest cover often within one mile of large water body.	S	MIIH	Project includes overhead power.
Brewer's sparrow (Spizella breweri)	Basin-prairie shrub	S	MIIH	Sagebrush cover will be affected.
Burrowing owl (Athene cunicularia)	Grasslands, basin-prairie shrub	S	MIIH	Prairie dog colony present.
Ferruginous hawk (Buteo regalis)	Basin-prairie shrub, grasslands, rock outcrops	K	MIIH	Active nest present.
Greater sage-grouse (Centrocercus urophasianus)	Basin-prairie shrub, mountain-foothill shrub	K	WIPV	Sagebrush cover will be affected.
Loggerhead shrike (Lanius ludovicianus)	Basin-prairie shrub, mountain-foothill shrub	K	MIIH	Sagebrush cover will be affected.
Long-billed curlew (Numenius americanus)	Grasslands, plains, foothills, wet meadows	NP	NI	Habitat not present.
Mountain plover (Charadrius montanus)	Short-grass prairie with slopes < 5%	NS	MIIH	Habitat is present but the species has not been observed within the project area.
Northern goshawk (Accipiter gentilis)	Conifer and deciduous forests	NP	NI	No forest habitat present.
Peregrine falcon (Falco peregrinus)	cliffs	NP	NI	No nesting habitat present.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Sage sparrow (Amphispiza billneata)	Basin-prairie shrub, mountain-foothill shrub	S	MIIH	Sagebrush cover will be affected.
Sage thrasher (Oreoscoptes montanus)	Basin-prairie shrub, mountain-foothill shrub	S	MIIH	Sagebrush cover will be affected.
Trumpeter swan (Cygnus buccinator)	Lakes, ponds, rivers	S	MIIH	Reservoirs may provide migratory habitat.
White-faced ibis (Plegadis chihi)	Marshes, wet meadows	NP	NI	Permanently wet meadows not present.
Yellow-billed cuckoo (Coccyzus americanus)	Open woodlands, streamside willow and alder groves	NP	NI	Streamside habitats not present
Fish				
Yellowstone cutthroat trout (Oncoryhynchus clarki bouvieri)	Mountain streams and rivers in Tongue River drainage	NP	NI	Outside species range.
Mammals				
Black-tailed prairie dog (Cynomys ludovicianus)	Prairie habitats with deep, firm soils and slopes less than 10 degrees.	K	MIIH	Prairie dog towns will be affected.
Fringed myotis (Myotis thysanodes)	Conifer forests, woodland chaparral, caves and mines	NP	NI	Habitat not present.
Long-eared myotis (Myotis evotis)	Conifer and deciduous forest, caves and mines	NP	NI	Habitat not present.
Spotted bat (Euderma maculatum)	Cliffs over perennial water.	NP	NI	Cliffs & perennial water not present.
Swift fox (Vulpes velox)	Grasslands	NP	NI	Habitat not present.
Townsend's big-eared bat (*Corynorhinus townsendii*)	Caves and mines.	NP	NI	Habitat not present.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Plants				
Porter's sagebrush (Artemisia porteri)	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.	NP	NI	Habitat not present.
William's wafer parsnip (Cymopterus williamsii)	Open ridgetops and upper slopes with exposed limestone outcrops or rockslides, 6000-8300 ft.	NP	NI	Habitat not present.

Presence
K Known, documented observation within project area.
S Habitat suitable and species suspected, to occur within the project area.
NS Habitat suitable but species is not suspected to occur within the project area.
NP Habitat not present and species unlikely to occur within the project area.

Project Effects
NI No Impact.
MIIH May Impact Individuals or Habitat, but will not likely contribute to a trend towards Federal listing or a loss of viability to the population or species.
WIPV Will Impact Individuals or Habitat with a consequence that the action may contribute to a trend towards Federal listing or cause a loss of viability to the population or species.
BI Beneficial Impact

4.5.3.2.3. Bald eagle Direct and Indirect Effects

To reduce the risk of decreased productivity or nest failure, BLM BFO requires a 0.5 mile no surface occupancy radius and a one mile radius timing limitation of all activity during the breeding season around active bald eagle nests. To reduce the risk of disruption to the winter roosting activities of bald eagles, the BLM BFO requires a 0.5 mile no surface occupancy radius and a one mile radius timing limitation of all winter roosts (either communal or consistent use).

The entire project area falls within one mile of the Powder River and is considered suitable winter roosting habitat. The number and frequency of bald eagles during the winter roost surveys, 2004-2008, indicate consistent winter use by roosting bald eagle within the Michelena project area. Gallery forest of cottonwood trees within the projects area provides for roosting areas. Bald eagles are sensitive to human activities and can abandon an area due to the activity. Bald eagle winter roosting timing limitations will apply as appropriate to minimize effects to winter roosting bald eagles.

The Michelena project requires the improvement of 0.9 mile of existing primitive roads to access wells locations. There is no overhead head power proposed for this project. However, there is currently 1 mile of improved road and 2 miles of existing overhead powerlines southeast and southwest of the project area.

There are 5.11 miles of existing overhead three-phase distribution lines within the project area. The wire spacing is likely in compliance with the Avian Power Line Interaction Committee's (2006) suggested practices and with the Service's standards (USFWS 2007); however other features may not be in compliance. There are currently 1.97 miles of improved roads within the project area, with 0.9 miles proposed.

Typically two-tracks and improved project roads pose minimal collision risk. In one year of monitoring road-side carcasses the BLM Buffalo Field Office reported 439 carcasses, 226 along Interstates (51%), 193 along paved highways (44%), 19 along gravel county roads (4%), and 1 along an improved CBNG road (<1%) (Bills 2004). No road-killed eagles were reported; eagles (bald and golden) were observed feeding on 16 of the reported road-side carcasses (<4%). The risk of big-game vehicle-related mortality along CBNG project roads is so insignificant or discountable that when combined with the lack of bald eagle mortalities associated with highway foraging leads to the conclusion that CBNG project roads do not affect bald eagles.

Produced water will be stored in 1 existing reservoir which may attract eagles if reliable prey is present, most likely in the form of waterfowl. The effect of the reservoir on eagles is unknown. The reservoir could prove to be a benefit (e.g. increased food supply) or an adverse effect (e.g. contaminants, proximity of power lines and/or roads to water). Eagle use of reservoirs should be reported to determine the need for any future management.

4.5.3.2.4. Black-tailed prairie dog Direct and Indirect Effects

Arcadis and BLM identified 3 active prairie dog colonies within the project area. The colonies are located in Sections 4, 9 and 17 as described below in Table 3.5 totaling 125.8 acres in size. The operator proposes 0.12 miles of 2-track road with utility corridor and 3 CBM wells on a single location within an active prairie.

Individuals that survive the excavation process but whose burrows were destroyed will be displaced. Dispersal of prairie dogs occurs as single individuals. Prairie dogs prefer to move into an existing colony or one that has been abandoned rather than start a completely new colony. Dispersing prairie dogs have increased stress levels, higher exposure to predators, and are unlikely to be accepted by other colonies if they even encounter one (Hoogland 1995).

Unlike roads and pipelines, the construction and operation of reservoirs will permanently remove habitat. By the time the reservoirs are no longer needed, the reservoirs may become hard-pan, soil that has hardened due to mineral deposits and evaporation. Prairie dogs may be unable to burrow in this type of soil compaction. The presence of a reservoir will limit colony expansion. Well houses and power poles may provide habitats for mammal and avian predators increasing prairie dog predation. Mineral related traffic on the adjacent roads may result in prairie dog road mortalities. During construction of these facilities, there is the possibility that prairie dogs within these colonies may be killed as a direct result of the earth moving equipment. Constant noise and movement of equipment and the destruction of burrows puts considerable stress on the animals and will cause an increase in prairie dog mortalities. During the construction of these facilities individuals are exposed more frequently to predators and have less protective cover.

4.5.3.2.5. Burrowing owl Direct and Indirect Effects

Effects to burrowing owl nesting habitat will be similar to effects to prairie dog colonies.

The dramatic reduction of prairie habitat in the United States has been linked to reduction of burrowing owl populations (Klute et al. 2003). Use of roads and pipeline corridors may increase owl vulnerability to vehicle collision. Overhead power lines provide perch sites for larger raptors that could potentially result in increased burrowing owl predation. CBNG infrastructure such as roads, pipe line corridors, and nearby metering facilities may provide shelter and den sites for ground predators such as skunks and foxes.
The USDAFS Thunder Basin National Grasslands in Campbell County, WY, whom cooperated with the BLM in the creation of the 2003 PRB EIS, recommends a 0.25 mile timing restriction buffer zone for burrowing nest locations during their nesting season (April 15 to August 31). Instruction Memorandum No. 2006-197, directs the field offices to "use the least restrictive stipulations that effectively accomplish the resource objectives or uses." Alteration of the general raptor nest timing limitation (Feb 1 to July 31) to a more specific burrowing owl nesting season timing limitation will effectively reduce the vulnerability of owls to collision while shortening the timing restriction period to four and one half months (See Chapter 3 for breeding, nesting, and migration chronology) from six and one half months and from 0.5 mile to 0.25 mile.

4.5.3.2.6. Grouse

4.5.3.2.6.1. Greater sage-grouse Direct and Indirect Effects

One sage-grouse lek, the Kinney Draw III lek, exists within 3 miles of the project area. See Table 3.6. The proposed action will adversely impact suitable nesting, brood rearing, late summer and winter habitat. Proposed project elements that are anticipated to negatively impact grouse habitat are approximately: 9 CBNG wells on 3 locations, 1.1 miles of new roads, 0.78 miles of utility corridor and increased vehicle traffic on established roads and increased noise from compressor stations. Using 0.6 miles as a distance for impacts (Holloran et al. 2007, Aldridge and Boyce 2007), effective sage-grouse habitat loss will be 844 acres from roads and utility corridors and 2,170 acres from the 3 proposed well locations. These numbers are not additive since each well location has an associated road and power and in many cases wells are closer than 0.6 miles to each other. Therefore, the above numbers over-represent anticipated impacts within the project area if totaled, however since most well locations are within 0.6 miles of each other the entire project area (approximately 2,255 acres within the POD boundaries) can be considered affected.

Based on the best available science, which is summarized below, the proposed action may contribute to the extirpation of the local grouse population however the habitat that exists within the project area does not appear to be utilized by sage grouse. It is possible that sage grouse avoid this habitat due to the disturbance and human activity associated with non-federal CBNG development and/or historic livestock operations (WGFD 2005).

4.5.3.2.6.2. Greater sage-grouse Cumulative Effects

In addition to the direct impacts to sage-grouse habitat that will be created by the federal wells and associated infrastructure the project area does contain existing fee, state, and federal fluid mineral development. The sage-grouse cumulative impact assessment area for this project encompasses a four mile radius from the Kinney Draw I, II, & III and Nurse Draw sage-grouse leks. The 4-mile distance was recommended by the State wildlife agencies' ad hoc committee for consideration of oil and gas development effects to nesting habitat (WGFD 2008). As of December 1, 2008, there are approximately 262 existing wells and associated infrastructure within four miles of the 4 leks - an area of 60.4 square miles. The existing well density is approximately 4.3 wells/section. Due to this level of development there is a strong potential that the population(s) breeding at these leks may become extirpated without the federal development.

None of the proposed wells are within four miles of the 4 leks associated with this project. With the addition of the 270 proposed wells (as of WYOGC update 4/7/09) that are not associated with this proposed action, the well density within four miles of the 4 leks increases to 8.8 wells/section. With approval of alternative C (3 proposed well locations) the well density does not increases because the wells proposed in the Michelena POD are not within 4 mile of the leks.

CBNG is a recent development, with the first well drilled in 1987 (Braun et al. 2002). In February 1998 there were 420 producing wells primarily restricted to eastern Campbell County (BFO 1999). By May 2003 there were 26,718 CBNG wells permitted within the BFO area (WGFD 2004). The PRB FEIS estimated 51,000 additional CBNG wells to be drilled over a ten year period beginning in 2003 (BFO 2003).

The Powder River Basin Oil and Gas Project FEIS (BLM 2003) concluded that "Activities associated with the proposed project would affect sage-grouse in several ways. These effects may include: (1) increased direct mortality (including legal hunting, poaching, and collision with power lines and vehicles); (2) the introduction of new perches for raptors and thus the potential change in rate of predation; (3) direct loss or degradation of habitats; (4) indirect disturbance resulting from human activity (including harassment, displacement, and noise); (5) habitat fragmentation (particularly through construction of roads); and (6) changes in population (pg. 4-257)." The FEIS goes on to state that "implementation of several mitigation measures would reduce the extent of each impact addressed by those measures. Despite these measures, the synergistic effect of several impacts would likely result in a downward trend for the sage-grouse population, and may contribute to the array of cumulative effects that may lead to its federal listing. Local populations may be extirpated in areas of concentrated development, but viability across the Powder River Basin or the entire range of the species is not likely to be compromised (pg. 4-270)."

The Powder River Basin Oil and Gas Project Record of Decision (BLM 2003) included a Mitigation Monitoring and Reporting Plan (MMRP). The uncertainties as to where and at what level development was to proceed as well as the uncertainties associated with the assumptions that were used to predict impacts suggests that one-time determination of impacts that is included in the EIS may not occur as projected. The MMRP helps to continually assess the effects of the project and the adequacy of the mitigation. Such a plan/process provides a mechanism to continuously modify management practices in order to allow development while continuing to protect the environment (E-1)." In other words, development pace and patterns may not occur as predicted, and so the BLM may use the adaptive management process provided for in the BFO RMP.

Impacts from CBNG development are likely to be significant and additive to the long-term impacts afflicting the sage-grouse population (WGFD 2004). Greater sage-grouse habitat is being directly lost with the addition of well sites, roads, pipelines, powerlines, reservoirs and other infrastructure in the

Powder River Basin (WGFD 2005, WGFD 2004). Sage-grouse avoidance of CBNG infrastructure results in even greater indirect habitat loss. In southwestern Wyoming, yearling female greater sage-grouse avoid nesting in areas within 0.6 miles of producing well pads (Holloran et al. 2007), and in southern Alberta, brood-rearing females avoid areas within 0.6 miles of producing wells (Aldridge and Boyce 2007). Doherty et al. (2008) demonstrated that sage-grouse in the Powder River Basin avoided otherwise suitable wintering habitats once they have been developed for energy production, even after timing and lek buffer stipulations had been applied. The WGFD feels a well density of eight wells per section creates a high level of impact for sage-grouse and that sage-grouse avoidance zones around mineral facilities overlap creating contiguous avoidance areas (WGFD 2004). As interpreted by coordinated effort with state fish and wildlife agencies from Montana, Colorado, Utah, South Dakota, North Dakota and Wyoming, (State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development 2008), research indicates that oil or gas development exceeding approximately 1 well pad per square mile with the associated infrastructure, results in calculable impacts on breeding populations, as measured by the number of male sage-grouse attending leks (Holloran 2005, Walker et al. 2007).

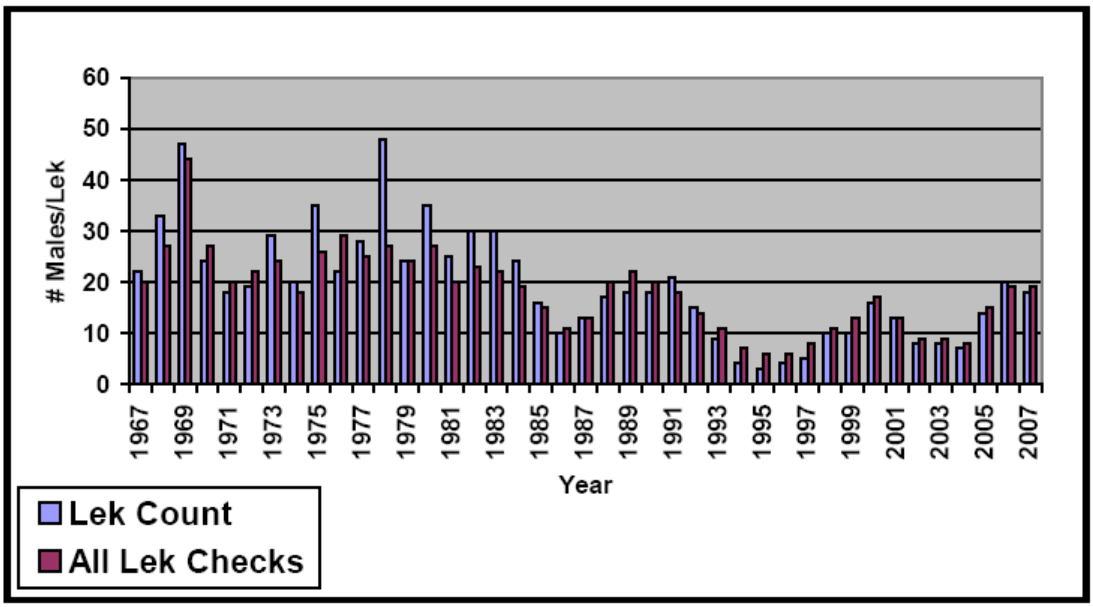
Noise can affect sage-grouse by preventing vocalizations that influence reproduction and other behaviors (WGFD 2003). In a study of greater sage-grouse population response to natural gas field development in western Wyoming, Holloran (2005) concluded that increased noise intensity, associated with active drilling rigs within 5 km (3.1 miles) of leks, negatively influenced male lek attendance. In 2002, Braun et al. documented approximately 200 CBNG facilities within one mile of sage-grouse leks. Sage-grouse numbers were found to be consistently lower for these leks than for leks without this disturbance. Direct habitat losses from the facilities themselves, roads and traffic, and the associated noise were found to be the likely reason for this finding.

Vegetation communities within the Powder River Basin are naturally fragmented, as they represent a transition between the intermountain basin sagebrush communities to the west and the prairie communities to the east. The Powder River Basin is also near the eastern edge of greater sage-grouse range. A sagebrush cover assessment within Wyoming basins estimated sagebrush coverage within the Powder River Basin to be 35% with an average patch size less than 300 acres (Rowland et al. 2005). The Powder River Basin patch size has decreased by more than 63% in the past forty years, from 820 acre patches and an overall coverage of 41% in 1964 (Rowland et al. 2005). The existing development within the cumulative impacts assessment area has further fragmented the sage-grouse habitat. Disturbance created by this project will contribute to additional fragmentation.

Another concern with CBNG development is that reservoirs created for water disposal provide habitat for mosquitoes associated with West Nile virus (WGFD 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse an average of 25% within four populations including the Powder River Basin (Naugle et al. 2004). In northeastern Wyoming and southeastern Montana, West Nile virus-related mortality during the summer resulted in an average decline in annual female survival of 5% from 2003 to 2006 (Walker et al. 2007). Powder River Basin sage-grouse losses during 2004 and 2005 were not as severe. Summer 2003 was warm and dry, more conducive to West Nile virus replication and transmission than the cooler summers of 2004 and 2005 (Cornish pers. comm.).

The sage-grouse population within northeast Wyoming is exhibiting a steady long term downward trend (Figure 1) (WGFD 2005). The figure illustrates a ten-year cycle of periodic highs and lows. Each subsequent population peak is lower than the previous peak. Long-term harvest trends are similar to that of lek attendance (WGFD 2005).

Figure 4.2. Male sage-grouse lek attendance within northeastern Wyoming, 1967-2007.



The BFO Resource Management Plan (BLM 2001) and the Powder River Basin Oil and Gas Project Record of Decision (BLM 2003) include a two-mile timing limitation within sage-grouse nesting habitat. The two-mile measure originated with the Western Association of Fish and Wildlife Agencies (WAFWA) (BLM 2004). BLM Wyoming adopted the two-mile recommendation in 1990 (BLM 1990). The two-mile recommendation was based on early research which indicated between 59 and 87 percent of sage-grouse nests were located within two miles of a lek (BLM 2004). These studies were conducted within prime, contiguous sage-grouse habitat such as Idaho's Snake River plain.

Additional studies, across more of the sage-grouse's range, indicate that many populations nest much farther than two miles from the breeding lek (BLM 2004). Holloran and Anderson (2005), in their Upper Green River Basin study area, reported only 45% of their sage-grouse hens nested within 3 km (1.86 mi) of the capture lek. Moynahan and Lindberg (2004) found only 36% of their grouse nesting within 3 km of the capture lek. Moynahan's study area was north-central Montana in an area of mixed-grass prairie and sagebrush steppe, with Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) being the dominant shrub species (Moynahan et al. 2007). Habitat conditions and sage-grouse biology within the Buffalo Field Office are more similar to Moynahan's north-central Montana study area than the Upper Green River area.

A two-mile timing limitation, given the long-term population decline and that less than 50% of sage-grouse are expected to nest within the limitation area, is insufficient to reverse the population decline. Moynahan and Lindberg (2004) like WAFWA (Connelly et al. 2000), recommend increasing the protective distance around sage-grouse leks. The BLM and University of Montana are currently researching nest location and other sage-grouse questions and relationships between grouse and coalbed natural gas development. Thus far, this research suggests that impacts to leks from energy development are discernable out to a minimum of four miles, and that some leks within this radius have been extirpated as a direct result of energy development (State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development 2008). Even with a timing limitation on construction activities, sage-grouse may avoid nesting within CBNG fields because of the activities associated with operation and production. In a typical landscape in the Powder River Basin, energy development within two miles of leks is projected to reduce the average probability of lek persistence from 87% to 5% percent (Walker et al. 2007).
Walker et al, 2007 indicates the size of a no-development buffer sufficient to protect leks would depend on the amount of suitable habitat around the lek and the population impact deemed acceptable. Also,

rather than limiting mitigation to only timing restrictions, research suggests more effective mitigation strategies include, at a minimum, burying power lines (Connelly et al. 2000 b); minimizing road and well pad construction, vehicle traffic, and industrial noise (Lyon and Anderson 2003, Holloran 2005); and managing produced water to prevent the spread of mosquitoes with the potential to vector West Nile Virus in sage grouse habitat (Walker et al 2007).

The multi-state recommendations presented to the WGFD for identification of core sage grouse areas acknowledges there may be times when development in important sage grouse breeding, summer, and winter habitats cannot be avoided. In those instances they recommend, "…infrastructure should be minimized and the area should be managed in a manner that effectively conserves sagebrush habitats (State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development 2008).

In order to minimize the potential impacts to sage-grouse, condition of approval has been applied to the Michelena POD as timing limitation stipulation for those surface disturbing activities proposed identified within sage-grouse nesting habitat. This affects the following location(s) and infrastructure: **43-9-5177 B,C,D** and all associated access road and utility corridor within the **NESE and NWSE** of this section.

4.5.3.2.6.3. Sharp-tailed grouse Direct and Indirect Effects

Effects similar to sage-grouse.

4.5.3.2.7. Mountain plover Direct and Indirect Effects

Arcadis and BLM identified 3 active prairie dog colonies within the project area. The colonies are located in Sections 4, 9 and 17 as described below in Table 3.5 totaling 125.8 acres in size.

Mineral development has mixed effects on mountain plovers. Disturbed ground, such as buried pipeline corridors and roads, may be attractive to plovers, while human activities within one-quarter mile may be disruptive. To reduce impacts to nesting mountain plovers, the BLM BFO requires a 0.25 mile timing limitation for potential nesting habitat prior to nest survey completion and a 0.25 mile timing limitation for all occupied nesting habitat for the entire nesting season.

Use of roads and pipe line corridors by mountain plovers may increase their vulnerability to vehicle collision. Limiting travel speed to 25mph provides drivers an opportunity to notice and avoid mountain plovers and allows mountain plovers sufficient time to escape from approaching vehicles. Even if a nesting plover flushes in time, the nest likely would still be destroyed. Overhead power lines provide perch sites for raptors that could result in increased mountain plover predation. CBNG infrastructure such as well houses, roads, pipeline corridors, and nearby metering facilities may provide shelter and den sites for ground predators such as skunks and foxes.

Mountain plovers have been forced to seek habitat with similar qualities that may be poor quality habitat when loss or alteration of their natural breeding habitat (predominately prairie dog colonies) occurs, such as heavily grazed land, burned fields, fallow agriculture lands, roads, oil and gas well pads and pipelines. These areas could become reproductive sinks. Adult mountain plovers may breed there, lay eggs and hatch chicks; however, the young may not reach fledging age due to the poor quality of the habitat. Recent analysis of the USWFS Breeding Bird Survey (BBS) data suggests that mountain plover populations have declined at an annual rate of 3.7 % over the last 30 years which represents a cumulative decline of 63% during the last 25 years (Knopf and Rupert 1995). An analysis of direct and indirect impacts to mountain plover due to oil and gas development is included in the PRB FEIS (4-254-255).

4.5.3.3. Sensitive Species Cumulative effects

The cumulative effects associated with Alternative C are within the analysis parameters and impacts described in the PRB FEIS. For details on expected cumulative impacts, please refer to the referenced PRB FEIS, Volume 2, Chapter 4, page 4-271.

4.6. West Nile Virus Direct and Indirect Effects

This project is likely to result in standing surface water which may potentially increase mosquito breeding habitat. BLM has consulted with applicable state agencies, County Weed and Pest and the State Health Department, per above mitigation in the PRB ROD page 18, regarding the disease and the need to treat. BLM has also consulted with the researchers that are studying the dynamics of WNv species and its effects in Wyoming.

There is no evidence that treatment, either through the use of larvicides or malithion, on a site specific or basin-wide scale will have any effect on the overall spread of the disease. The State agencies have not instituted state-wide treatment for mosquitoes due to WNv, nor are they requiring any mitigation specific to permitting for CBM operations.

Cumulatively, there are many sources of standing water, beyond CBM discharge, throughout the PRB that would add to the potential for mosquito habitat. Sources include; natural flows, livestock watering facilities, coal mining operations, and outdoor water use and features in and around communities.

BLM will keep monitoring this issue by continuing to consult with the State agencies and the researchers working in the area in order to stay abreast of the most current developments and any need to apply mitigation.

4.7. Water Resources

The operator has submitted a comprehensive WMP for this project. It is incorporated-by-reference into this EA pursuant to 40 CFR 1502.21. The WMP incorporates sound water management practices, monitoring of downstream impacts within the Upper Powder River and commitment to comply with Wyoming State water laws/regulations. It also addresses potential impacts to the environment and landowner concerns. Qualified hydrologists, in consultation with the BLM, developed the water management plan. Adherence with the plan, in addition to BLM applied mitigation (in the form of COAs), would reduce project area and downstream impacts from proposed water management strategies.

The WDEQ has assumed primacy from United States Environmental Protection Agency for maintaining the water quality in the waters of the state. The WSEO has authority for regulating water rights issues and permitting impoundments for the containment of surface waters of the state.

The maximum water production is predicted under alternative C is 32.0 gpm per well or 288 gpm (0.63cfs or 464 acre-feet per year) for this POD. The PRB FEIS projected the total amount of water that was anticipated to be produced from CBNG development per year (Table 2-8 Projected Amount of Water Produced from CBM Wells Under Alternatives 1, 2A and 2B pg 2-26). For the Upper Powder River drainage, the projected volume produced within the watershed area was 88,046 in 2009 (171,423 acre-feet in 2006 at maximum CBNG production). As such, the volume of water resulting from the production of these 9 wells is 0.5% of the total volume projected for 2009, which will result in an insignificant increase to the present volume of water produced from coal bed natural gas in the Powder River Basin. This volume of produced water is also within the predicted parameters of the PRB FEIS.

4.7.1. Groundwater

The PRB FEIS predicts an infiltration rate of 40% to groundwater aquifers and coal zones in the Upper Powder River drainage area (PRB FEIS pg 4-5). For this action, it may be assumed that a maximum of

115.2 gpm will infiltrate at or near the discharge points and impoundments (184.5 acre feet per year). This water will saturate the near surface alluvium and deeper formations prior to mixing with the groundwater used for stock and domestic purposes. According to the PRB FEIS, "the increased volume of water recharging the underlying aquifers of the Wasatch and Fort Union Formations would be chemically similar to alluvial groundwater." (PRB FEIS pg 4-54). Therefore, the chemical nature and the volume of the discharged water may not degrade the groundwater quality.

The PRB FEIS predicts that one of the environmental consequences of coal bed natural gas production is possible impacts to the groundwater. "The effects of development of CBM on groundwater resources would be seen as a drop in the water level (drawdown) in nearby wells completed in the developed coal aquifers and underlying or overlying sand aquifers." (PRB FEIS page 4-1). In the process of dewatering the coal zone to increase natural gas recovery rates, this project may have some effect on the static water level of wells in the area. The permitted water wells produce from depths which range from 370 to 940 feet compared to 1,216 to 1,790 feet to the Upper Canyon, Kennedy and Werner coal zones. As mitigation, the operator has committed to offer water well agreements to holders of properly permitted domestic and stock wells within the circle of influence of the proposed wells.

Recovery of the coal bed aquifer was predicted in the PRB FEIS to "…resaturate and repressurize the areas that were partially depressurized during operations. The amount of groundwater storage within the coals and sands units above and below the coals is enormous. Almost 750 million acre-feet of recoverable groundwater are stored within the Wasatch - Tongue River sand and coals (PRB FEIS Table 3-5). Redistribution is projected to result in a rapid initial recovery of water levels in the coal. The model projects that this initial recovery period would occur over 25 years." (PRB FEIS page 4-38).

Adherence to the drilling plan, the setting of casing at appropriate depths, following safe remedial procedures in the event of casing failure, and utilizing proper cementing procedures will protect any potential fresh water aquifers above the target coal zone. This will ensure that ground water will not be adversely impacted by well drilling and completion operations.

In order to determine the actual water quality of the producing formations in this POD, and to verify the water analysis submitted for the pre-approval evaluation, the operator has committed to designate a reference well within the POD. The reference well will be sampled at the well head for analysis within sixty days of initial production and a copy of the water analysis will be submitted to the BLM Authorizing Officer.

The WDEQ requires that operators determine initial groundwater quality below impoundments to be used for CBNG produced water storage. If high quality water is detected (Class 3 or better) the operator is required to establish a groundwater monitoring program at those impoundments.

In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ developed a guidance document, "Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments" (June 14, 2004). This guidance document became effective August 1, 2004, and was revised as the "Compliance Monitoring and Siting Requirements for Unlined Coalbed Methane Produced Water Impoundments" which was approved in June, 2006.

The Wyoming DEQ established an Impoundment Task Force which drafted an "Impoundment Monitoring Plan" to investigate the potential for existing impoundments to have impacted shallow groundwater. Drilling at selected existing impoundments began in the spring of 2006.

As of April of 2009, approximately 1,999 impoundment sites had been investigated through over 2,272 borings. Of these impoundments, 277 met the criteria to require "compliance monitoring" if constructed

and used for CBNG water containment. Only 155 impoundments requiring monitoring are presently being used. As of the first quarter of 2009, only 18 of those monitored impoundments caused a change in the "Class of Use" of the underlying aquifer water.

4.7.1.1. Groundwater Cumulative Effects:

As stated in the PRB FEIS, "The aerial extent and magnitude of drawdown effects on coal zone aquifers and overlying and underlying sand units in the Wasatch Formation also would be limited by the discontinuous nature of the different coal zones within the Fort Union Formation and sandstone layers within the Wasatch Formation." (PRB FEIS page 4-64).

Development of CBNG through 2018 (and coal mining through 2033) would remove 4 million acre-feet of groundwater from the coal zone aquifer (PRB FEIS page 4-65). This volume of water "…cumulatively represents 0.5 percent of the recoverable groundwater stored in the Wasatch – Tongue River sands and coals (nearly 750 million acre-feet, from Table 3-5). All of the groundwater projected to be removed during reasonably foreseeable CBNG development and coal mining would represent less than 0.3 percent of the total recoverable groundwater in the Wasatch and Fort Union Formations within the PRB (nearly 1.4 billion acre-feet, from Table 3-5)." (PRB FEIS page 4-65). No additional mitigation is necessary.

4.7.2. Surface Water

The following table shows Wyoming proposed numeric limits for the watershed for SAR, and EC, the average value measured at selected USGS gauging stations at high and low monthly flows, and Wyoming groundwater quality standards for TDS and SAR for Class I to Class III water. It also shows pollutant limits for TDS, SAR and EC detailed in the WDEQ's WYPDES permit, and the levels found in the POD's representative water sample.

Table 4.4 Comparison of Regulated Water Quality Parameters to Predicted Water Quality

Predicted Values	**TDS, mg/l**	**SAR**	**EC,** µmhos/cm
Most Restrictive Proposed Limit –		2.0	1,000
Least Restrictive Proposed Limit		10.0	3,200
Primary Watershed at Arvada, Wyoming Gauging station Historic Data Average at Maximum Flow Historic Data Average at Minimum Flow		 4.76 7.83	 1,797 3,400
WDEQ Quality Standards for Wyoming Groundwater (Chapter 8) Drinking Water (Class I) Agricultural Use (Class II) Livestock Use (Class III)	 500 2,000 5,000	 8	
WDEQ Water Quality Requirement for WYPDES Permit # WYG390013 At discharge point 002 to Michelena 002 off-channel pit WDEQ Water Quality Requirement for WYPDES Permit # WY0051934 At discharge point 001 to the Upper Powder River March - October November - February	 5,000 	 7.0 9.75	 2500 2500
Predicted Produced Water Quality Upper Canyon Coal	 2,200	 28.5	 3,270

Predicted Values	**TDS, mg/l**	**SAR**	**EC,** µmhos/cm
Kennedy Coal	500	9.7	803
Werner Coal	1,980	46.7	2,940

Based on the analysis performed in the PRB FEIS, the primary beneficial use of the surface water in the Powder River Basin is the irrigation of crops (PRB FEIS pg 4-69). The water quality projected for this POD is 2220 mg/l TDS which is not within the WDEQ criteria for agricultural use (2000 mg/l TDS). However direct land application is not included in this proposal. If at any future time the operator entertains the possibility of irrigation or land application with the water produced from these wells, the proposal must be submitted as a sundry notice for separate environmental analysis and approval by the BLM.

The quality for the water produced from the Upper Canyon, Werner and Kennedy target coal zones from these wells is predicted to be similar to the sample water quality collected from locations near the POD. A maximum of 32.0 gallons per minute (gpm) is projected is to be produced from these 9 wells, for a total of 288 gpm for the POD. See Table 4.5.

For more information, please refer to the WMP included in this POD.

There is 1 existing discharge point for this project. The water management strategy and associated infrastructure was analyzed in detail under the 2006 environmental assessment WY-070-05-295.

To manage the produced water, one existing impoundment (14.3 acre feet) will receive CBNG produced water within the project area. There will be no additional surface disturbance associated with water management control structures for this project. The off-channel impoundments would result in evaporation and infiltration of CBNG water. Criteria identified in "Off-Channel, Unlined CBNG Produced Water Pit Siting Guidelines for the Powder River Basin, Wyoming" (WDEQ, 2002) will be used to locate these impoundments. Monitoring may be required based upon WYDEQ findings relative to "Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments" (June 14, 2004). The existing impoundment has been upgraded to meet the requirements of the WSEO, WDEQ and the needs of the operator and the landowner. All water management facilities were evaluated for compliance with best management practices during the onsite.

The PRB FEIS assumes that 15% of the impounded water will re-surface as channel flow (PRB FEIS pg 4-74). Consequently, the volume of water produced from these wells may result in the addition of 0.1cfs below the lowest reservoir (after infiltration and evapotranspiration losses) if the entire produced volume was impounded. The operator has committed to monitor the condition of channels and address any problems resulting from discharge. Discharge from the impoundments will potentially allow for streambed enhancement through wetland-riparian species establishment. Sedimentation will occur in the impoundments, but would be controlled through a concerted monitoring and maintenance program. Phased reclamation plans for the impoundments will be submitted and approved on a site-specific, case-by-case basis as they are no longer needed for disposal of CBNG water, as required by BLM applied COAs.

Alternative (2A), the approved alternative in the Record of Decision for the PRB FEIS, states that the peak production of water discharged to the surface will occur in 2006 at a total contribution to the mainstem of the Upper Powder River of 68 cfs (PRB FEIS pg 4-86). The predicted maximum discharge rate from these 9 wells is anticipated to be a total of 288 gpm or 0.63 cfs to one impoundment and the Upper Powder River. The majority of the produced water will be treated and discharged to the Upper Powder River adding a maximum 0.63 cfs to the Upper Powder River flows, or 0.9% of the predicted total maximum CBNG produced water contribution. The addition of the water produced from these wells

will not significantly impact the water quantity in the mainstem of the Upper Powder River. For more information regarding the maximum predicted water impacts resulting from the discharge of produced water, see Table 4-6 (PRB-FEIS pg 4-85).

In the WMP portion of the POD, the operator provided an analysis of the potential development in the watershed above the project area (WMP page 4). Based on the area of the Turner Draw watershed above the Michelena POD (65.4 sq mi) and an assumed density of 3 wells per location every 80 acres, the potential exists for the development of 800 wells which could produce a maximum flow rate of 19,200 gpm (42.7 cfs) of water. The BLM agrees with the operator that this is not expected to occur because:

1. Some of these wells have already been drilled and are producing.
2. New wells will be phased in over several years, and
3. A decline in well discharge generally occurs after several months of operation.

The potential maximum flow rate of produced water within the watershed upstream of the project area, 42.7 cfs, is much less than the volume of runoff estimated from the 2-year storm event for (506 cfs) of the Turner Draw drainage. Therefore, the estimated flow rate of water produced from the full development in the watershed above the project area is significantly less than the natural runoff from the area.

The proposed method for surface discharge at discharge point 002 provides passive treatment through the aeration supplied by the energy dissipation configuration at each discharge point outfall. Aeration adds dissolved oxygen to the produced water which can oxidize susceptible ions, which may then precipitate. This is particularly true for dissolved iron. Because iron is one of the key parameters for monitoring water quality, the precipitation of iron oxide near the discharge point will improve water quality at downstream locations.

The operator has obtained a Wyoming Pollutant Discharge Elimination System (WYPDES) permit for the discharge of water produced to the Michelena 002 off-channel pit from the WDEQ.

Permit effluent limits were set for discharge 002 at (WYPDES WYG309913 page 3):

Total Petroleum Hydrocarbons	10 mg/l max
pH	6.5 to 8.5
TDS	5000 mg/l max
Sulfates	3000 mg/l max
Radium 226	60 pCi/l max
Total Arsenic	20µg/l max
Chlorides	2000 mg/l

The WYPDES permit also addresses existing downstream concerns, such as irrigation use, in the COA for the permit. The designated point of compliance identified for this permit is discharge point 002.

The proposed method for surface discharge at discharge point 001 provides active treatment at a EMITS water treatment facility. EMITS is designed to remove susceptible ions from the produced water to improve the water quality to meet WYDEQ requirements for irrigation.

The operator has obtained a Wyoming Pollutant Discharge Elimination System (WYPDES) permit for the discharge of treated water to the main stem Upper Powder River from the WDEQ.

Permit effluent limits were set for discharge point 001 at (WYPDES WY0051934 page 2):

pH	6.5 to 8.5
TDS	5000 mg/l max
Specific Conductance	2500 µmhos/cm max
Sulfates	3000 mg/l max
Radium 226	1 pCi/l max
Dissolved iron	299.7 µg/l max
Total Barium	1800 µg/l max
Total Arsenic	7 µg/l max
Chlorides	150 mg/l
Total Flow (Million Gallons per Day)	12.97 MGD (20 cfs)

The WYPDES permit also addresses existing downstream concerns, such as irrigation use, in the COA for the permit. The designated point of compliance identified for this permit is discharge point 001.

In order to determine the actual water quality of the producing formations in this POD and to verify the water analysis submitted for the pre-approval evaluation, the operator has committed to designate a reference well to each coal zone within the POD boundary. The reference well will be sampled at the wellhead for analysis within sixty days of initial production. A copy of the water analysis will be submitted to the BLM Authorized Officer.

As stated previously, the operator has committed to offer water well agreements to properly permitted domestic and stock water wells within the circle of influence of the proposed CBNG wells.

In-channel downstream impacts are addressed in the WMP for the Michelena POD prepared by EMITS Inc. for Black Diamond Energy, Inc.

4.7.2.1. Surface Water Cumulative Effects

The analysis in this section includes cumulative data from Fee, State and Federal CBNG development in the Upper Powder River watershed. These data were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC).

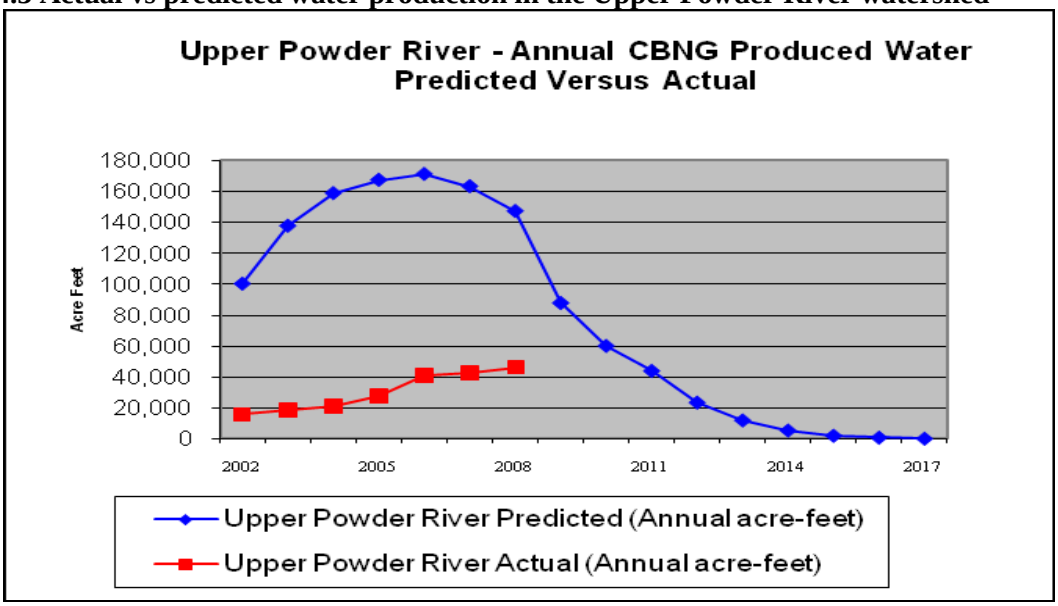
As of December 2007, all producing CBNG wells in the Upper Powder River watershed have discharged a cumulative volume of 45,936 acre-ft of water compared to the predicted 212,522 acre-ft disclosed in the PRB FEIS (Table 2-8 page 2-26). These figures are presented graphically in Figure 4.3 and Table 4.5 following. This volume is 20. 3% of the total predicted produced water analyzed in the PRB FEIS for the Upper Powder River watershed.

Table 4.5 Actual vs predicted water production in the Upper Powder River watershed *2007 Data Update 3-08-08*

Year	Upper Powder River Predicted (Annual acre-feet)	Upper Powder River Predicted (Cumulative acre-feet from 2002)	Upper Powder River Actual (Annual acre-feet)		Upper Powder River Actual (Cumulative acre-feet from 2002)	
			A-ft	% of Predicted	A-Ft	% of Predicted
2002	100,512	100,512	15,846	15.8	15,846	15.8

Year	Upper Powder River Predicted (Annual acre-feet)	Upper Powder River Predicted (Cumulative acre-feet from 2002)	Upper Powder River Actual (Annual acre-feet)		Upper Powder River Actual (Cumulative acre-feet from 2002)	
			A-ft	% of Predicted	A-Ft	% of Predicted
2003	137,942	238,454	18,578	13.5	34,424	14.4
2004	159,034	397,488	20,991	13.2	55,414	13.9
2005	167,608	565,096	27,640	16.5	83,054	14.7
2006	171,423	736,519	40,930	23.9	123,984	16.8
2007	163,521	900,040	42,112	25.8	166,096	18.5
2008	147,481	1,047,521	45,936	31.1	212,522	20.3
2009	88,046	1,135,567				
2010	60,319	1,195,886				
2011	44,169	1,240,055				
2012	23,697	1,263,752				
2013	12,169	1,275,921				
2014	5,672	1,281,593				
2015	2,242	1,283,835				
2016	1,032	1,284,867				
2017	366	1,285,233				
Total	**1,285,233**		**166,096**			

Figure 4.3 Actual vs predicted water production in the Upper Powder River watershed



The PRB FEIS identified downstream irrigation water quality as the primary issue for CBNG produced water. Electrical Conductivity (EC) and SAR are the parameters of concern for suitability of irrigation

water. The water quality analysis in the PRB FEIS was conducted using produced water quality data, where available, from–existing wells within each of the ten primary watersheds in the Powder River Basin. These predictions of EC and SAR can only be reevaluated when additional water quality sampling is available.

The PRB FEIS states, "Cumulative effects to the suitability for irrigation of the Powder River would be minimized through the interim Memorandum of Cooperation (MOC) that the Montana and Wyoming DEQ's (Departments of Environmental Quality) have signed. This MOC was developed to ensure that designated uses downstream in Montana would be protected while CBM development in both states continued. However, this MOC has expired and has not been renewed. The EPA has approved the Montana Surface Water Standards for EC and SAR and as such the WDEQ is responsible for ensuring that the Montana standards are met at the state line under the Clean Water Act (CWA). Thus, through the implementation of in-stream monitoring and adaptive management, water quality standards and interstate agreements can be met." (PRB FEIS page 4-117)

As referenced above, the PRB FEIS did disclose that cumulative impacts may occur as a result of discharged produced CBNG water. The cumulative effects relative to this project are within the analysis parameters and impacts described in the PRB FEIS for the following reasons:

1. They are proportional to the actual amount of cumulatively produced water in the Upper Powder River drainage, which is approximately 20.3% of the total predicted in the PRB FEIS.
2. The WDEQ enforcement of the terms and conditions of the WYPDES permit that are designed to protect irrigation downstream.
3. The commitment by the operator to monitor the volume of water discharged.

No additional mitigation measures are required.

Refer to the PRB FEIS, Volume 2, page 4-115 – 117 and table 4-13 for cumulative effects relative to the Upper Powder River watershed and page 117 for cumulative effects common to all sub-watersheds.

4.8. Cultural Resources

No historic properties will be impacted by the proposed project. Following the Wyoming State Protocol Section VI(A)(1) the Bureau of Land Management electronically notified the Wyoming State Historic Preservation Officer (SHPO) on 12/15/2008, that no historic properties exist within the Area of Project Effect. If any cultural values [sites, artifacts, human remains (Appendix L PRB FEIS)] are observed during operation of this lease/permit/right-of-way, they will be left intact and the Buffalo Field Manager notified. Further discovery procedures are explained in the Standard COA (General)(A)(1).

4.9. Recreation

There is no legal public access to any of the POD area. Land owners have allowed limited public access upon request. The Fortification Creek area has been popular with the hunting public because of the limited access and because it is one of the few large land blocks available within the Powder River Basin. CBNG development is changing the rural undeveloped nature of the Basin to a rural industrial setting, decreasing the satisfaction levels of many hunters and other recreationists. One permitted outfitter with the BLM Buffalo Field Office returned his 2005 permit due to client dissatisfaction with hunting in natural gas fields. Other outfitters have also made similar comments and discussed returning their permits.

Drilling and construction activities are the most disruptive to big game and hunters. Construction noise and activity displaces big game and competes with the solitude and primitive experience many hunters seek. Elk, mule deer, and pronghorn are expected to return to the project area following drilling and construction, however in lower numbers than before; metering and maintenance activities will likely continue to displace big game, particularly elk and mule deer. The hunting experience is expected to

improve somewhat following construction, but the solitude and primitive experiences prior to development would not. The end result is likely to be long term decreased hunting activity in the area.

Conflicts between different recreation users and CBNG activities may increase. With the increased roads and access, illegal offroad vehicle use and trespass are likely to increase. The CBNG activity may also pose as a danger to recreation users due to heavy machinery on the roads.

4.10. Visual Resource Management

The 3 well locations are not visible from the Powder River Road. The locations will require only minor rig leveling to drill, and should be visible only during drilling, enhancement, or work-overs.
There are no significant VRM concerns with the project. The project, as proposed, meets the Class III objective. Additional mitigation measures include using color to camouflage the installations and blend the structures into the landscape background. The color, Covert Green, has been chosen for all above-ground facilities.

Most above-ground facilities will be at least partially obscured by topographic features, the angle of observation is low so surface disturbance will not be very visible, access roads are mostly existing roads, pipelines not using existing roads would re-vegetate in approximately 2 – 3 years. The project is a far enough distance from the KOPs to appear small. The scale of the project features, compared to the backdrop of the Powder River Breaks, is small, recovery time is short (as long as an acceptable mix of appropriate veg species is included in the seed mix).

4.11. Wilderness Characteristics

Wilderness characteristics will not be affected by the proposed development as there is a 5.6 mile distance between the proposed development and the Wilderness Study Area. The distance between this proposed development and the WSA will avoid visual impacts. The project is not visible from the WSA. Impacts to elk from this project are not anticipated to decrease elk use or numbers within the WSA.

4.12. Area of Critical Environmental Concern

The proposed wells are located on private surface. There will be no direct impact from these wells on the proposed ACEC which is approximately 3 miles from the nearest well. The distance between this proposed development and the proposed ACEC should mitigate any visual impacts. The project will not be visible from the proposed ACEC. The other characteristics that met the relevance and importance criteria that may be affected are the elk herd and wilderness quality. Impacts to elk from this project are not anticipated to decrease elk use or numbers within the proposed ACEC.

5. CONSULTATION/COORDINATION

Contact	Title	Organization	Present at Onsite
Mary Hopkins	Wyoming State Historic Preservation Officer	Wyoming SHPO	No

6. OTHER PERMITS REQUIRED

A number of other permits are required from Wyoming State and other Federal agencies. These permits are identified in Table A-1 in the PRB FEIS Record of Decision.

7. REFERENCES AND AUTHORITIES

Agnew, W. D. 1983. Flora and Fauna Associated with Prairie Dog Ecosystems. Unpublished thesis. Colorado State University, Fort Collins. 47pp.

Agnew, W. D. 1988. Arthropod Consumption by Small Mammals on Prairie Dog Colonies and Adjacent Ungrazed Mixed-grass Prairie in Western South Dakota. Eighth Great Plains Wildlife Damage Control Workshop Proceedings. USDA Forest Service General Technical Report RM 154. pgs. 81-87.

Agnew, W., D. W. Uresk. and R. M. Mansen. 1986. Flora and Fauna Associated with Prairie Dog Colonies and Adjacent Ungrazed Mixed-grass Prairie in Western South Dakota. Journal of Range Management 39, pgs 135-139

AHPIS, Animal and Plant Health Inspection Service. 2002. General information available online at http://www.aphis.usda.gov/lpa/issues/wnv/wnv.html.

Aldridge, C. L., and M. S. Boyce. 2007. Linking occurrence and fitness to persistence: a habitat-based approach for endangered greater sage-grouse. Ecological Applications 17:508-526.

Apa, A. D. 1985. Efficiency of Two Black-tailed Prairie Dog Rodenticides and Their Impacts on Non-target Bird Species. Unpublished thesis, South Dakota State University Brookings. 71pp.

Arcasis, 2006. Michelena Plan of Development (POD) Wildlife Report.

Avian Power Line Interaction Committee (APLIC) 2006. R. Harness, contributing author to: Suggested Practices for Avian Protection on Power Lines: State of the Art in 2006. 207pp.

Bills, Thomas E. 2004. Powder River Basin Oil & Gas Project Semi-Annual Report: May 1, 2003 – October 31, 2003. BLM Buffalo Field Office. Buffalo, WY. 8pp.

Big Horn Environmental Consultants. 2007. Augusta Unit – Zeta POD Wildlife Survey and Habitat Report. Sheridan, WY. 11pp.

Big Horn Environmental Consultants. 2008. Augusta Unit – Zeta POD Wildlife Survey and Habitat Report. Sheridan, WY. 11pp.

Braun C. E. 1998. Sage-grouse declines in western North America: what are the problems? Proceedings of the Western Association of State Fish and Wildlife Agencies. 67:134–144.

Braun C. E., M. F. Baker, R. L. Eng, J. S. Gashwiler, and M. H. Schroeder. 1976. Conservation committee report on effects of alteration of sagebrush communities on the associated avifauna. Wilson Bulletin. 88:165–171.

Braun, C.E., O.O. Oedekoven, and C.L. Aldridge. 2002. Oil and Gas Development in Western north America: Effects on Sagebrush Steppe Avifauna with Particular Emphasis on Sage Grouse. In: Transactions of the 67th North American Wildlife and Natural Resources Conference. pp337-349.

Bromley, M. 1985. Wildlife Management Implications of Petroleum Exploration and Development in Wildland Environments. General Technical Report INT-191. USDA Forest Service – Intermountain Research Station. Ogden, Utah.

Bureau of Land Management. 2004. Instruction Memorandum No. WY-2005-057: Statement of Policy Regarding Sage-Grouse Management Definitions, and Use of Protective Stipulations, and Conditions of Approval. Bureau of Land Management, Wyoming State Office. Cheyenne, WY.

Bureau of Land Management. 2006. Cumulative Effects Analysis (An Evaluation) Fortification Creek Area of Special Management Consideration. Buffalo Field Office. Buffalo, Wyoming.

Bureau of Land Management. 2006. Jack Morrow Hills Coordinated Activity Plan Final EIS. Rock Spring Field Office. Rock Springs, Wyoming.

Bureau of Land Management. 2008. Fact Sheet Greater Sage-Grouse Buffalo Field Office RMP Amendment. May 28, 2008

Bureau of Land Management. 1990. Instruction Memorandum No. WY-90-564: Resource Management Plan Action and Wyoming BLM Standard Mitigation Guidelines for Surface Disturbing Activities. Bureau of Land Management, Wyoming State Office. Cheyenne, WY.

Campbell, Thomas and Tim Clark. 1981. Colony Characteristics and Vertebrate Associates of White-tailed and Black-tailed Prairie Dogs. American Midland Naturalist, Vol. 105, No. 2 (April 1981). pgs 269-276.

Canfield, J. E., L. J. Lyon, J. M. Hillis, and M. J. Thompson. 1999. Ungulates. Chapter 6 in Effects of Recreation on Rocky Mountain Wildlife: A Review for Montana, coordinated by G. Joslin and H. Youmans. Committee on Effects of Recreation on Wildlife, Montana Chapter of The Wildlife Society.

Clark, T. W., T. M. Campbell, D. G. Socha, and D. E. Casey. 1982. Prairie Dog Colony attributes and Associated Vertebrate Species. Great Basin Naturalist 42: 572-582.

Code of Federal Regulations (CFR)
40 CFR All Parts and Sections inclusive Protection of Environment. Revised as of July 1, 2004.
43 CFR All Parts and Sections inclusive - Public Lands: Interior. Revised as of October 1, 2006.

Confluence Consulting, Inc. 2004. Powder River Biological Survey and Implications for Coalbed Methane Development. Bozeman, MT. 179pp.

Connelly, J. W., M. A. Schroeder, A. R. Sands, and C. E. Braun. 2000. Guidelines for management of sage grouse populations and habitats. Wildlife Society Bulletin 28:967-985.

Connelly, J. W., S. T. Knick, M. A. Schroeder, and S. J. Stiver. 2004. Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats. Western Association of Fish and Wildlife Agencies. Unpublished Report. Cheyenne, Wyoming.

Cornish, Todd; Terry Creekmore; Walter Cook; and Elizabeth Williams. 2003. "West Nile Virus - Wildlife Mortality in Wyoming 2002-2003". In: The Wildlife Society Wyoming Chapter Program and Abstracts for the Annual Meeting at the Inn in Lander, WY November 18-21, 2003. Wildlife Society Wyoming Chapter. 17pp.

Cornish, Todd. Personal Communication. Wyoming State Veterinary Laboratory, University of Wyoming. Laramie, WY. (307) 742-6638. tcornish@uwyo.edu.

Dantzker, M. S., Deane, G. B. & Bradbury, J. W. 1999. Directional acoustic radiation in the strut display of male sage grouse Centrocercus urophasianus. Journal of Experimental Biology, 202, 2893–2909.

Danvir, Rick E. 2002. Sage Grouse Ecology and Management in Northern Utah Sagebrush-Steppe: A Deseret Land and Livestock Wildlife Research Report. Deseret Land and Livestock Ranch and the Utah Foundation for Quality Resource Management. Woodruff, UT.

Deisch, M. S., D. W. Uresk, and R. L. Lindor. 1989. Effects of Two Prairie Dog Rodenticides on Ground Dwelling Invertebrates in Western South Dakota. Ninth Great Plains Wildlife Damage Control Workshop Proceedings. USDA Forest Service General Technical Report RM. Pgs 171-181.

Dobkin D. S. 1994. Conservation and management of Neotropical migrant landbirds in the northern Rockies and Great Plains. University of Idaho Press, Moscow, ID.

Doherty, K.E., D.E. Naugle, B.L. Walker, J.M. Graham. 2008. Greater sage-grouse winter habitat selection and energy development. Journal of Wildlife Management. In press.

Fahrig, L., and J. Paloheimo. 1988. Determinations of local population size in patchy habitats. Theorectical Population Biology 34:194-213.

Fertig, W. 2000. Status Review of the Ute Ladies Tresses (Spiranthes diluvialis) in Wyoming. Wyoming Natural Diversity Database, Laramie, Wyoming.

Geist, V. 1978. Behavior. Big Game of North America; ecology and management. Stackpole Books, Harrisburg, Pennsylvania.

Gelbard J. L., and J. Belnap. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology. 17:420–432.

Gibson, R. M. 1989. Field playback of male display attracts females in lek breeding Sage Grouse. Behavioral Ecology and Sociobiology 24: 439-443.

Gibson, R. M. and J. W. Bradbury. 1986. Male and female mating strategies on sage grouse leks. Pp. 379-398 in Ecological aspects of social evolution: birds and mammals (D. I. Rubenstein and R. W. Wrangham, eds.). Princeton Univ. Press, Princeton, New Jersey.

Grenier, M., B. Oakleaf, K. Taylor, and M. Hymas. 2004. Inventory and Mapping of Black tailed Prairie Dogs in Wyoming – An Estimate of Acreage Completion Report.

Grenier, M. 2003. An Evaluation of Black-footed Ferret Block Clearances in Wyoming: Completion Report. Wyoming Game and Fish Department. Lander, WY. 16pp

Haug, E. A. and L. W. Oliphant. 1985. Movements, Activity Patterns, and Habitat Use of Burrowing Owls in Saskatchewan. Journal of Wildlife Management. 54(1):27-35.

Hazlett, D.L. 1996. The discovery of Spiranthes diluvialis along the Niobrara River in Wyoming and Nebraska. Report prepared for the Bureau of Land Management Wyoming State Office.

Hazlett, D.L. 1997. A 1997 search for Spiranthes diluvialis in southeastern Wyoming and western Nebraska. Report prepared for the Bureau of Land Management Wyoming State Office.

Heidel, Bonnie. Botanist. Wyoming Natural Diversity Database. University of Wyoming. Laramie, WY

Hiat, G.S. and D. Baker. 1981. Effects of oil/gas drilling on elk and mule deer winter distributions on Crooks Mountain, Wyoming. Wyoming Game and Fish Department.

Holloran, M. J, and S. H. Anderson. 2005. Spatial distribution of Greater Sage-Grouse nests in relatively contiguous sagebrush habitats. Condor 107:742-752.

Holloran, M J.; B. J. Heath; A. G. Lyon; S. J. Slater; J. L. Kuppiers; and S. H. Anderson. 2005. Greater sage-grouse nesting habitat selection and success in Wyoming. J. Wildl. Manage. 69(2):638-649.

Holloran, M. J., R. C. Kaiser, and W. A. Hubert. 2007. Population Response of yearling greater sage-grouse to the infrastructure of natural gas fields in southwestern Wyoming. Completion report. Wyoming Cooperative Fish and Wildlife Research Unit, Laramie, WY, USA. 34pp.

Hoogland, J. 1995. The black-tailed prairie dog: Social life of a burrowing mammal. Chicago: Chicago University Press.

Hubert, W. A. 1993. The Powder River: a relatively pristine stream on the Great Plains. Pages 387-395 in L. W. Hesse, C. B. Stalnaker, N. G. Benson, and J. R. Zuboy, editors. Restoration planning for the rivers of the Mississippi River ecosystem. Biological Report 19, National Biological Survey, Washington, D.C.

Ingelfinger, F., and S. Anderson. 2004. Passerine response to roads associated with natural gas extraction in a sagebrush steppe habitat. Western North American Naturalist 64:385-395

Ingelfinger F. 2001. The effects of natural gas development on sagebrush steppe passerines in Sublette County, Wyoming. M.Sc. thesis, University of Wyoming, Laramie, WY.

Jalkotzy, M.G., P.I. Ross, and M.D. Nasserden. 1997. The Effects of Linear Developments on Wildlife: A Review of Selected Scientific Literature. Arc Wildlife Services Ltd., Calgary, Alberta, Canada.

Jahnke, Lynn. 2006. Personal communication regarding status of, and impacts on, Powder River Basin big game populations relative to CBNG development in the Fortification Creek area. Wyoming Game and Fish Department. Sheridan, Wyoming.

Jellison, Bert. 2005. Sage-Grouse Restoration Project: Lake DeSmet Conservation District. Wyoming Game and Fish Department. Sheridan, WY.

Johnson, B.K. and D. Lockman. 1980. Response of Elk During Calving to Oil/Gas Drilling Activity in Snider Basin, Wyoming. Wyoming Game and Fish Department. Big Piney, Wyoming.

Kelly Brian T. 2004. Letter to interested parties: Black-footed ferret clearance surveys. U.S. Fish and Wildlife Service (February 2, 2004). Cheyenne, WY. 4pp.

King, J. A. 1955. Social Behavior, Social Organization and Population Dynamics in a Black-tailed Prairie Dog Town in the Black Hills of South Dakota. Contr. Lab. Vert. Biol., University of Michigan. 67pp.

Klute, D. S., L.W. Ayers, M.T. Green, W.H. Howe, S.L. Jones, J.A. Shaffer, S.R. Sheffield, and T.S. Zimmerman. 2003. Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States. U.S. Department of the Interior; Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R6001-2003, Washington, D.C.

Knick, S. T., and J. T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conservation Biology 9:1059-1071.

Knick S. T., D. S. Dobkin, J. T. Rotenberry, M. A. Schroeder, W. M. Vander Haegen, and C. van Riper III. 2003. Teetering on the edge or too late? Conservation and research issues for avifauna of sagebrush habitats. Condor. 105:611–634.

Knight R. L., and J. Y. Kawashima. 1993. Responses of raven and Red-tailed Hawk populations to linear right-of-ways. Journal of Wildlife Management. 57:266–271.

Knopf F.L. and J.R Rupert. 1995. Habits and habitats of Mountain Plovers in California. Condor 97:743-751.

Landry, R.E. 1979. Growth and development of the Burrowing Owl. M.S. thesis, California State University, Long Beach, CA.

Litzel, R. 2004. Personal communication [January 6 phone conversation with Jim Sparks]. Johnson County Weed and Pest District.

Lowham, H.W. Streamflows in Wyoming WRIR 88-4045 U.S. Geological Survey 1988

Lustig, Thomas D., March. 2003. Where Would You Like the Holes Drilled into Your Crucial Winter Range? Transactions of the 67th North American Wildlife and Natural Resources Conference.

Marra PP, Griffing SM, McLean RG. West Nile virus and wildlife health. Emerg Infect Dis [serial online] 2003 Jul. Available from: URL: http://www.cdc.gov/ncidod/vol9no7/03-0277.htm.

McCraken, J. G., D. W. Uresk and R. M. Mansen. 1985. Burrowing Owl Foods in Conata Basin, South Dakota. Great Basin Naturalist 45: 287-290.

McDonald, D., N.M. Korfanta, and S.J. Lantz. 2004. The Burrowing Owl (Athene cunicularia): a technical conservation assessment. USDA Forest Service, Rocky Mountain Region.

Meffe, G.K. and C.R. Carroll. 1994. Principles of Conservation Biology. Sinauer Associates, Inc. Sunderland, MA.

Miller, K.A Peak-Flow Characteristics of Wyoming Streams WRIR 03-4107 U.S. Geological Survey 2003

Mooney, A. 2004. Personal Communication [January 6 phone conversation with Jim Sparks]. Campbell County Weed and Pest District.

Moynahan, B. J. and M. S. Lindberg. 2004. Nest Locations of Greater Sage-Grouse in Relation to Leks in North-Central Montana. Presented at Montana Sage-Grouse Workshop, Montana Chapter of The Wildlife Society, Billings.

Moynahan, B. J.; M. S. Lindberg; J. J. Rotella; and J. W. Thomas. 2005. Factors Affecting Nest Survival of Greater Sage-Grouse in Northcentral Montana. J. Wildl. Manage.

Moynahan, B. J., M. S. Lindberg, J. J. Rotella, and J. W. Thomas. 2007. Factors affecting nest survival of greater sage-grouse in north-central Montana. Journal of Wildlife Management 71:1773-1783.

Naugle, D. E.; C. L. Aldridge; B. L. Walker; T. E. Cornish; B. J. Moynahan; M. J. Holloran; K. Brown; G. D. Johnson; E. T. Schmidtmann; R. T. Mayer; C. Y. Kato; M. R. Matchett; T. J. Christiansen; W. E. Cook; T. Creekmore; R. D. Falise; E. T. Rinkes; and M. S. Boyce. 2004. West Nile virus: Pending Crisis of Greater Sage-grouse. Ecology Letters. 7:704-713.

Naugle, David E.; Brett L. Walker; and Kevin E. Doherty. 2006. Sage Grouse Population Response to Coal-bed Natural Gas Development in the Powder River Basin: Interim Progress Report on Region-wide Lek Analyses. May 26, 2006. University of Montana. Missoula, MT. 10pp.

Noss, R. F. and A. Cooperrider. 1994. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Defenders of Wildlife and Island Press, Washington, D. C.

Oakleaf, Bob. January 13, 1988. Letter to BFAT: Preliminary BFF Reintroduction Site Analysis, Meeteetse Management Plan Assignments. Wyoming Game and Fish Department. Lander, WY. 10pp.

Olenick, B. E. 1990. Breeding biology of burrowing owls using artificial nest burrows in southeastern Idaho. Thesis, Idaho State University, Pocatello, Idaho, USA.

Paige, C., and S. A. Ritter. 1999. Birds in a sagebrush sea: managing sagebrush habitats for bird communities. Partners in Western Flight working group, Boise, ID.

Patterson, C. T. and S. H. Anderson. 1985. Distributions of Eagles and a Survey for Habitat Characteristics of Communal Roosts of Bald Eagles (Haliaeetus leucocephalus) Wintering in Northeastern Wyoming. Wyoming Cooperative Fishery and Wildlife Research Unit. University of Wyoming. Laramie, WY.

Powell, J.H. 2003. Distribution, Habitat Use Patterns, and Elk Response to Human Disturbance in the Jack Morrow Hills, Wyoming. A thesis – University of Wyoming. Laramie, Wyoming.

Porneluzi, P, J. C. Bednarz, L. J. Goodrich, N. Zawada, and J. Hoover. 1993. Reproductive performance of territorial Ovenbirds occupying forest fragments and a contiguous forest in Pennsylvania. Conservation Biology 7:618-622.

Primack, R.B. 1993. Essentials of conservation biology. Sinauer Associates, Sunderland, Massachusetts, USA.

Reading, R. P., S. R. Beissinger, J. J. Grensten, and T. W. Clark. 1989. Attributes of Black-tailed Prairie Dog Colonies in North Central Montana with Management Recommendations for the Conservation of Biodiversity. Attributes of Black-tailed Prairie Dog Colonies in North Central Montana with Management Recommendations for the Conservation of Biodiversity. pgs 13-28.

Reading, R., and Randy Matchet. 1997. Attributes of Black-tailed Prairie Dog Colonies in Northcentral Montana. Journal of Wildlife Management 61(3): 664-673.

Rinkes, T. 2003. Personal communication [Draft notes from Annual Sage-Grouse and Sagebrush Species of Concern Meeting]. Bureau of land Management Wildlife Biologist/Sage Grouse Coordinator.

Robinson, S. K. 1992. Population dynamics of breeding birds in a fragmented Illinois landscape. Pages 408-418 in J. Hagan and D. W. Johnston, editors. Ecology and conservation of neotropical migrant land birds. Smithsonian Institution press, Washington, D. C.

Rogers, Brad. Personal Communication. Fish and Wildlife Biologist. U.S. Fish and Wildlife Service, Cheyenne Field Office. Cheyenne, WY.

Romin, Laura A., and Muck, James A. May 1999. Utah Field Office Guidelines For Raptor Protection From Human And Land Use Disturbances. U.S. Fish and Wildlife Service, Salt Lake City, Utah

Rotenberry J. T., and J. A. Wiens. 1980a. Habitat structure, patchiness, and avian communities in North American steppe vegetation: a multivariate analysis. Ecology. 61:1228–1250.

Rowland, M. M., M. Leu, , S. P. Finn, S. Hanser, L. H. Suring, J. M. Boyd, C. W. Meinke, S. T. Knick, and M. J. Wisdom. 2005. Assessment of threats to sagebrush habitats and associated species of concern in the Wyoming Basins. Version 1.1, June 2005, unpublished report on file at USGS Biological Resources Discipline, Snake River Field Station, 970 Lusk St., Boise, ID 83706.

Rowland, M. M., M. Leu, , S. P. Finn, S. Hanser, L. H. Suring, J. M. Boyd, C. W. Meinke, S. T. Knick, and M. J. Wisdom. 2005. Assessment of threats to sagebrush habitats and associated species of concern in the Wyoming Basins. Version 1.1, June 2005, unpublished report on file at USGS Biological Resources Discipline, Snake River Field Station, 970 Lusk St., Boise, ID 83706.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey, and J.R. Squires. 1999. The Scientific Basis for Lynx Conservation: Qualified Insights. Ch16. USDA Forest Service Technical Report RMRS-GTR-30.

Saab, V., and T. Rich. 1997. Large-scale conservation assessment for neotropical migratory landbirds in the Interior Columbia River Basin. USDA Forest Service General Technical Report PNW-GTR-399, Portland, Oregon, USA.

Sawyer, H., R. Nielson, D. Strickland and L. McDonald. 2005. Seasonal distribution and habitat use patterns of elk I the Jack Morrow Hills Planning Area, Wyoming. Western EcoSystems Technology, Inc. Cheyenne, Wyoming.

Sawyer, H., R. Nielson, D. Strickland and L. McDonald. 2005. Sublette Mule Deer Study (Phase II) – Long-term Monitoring Plan to Assess Potential Impacts of Energy Development on Mule Deer in the Pinedale Anticline Project Area. Western EcoSystems Technology, Inc. Cheyenne, Wyoming.

Southerland, M. 1993. Habitat Evaluation: Guidance for the Review of Environmental Inpact Assessment Documents. Submitted to the U.S. Environmental Protection Agency – Office of Federal Activities. Dynamac Corporation Rockville, MD.

State wildlife agencies' ad hoc committee for sage-grouse and oil and gas development. 2008. Using the best available science to coordinate conservation actions that benefit greater sage-grouse across states affected by oil and gas development in Management Zones I-II (Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming). Unpublished report. Colorado Division of Wildlife, Denver; Montana Fish, Wildlife and Parks, Helena; North Dakota Game and Fish Department, Bismarck; Utah Division of Wildlife Resources, Salt Lake City; Wyoming Game and Fish Department, Cheyenne.

Steenhof K., M. N. Kochert, and J. A. Roppe. 1993. Nesting by raptors and Common Ravens on electrical transmission line towers. Journal of Wildlife Management. 57:272–281.

Stinson, D. W., D. W. Hays, and M. A. Schroeder. 2004. Washington State Recovery Plan for the Sage-grouse. Washington Department of Fish and Wildlife, Olympia, Washington. 109 pages.

Temple S. A. 1986. Predicting impacts of habitat fragmentation on forest birds: A comparison of two models. Pages 301-304 in Wildlife 2000 (J. Verner, C. J. Ralph, and M. L. Morrison, Eds.). Univ. Wisconsin Press, Madison.

Temple S.A., and J. R. Cary. 1988. Modeling dynamics of habitat-interior bird populations in fragmented landscapes Conserv. Biol.2 :340-347.

Temple, S.A., and B.A. Wilcox. 1986. Introduction: Predicting effects of habitat patchiness and fragmentation. In Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates, ed. J. Verner, M.L. Morrison, and C.J. Ralph, 261-62. Madison: University of Wisconsin Press.

The National Environmental Policy Act of 1969 (NEPA), as amended (Pub. L. 91-90, 42 U.S.C. 4321 et seq.).

Urban, D. L., and H. H. Shugart, Jr. 1984. Avian demography in mosaic landscapes: modeling paradigm and preliminary results. Pages 273-280 in J. Verner, M. L. Morrison, and C. J. Ralph editors. Wildlife 2000: Modeling habitat relationships of terrestrial vertebrates. University of Wisconsin Press, Madison.

U.S. Department of the Interior, Bureau of Land Management and Office of the Solicitor (editors). 2001. The Federal Land Policy and Management Act, as amended. Public Law 94-579.

U.S. Department of the Interior 2001, Bureau of Land Management, Buffalo Field Office. Approved Resource Management Plan for Public Lands Administered by the Bureau of Land Management Buffalo Field Office April 2001.

U.S. Department of the Interior 2003, Bureau of Land Management. Powder River Oil and Gas Project Environmental Impact Statement and Resource Management Plan Amendment. April 30, 2003.

U.S. Department of the Interior 2007, US Fish and Wildlife Service. Reinitiation of Formal Consultation for Powder River Oil and Gas Project. March 23, 2007

U.S. Department of the Interior, Fish and Wildlife Service. 2002. Final Biological and Conference Opinion for the Powder River Oil and Gas Project, Campbell, Converse, Johnson, and Sheridan Counties (WY6633). U.S. Fish and Wildlife Service. December 17, 2002. Cheyenne, WY. 58pp.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). 1989. Black-footed ferret Survey Guidelines for Compliance with the Endangered Species Act. Denver, CO and Albuquerque, NM.

Vander Haegen, W. M., F. C. Dobler, and D. J. Pierce. 2000. Shrubsteppe bird response to habitat and landscape variables in eastern Washington, USA. Conservation Biology 14:1145-1160.

Walker B, Naugle D, Rinkes T. 2003. The Response of Sage Grouse to Coal-bed Methane Development and West Nile virus in the Powder River Basin: Is There a Link ? Page 6 in: Program and Abstracts for the Annual Wildlife Society Meeting, Wyoming Chapter.

Walker, B.L., D. E. Naugle, and K.E. Doherty. 2007. Greater sage-grouse population response to energy development and habitat loss. Journal of Wildlife Management 71:2644-2654.

Ward, A.L. and J.J. Cupal. 1979. Telemetered Heart Rate of Three Elk as Affected by Activity and Human Disturbance. In Proceedings of Dispersed Recreation and Natural Resource Management – A Symposium. Utah State University, Logan, Utah.

WDEQ, June 14, 2004. Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments

Windingstad, R. M., F. X. Kartch, R. K. Stroud, and M. R. Smith. 1987. Salt toxicosis in waterfowl in North Dakota. Jour. Wildlife Diseases 23(3):443-446.

Wyoming Game and Fish Department (WGFD). 2004. Minimum Recommendations for Development of Oil and Gas Resources within Crucial and Important Wildlife Habitats on BLM Lands. WGFD. Cheyenne, WY

WGFD. 2003. Wyoming Greater Sage-Grouse Conservation Plan. WGFD. Cheyenne, WY

WGFD. 2004. Sheridan Region Wyoming Game and Fish Department: Annual Sage-Grouse Completion Report for 2004. Wyoming Game and Fish Department. Gillette, WY.

WGFD. 2005. Northeast Wyoming Local Working Group Area: Annual Sage-Grouse Completion Report for 2005. Wyoming Game and Fish Department. Buffalo, WY. 42pp.

WGFD. 2008. Hunting and Sage-Grouse: A Technical Review of Harvest Management On a Species of Concern in Wyoming. Wyoming Game and Fish Department. Green River, WY. 21pp.

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