

**FINDING OF NO SIGNIFICANT IMPACT & DECISION RECORD
FOR**

Lance Oil & Gas Company, Inc.
Highland Unit Gamma

ENVIRONMENTAL ASSESSMENT –WY-070-07-195

DECISION: Is to approve Alternative C as described in the attached Environmental Assessment (EA) and authorize Lance O&G’s Highland Unit Gamma Coal Bed Natural Gas (CBNG) POD comprised of the following 19 Applications for Permit to Drill (APDs):

	Well Name	Well #	Qtr/Qtr	Section	TWP	RNG	Lease #
1	HIGHLAND GAMMA HU	22-14	SENW	14	51N	78W	WYW149363
2	HIGHLAND GAMMA HU	11-14	NWNW	14	51N	78W	WYW149363
3	HIGHLAND GAMMA HU	12-14	SWNW	14	51N	78W	WYW149363
4	HIGHLAND GAMMA HU	42-14	SENE	14	51N	78W	WYW149363
5	HIGHLAND GAMMA HU	12-15	SWNW	15	51N	78W	WYW146926
6	HIGHLAND GAMMA HU	14-15	SWSW	15	51N	78W	WYW146926
7	HIGHLAND GAMMA HU	21-15	NENW	15	51N	78W	WYW146926
8	HIGHLAND GAMMA HU	23-15	NESW	15	51N	78W	WYW146926
9	HIGHLAND GAMMA HU	32-15	SWNE	15	51N	78W	WYW146926
10	HIGHLAND GAMMA HU	41-15	NENE	15	51N	78W	WYW146926
11	HIGHLAND GAMMA HU	44-15	SESE	15	51N	78W	WYW146926
12	HIGHLAND GAMMA HU FEDERAL	13-21	NWSW	21	51N	78W	WYW149364
13	HIGHLAND GAMMA HU FEDERAL	14-21	SWSW	21	51N	78W	WYW149364
14	HIGHLAND GAMMA HU FEDERAL	21-21	NENW	21	51N	78W	WYW149364
15	HIGHLAND GAMMA HU FEDERAL	22-21	SENW	21	51N	78W	WYW149364
16	HIGHLAND GAMMA HU FEDERAL	33-21	NWSE	21	51N	78W	WYW149364
17	HIGHLAND GAMMA HU FEDERAL	41-21	NENE	21	51N	78W	WYW149364
18	HIGHLAND GAMMA HU FEDERAL	43-21	NESE	21	51N	78W	WYW149364
19	HIGHLAND GAMMA HU FEDERAL	44-21	SESE	21	51N	78W	WYW149364

The following impoundments were inspected and approved for use in association with the water management strategy for the POD:

	IMPOUNDMENT Name / Number	Qtr/Qtr	Section	TWP	RNG	Capacity (Acre Feet)	Surface Disturbance (Acres)	Lease #
1	32-15-5178	SWNE	15	51	78	19.8	5	WYW146926
2	41-15-5178	NENE	15	51	78	15	3.5	WYW146926
3	11-14-5178	NWNW	14	51	78	15	4	WYW149363
4	PIT 13-11-5178	NWSW	11	51	78	39.8	9.8	WYW146342
5	PIT 44-09-5178	SESE	9	51	78	39	9.5	FEE

In addition to the listed APDs, it is my decision to approve the following right-of-way grant:

ROW Grant	Type	Sections	TWP/RNG
WYW169832	Access Road, 45’ wide, 2973’ long, approx. 3.071 acres	Sec.27, NENW, NWSE	T52N R78W

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.

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.

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.

Field Manager: _____ Date: _____

**BUREAU OF LAND MANAGEMENT
BUFFALO FIELD OFFICE
ENVIRONMENTAL ASSESSMENT (EA)
FOR
Lance Oil & Gas Company, Inc.
Highland Unit Gamma
PLAN OF DEVELOPMENT
WY-070-07-195**

INTRODUCTION

This site-specific analysis tiers to 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. This project EA addresses site-specific resources and impacts that are not covered within the PRB FEIS.

1. PURPOSE AND NEED

The purpose for the proposal is to define and produce coal bed natural gas (CBNG) on three valid federal oil and gas mineral leases issued to the applicant by the BLM. Analysis has determined that federal CBNG is being drained from the federal leases by surrounding fee or state mineral well development. The need exists because without approval of the Applications for Permit to Drill (APDs), federal lease royalties will be lost and the lessee will be deprived of the federal gas they have the rights to develop.

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

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: Lance Oil & Gas Co.’s Highland Unit Gamma Plan of Development (POD) for 19 coal bed natural gas well APD’s and associated infrastructure.

Proposed Well Information: There are 19 wells proposed within this POD. The wells are vertical bores proposed on an 80 acre spacing pattern with 1 well per location. Each well will produce from 1 coal seam, the Wall Coal. All production facilities for a well in this POD will be enclosed in a 42 cubic inch well house. Well and metering house color will be Covert Green, 18-0617 TPX; selected to blend with the surrounding vegetation. Wells are located as follows:

	Well Name	Well #	Qtr/Qtr	Section	TWP	RNG	Lease #
1	HIGHLAND GAMMA HU	23-14	NESW	14	51N	78W	WYW149363
2	HIGHLAND GAMMA HU	21-14	NENW	14	51N	78W	WYW149363
3	HIGHLAND GAMMA HU	12-14	SWNW	14	51N	78W	WYW149363
4	HIGHLAND GAMMA HU	32-14	SWNE	14	51N	78W	WYW149363
5	HIGHLAND GAMMA HU	12-15	SWNW	15	51N	78W	WYW146926
6	HIGHLAND GAMMA HU	14-15	SWSW	15	51N	78W	WYW146926
7	HIGHLAND GAMMA HU	21-15	NENW	15	51N	78W	WYW146926
8	HIGHLAND GAMMA HU	23-15	NESW	15	51N	78W	WYW146926
9	HIGHLAND GAMMA HU	32-15	SWNE	15	51N	78W	WYW146926
10	HIGHLAND GAMMA HU	41-15	NENE	15	51N	78W	WYW146926
11	HIGHLAND GAMMA HU	44-15	SESE	15	51N	78W	WYW146926
12	HIGHLAND GAMMA HU FEDERAL	13-21	NWSW	21	51N	78W	WYW149364
13	HIGHLAND GAMMA HU FEDERAL	14-21	SWSW	21	51N	78W	WYW149364
14	HIGHLAND GAMMA HU FEDERAL	21-21	NENW	21	51N	78W	WYW149364
15	HIGHLAND GAMMA HU FEDERAL	22-21	SENE	21	51N	78W	WYW149364
16	HIGHLAND GAMMA HU FEDERAL	33-21	NWSE	21	51N	78W	WYW149364
17	HIGHLAND GAMMA HU FEDERAL	41-21	NENE	21	51N	78W	WYW149364
18	HIGHLAND GAMMA HU FEDERAL	43-21	NESE	21	51N	78W	WYW149364
19	HIGHLAND GAMMA HU FEDERAL	44-21	SESE	21	51N	78W	WYW149364

Water Management Proposal: The following impoundments were proposed for use in association with the water management strategy for the POD.

	IMPOUNDMENT Name / Number	Qtr/Qtr	Sec	TWP	RNG	Capacity (Acre Feet)	Surface Disturbance (Acres)	Lease #
1	32-15-5178	SWNE	15	51	78	19.8	5	WYW146926
2	41-15-5178	NENE	15	51	78	15	3.5	WYW146926
3	11-14-5178	NWNW	14	51	78	15	4	WYW149363
4	PIT 13-11-5178	NWSW	11	51	78	39.8	9.8	WYW146342
5	PIT 44-09-5178	SESE	9	51	78	39	9.5	FEE
6	BLM 33-21-5178	SENE	21	51	78	29	1.8	WYW149364

County: Johnson

Applicant: Lance Oil & Gas Company, Inc (LOG).

Surface Owners: BLM, Charles Lawrence, State of Wyoming, Joaquin Michelena, Powder River Livestock.

Project Description:

The proposed action involves the following:

- Drilling of 19 total federal CBM wells into the Wall Coal zone to depths ranging from 2,450 to 3,220 feet. A single well bore will be installed at each location.

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 COAs 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 and maintenance shall be accomplished by a combination of telemetry and well visitation. Metering would entail approximately 1 visit every 6 months to each central metering facility once the field is up and running. Prior to that, each well site may be visited as often as once a week.
- A Water Management Plan (WMP) that involves the following infrastructure and strategy: 6 discharge points and 6 stock water reservoirs within the Upper Powder River watershed. Infrastructure interconnecting all wells and all outfalls, as well as connections to two water treatment facilities which discharge directly into the Powder River.
- An unimproved and improved road network.
- An above ground power line network to be constructed by Powder River Energy Corporation. The proposed route has been reviewed by the contractor. If the proposed route is altered, then the new route will be proposed via sundry application and analyzed in a separate NEPA action. Power line construction has not been scheduled and will not be completed before the CBNG wells are producing. If the power line network is not completed before the wells are in production, then temporary diesel generators shall be placed at 4 proposed power drops.
- A storage tank of 500 gallon capacity shall be located with each diesel generator. Generators are projected to be in operation for 24 months. Fuel deliveries are anticipated to be three times per week. Generator volume is expected to be 100.5 decibels at 1 meter distance.
- A buried gas, water and power line network. There are no central gathering/metering facilities proposed for this POD. Gas will be measured at the wellhead using an orifice plate in combination with an Electronic Flow Measurement (EFM) device.

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(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 – Environmentally Preferred

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 Highland Unit Gamma POD are listed below under 2.3.1.

2.3.1. Changes as a result of the on-sites

1. The following table provides a summary of the changes made at the pre-approval onsite:

Well ID	Aliquot	Section	T/R	Notes
HU-FED 12-15	SWNW	15	51N 78W	The pipeline route was relocated to an adjacent drainage crossing and will not connect with well 23-15 as proposed. The original location required a significant amount of earth work; and, is in excess of 25% slopes in some areas. The new route will follow the access road north and will bend east across the drainage intersection, and upslope connecting with well 21-15.
HU-FED 14-15	SWSW	15	51N 78W	The reserve pits will require an impermeable liner due to the location's proximity to an adjacent drainage. The pipeline corridor [crossing into state section 16] was moved farther north to a gentler slope. It will now include a template design road to access well 41-21.
HU-FED 41-21	NENE	21	51N 78W	The proposed well location was situated within a dense sagebrush stand. To minimize the impacts on desirable habitat, the well location was moved approx. 400' north, near the state section line. The new location is within a flat cheatgrass pocket. A slot design is proposed at this location. The proposed existing two-track (coming from the north) will not be used as an access route to this well location.
HU-FED 23-15	NESW	15	51N 78W	Refer to comments in 12-15 regarding the move of the proposed pipeline route. This is a non-constructed pad location. The well site layout will not exceed an area of 150' x 150'. The access road will come from the north, connecting well 23-15 with well 21-15. The reserve pits will require an impermeable liner due to the location's proximity to an adjacent drainage.

Well ID	Aliquot	Section	T/R	Notes
HU-FED 21-15	NENW	15	51N 78W	The reserve pits will require an impermeable liner due to the location's proximity to an adjacent drainage.
HU-FED 21-14	NENW	14	51N 78W	The well location was moved from the 21-14 location, approx. 75' W. The new well location, now an 11-14, is within a cheatgrass pocket. The pit was rotated to a spot outside the sagebrush. A slot design will be used at this well site. The access road will avoid sagebrush disturbance to the maximum extent possible, and will be limited to a clearing width of 25'.
HU-FED 32-14	SWNE	14	51N 78W	The pipeline route will follow the existing 2-track, primitive road, and will be allowed a maximum bench cut of 3'. The total working area for the installation of the utility corridor will be limited to 35'. The cut slope will be laid back to a 3:1 slope. During CBM operations, the utility corridor will be used for ranch traffic/access only. Signs will be posted at each end of the corridor. Additional interim reclamation efforts will be required to ensure site stabilization and revegetation, as well as to reduce topsoil loss, and minimize the growth of noxious weeds. The proposed well location was situated within a dense sagebrush stand. To minimize the impacts on desirable habitat, the well location was moved approx. 400' SW. The new location, now a 42-14, is within a flat cheatgrass pocket. This is a non-constructed pad location. The well site layout will not exceed an area of 150' x 150'.
HU-FED 23-14	NESW	14	51N 78W	The proposed well location was situated within a dense sagebrush stand. To minimize the impacts on desirable habitat, the well location was moved approx. 500' NW, across the adjacent drainage. The new well location, now a 22-14, is within a flat cheatgrass pocket. This is a non-constructed pad location. The well site layout will not exceed an area of 150' x 150'. If dirt work is required, the operator will contact the authorized officer.
HU-FED 44-21	SESE	21	51N 78W	The well location was moved approx. 100' N/NW to avoid disturbance of an archeological site. The new well location sits on a small saddle/grassy area. The reserve pits will require an impermeable liner due to the location's proximity to an adjacent drainage. Silt fences will be installed around the perimeter of the slot to minimize surface run-off.
HU-FED 43-21	NESE	21	51N 78W	The well location was moved approx. 120' SW. The new location will minimize the amount of cut/earthwork for the constructed pad, and the new design will incorporate the access road.

Well ID	Aliquot	Section	T/R	Notes
HU-FED 13-21	NWSW	21	51N 78W	The access road will require engineering upgrades throughout. A segment of the road was moved upslope to avoid impacts to the adjacent drainage. A constructed pad location is required to accommodate engineering access. The BLM 2-track road north of the well location will be reclaimed. Signs will be posted at each end of the primitive road. Unlike the non-disturbance approach described in 21-21, the operator will be required to break up the route's sub-surface compaction (approx. up to 4 inches below compacted layer) and drill seed.
HU-FED 14-21	SWSW	21	51N 78W	The well location was moved approx. 700' N/NW to the top of the hill by the existing road and fence. The well location was moved due to 1) sizeable surface disturbance associated with the proposed [engineered] access road; 2) highly erosive soils vulnerable to degradation; and, 3) slopes in excess of 25% in some areas.

2. The main access route from the north was originally proposed under two separate PODs; LOG's Highland Unit Gamma and Black Diamond Energy's Nurse Draw Unit. This main artery road from the SWNW of section 29 to the SWSW of section 35, T52N R78W has traditionally been used as a ranch access road by the private surface owner. Prior to the pre-approval onsite, BLM resource specialists identified the need for a common access route to the two neighboring projects. A common access route was required to avoid duplicating planning efforts both by operators and BLM resource specialists; and, analyzing the same acres of disturbance in the NEPA analysis process.

As a result of the onsites, and subsequent meetings between BLM specialists, operators and the affected landowner, the main north access route will be constructed and shared by both LOG and Black Diamond Energy. The latter will design and upgrade the non-improved section of the access road (currently a primitive two track), from the NESE of section 21 to the SWSW of section 35, T52N R78W. This segment of the access road lies on a ridge with highly erosive soils and poor reclamation potential. LOG will be responsible for meeting and maintaining BLM 9113 Road Standards on the existing improved segment of the access road, which parallels Crazy Woman Creek from the SWNW of section 29 to the NESE of section 21. Both operators will maintain the access road during the production phase of the PODs. In addition, intermediate and final reclamation activities, as well as the use of best management practices will be applied cooperatively to minimize duplication of efforts.

The impacts of upgrading and utilizing this access road will be analyzed in the Nurse Draw Unit EA, WY-070-07-188. Throughout the preplanning process and while on field visits (onsites) for this POD the BLM, operators and private surface owner searched for possible alternative access routes. However, no feasible alternatives were discovered. The affected landowner prefers the proposed main access road on this ridge since it would best serve his ranching needs. This access road will also provide access to future CBNG developments in the general area, including proposed PODs in LOG's Highland and Rose Draw Units.

3. Water Management:

- Dam BLM 33-21-5178 was dropped due to the presence of a 10-20 foot headcut a short distance downstream of the dam.

- The road around the 11-14 dam will be routed around the upper end of the pool and generally follow the present two-track road configuration rather than cut a new road through the sagebrush to cross the dam. A culvert may be required where the road goes around the top of the pool.
- The 34-15 dam will require construction oversight because of the presence of sandstone in the gully downstream of the dam. Construction oversight would allow for the modification of the structure to adjust for issues identified during building, rather than after problems occur.

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

In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ has developed a guidance document, "Compliance Monitoring and Siting Requirements for Unlined Coalbed Methane Produced Water Impoundments" which was approved September, 2006. For WYPDES permits received by DEQ after the effective date, the BLM requires that operators comply with the current approved DEQ compliance monitoring guidance document prior to discharge of federally-produced water into newly constructed or upgraded impoundments.

2.3.2.2. Surface Water

1. Channel Crossings:
 - a) Minimize channel disturbance as much as possible by limiting pipeline and road crossings.
 - b) Avoid running pipelines and access roads within floodplains or parallel to a stream channel.
 - c) Channel crossings by roads 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.
 - d) 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.
4. The operator will supply a copy of the complete approved SW-4, SW-3, or SW-CBNG permits to BLM as they are issued by WSEO for impoundments.

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. Wetland/Riparian

1. Power line corridors will avoid wetlands, to the extent possible, in order to reduce the chance of waterfowl hitting the lines. Where avoidance can't occur, the minimum number of poles necessary to cross the area will be used.
2. Wetland areas will be disturbed only during dry conditions (that is, during late summer or fall), or when the ground is frozen during the winter.
3. No waste material will be deposited below high water lines in riparian areas, flood plains, or in natural drainage ways.
4. The lower edge of soil or other material stockpiles will be located outside the active floodplain.
5. Disturbed channels will be re-shaped to their approximate original configuration or stable geomorphologic configuration and properly stabilized.
6. Reclamation of disturbed wetland/riparian areas will begin immediately after project activities are complete.

2.3.2.5. Wildlife

1. The Companies will locate facilities so that noise from the facilities at any nearby sage grouse or sharp-tailed grouse display grounds does not exceed 49 decibels (10 dBA above background noise) at the display ground.
2. The Companies will construct power lines to minimize the potential for raptor collisions with the lines. Potential modifications include burying the lines, avoiding areas of high avian use (for example, wetlands, prairie dog towns, and grouse leks), and increasing the visibility of the individual conductors.
3. The Companies will locate aboveground power lines, where practical, at least 0.5 mile from any sage grouse breeding or nesting grounds to prevent raptor predation and sage grouse collision with the conductors. Power poles within 0.5 mile of any sage grouse breeding ground will be raptor-proofed to prevent raptors from perching on the poles.
4. Containment impoundments will be fenced to exclude wildlife and livestock. If they are not fenced, they will be designed and constructed to prevent entrapment and drowning.
5. The Companies will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl colliding with power lines.
6. All stock tanks shall include a ramp to enable trapped small birds and mammals to escape. See Idaho BLM Technical Bulletin 89-4 entitled Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations.

2.3.2.6. Threatened, Endangered, or Sensitive Species

2.3.2.6.1. Bald Eagle

1. Special habitats for raptors, including wintering bald eagles, will be identified and considered during the review of the APD/POD or Sundry Notices.
2. A disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) will be established year-round

for all bald eagle nest sites. A seasonal minimal disturbance buffer zone of one mile will be established for all bald eagle nest sites (February 1 – August 15). These buffer zones and timing may be adjusted based on site-specific information through coordination with, and written approval from, the USFWS.

3. A disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) will be established year-round for all bald eagle winter roost sites. A seasonal minimal disturbance buffer zone of 1 mile will be established for all bald eagle winter roost sites (November 1 – April 1). These buffer zones and timing may be adjusted based on site-specific information through coordination with, and written approval from, the USFWS.
4. 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.

2.3.2.6.2. 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.

2.3.2.6.3. Mountain Plover

1. 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. Project-related features that encourage or enhance the hunting efficiency of predators of mountain plover will not be constructed within ½ mile of occupied mountain plover nesting habitat.
3. 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.
4. 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.
5. 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.
6. When above ground markers are used on capped and abandoned wells they will identified with

markers no taller than four feet with perch inhibiting devices on the top to avoid creation of raptor hunting perches within 0.5 mile of nesting areas.

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

2.3.2.6.4. Ute Ladies'-tresses Orchid

1. Suitable habitat will be avoided wherever possible.
2. Moist soils near wetlands, streams, lakes, or springs in the project area will be promptly revegetated if construction activities impact the vegetation in these areas. Revegetation will be designed to avoid the establishment of noxious weeds.

2.3.2.7. 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.

2.3.2.8. Noise

1. Noise mufflers will be installed on the exhaust of compressor engines to reduce the exhaust noise.
2. Where noise impacts to existing sensitive receptors are an issue, noise levels will be required to be no greater than 55 decibels measured at a distance of one-quarter mile from the appropriate booster (field) compressor. When background noise exceeds 55dBA, noise levels will be no greater than 5dBA above background. This may require the installation of electrical compressor motors at these locations.

2.3.2.9. Air Quality

1. 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. They have all been incorporated into the operator's POD. Please refer to Table 2.3.1 "Changes as a result of the onsite" on pages 6-8 of EA#WY-070-07-195, and/or the Post-Onsite Deficiency Letter dated 07/20/2007.
2. All roads, pads, impoundments and locations where engineered construction will occur will be completely slope staked for the pre-construction meeting.
3. All Lance Oil & Gas / Anadarko Petroleum representatives and contractors will have a copy of the approved POD map and conditions of approval with them at all times while conducting activities within the Highland Unit Gamma POD project area.
4. Onshore Order #1, as revised effective 05-07-07, requires that all operators certify to the Field Office

in writing that they have supplied a copy of the Surface Use Plan to each of the private surface owners affected by the project. This self-certification must be received by the Buffalo Field Office before construction on the project begins.

5. Please contact Julian Serafin – Natural Resource Specialist, @ (307) 684-1043, Bureau of Land Management, Buffalo, if there are any questions concerning surface use COAs.

Surface Use

1. 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 River Unit Gamma POD is Covert Green, 18-0617 TPX.
2. Interim Reclamation of disturbed areas will adhere to the following guidance (as per the Wyoming Policy on Reclamation (IM WY-90-231):
 - A. The reclaimed area shall be stable and exhibit none of the following characteristics:
 - i. Large rills or gullies.
 - ii. Perceptible soil movement or head cutting in drainages.
 - iii. Slope instability on, or adjacent to, the reclaimed area in question.
 - B. The soil surface must be stable and have adequate surface roughness to reduce runoff and capture rainfall and snow melt. Additional short-term measures, such as the application of mulch, shall be used to reduce surface soil movement.
 - C. Vegetation canopy cover (on unforested sites), production and species diversity (including shrubs) shall approximate the surrounding undisturbed area. The vegetation shall stabilize the site and support the planned post disturbance land use, provide for natural plant community succession and development, and be capable of renewing itself.
This shall be demonstrated by:
 - i. Successful onsite establishment of species included in the planting mixture or other desirable species.
 - ii. Evidence of vegetation reproduction, either spreading by rhizomatous species or seed production.
 - D. The reclaimed landscape shall have characteristics that approximate the visual quality of the adjacent area with regard to location, scale, shape, color and orientation of major landscape features and meet the needs of the planned post disturbance land use.
3. All topsoil removed during construction activities will be respread for interim reclamation success.
4. 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:

Ecological Site	Wells and infrastructure
Shallow Clayey	22-14, 13-21, 14-21, 22-21, 33-21, 41-21, 43-21, 44-21
Loamy	11-14, 12-14, 42-14, 12-15, 14-15, 21-15, 23-15, 32-15, 41-15, 44-15, 21-21

Loamy Ecological Sites:

Species	% in Mix	Lbs PLS*
Western Wheatgrass (Pascopyrum smithii)/or Thickspike Wheatgrass (Elymus lanceolatus ssp. lanceolatus)	35	4.2
Bluebunch Wheatgrass (Pseudoroegneria spicata ssp. Spicata)	15	2.1
Green needlegrass (Nassella viridula)	25	3.0
Rocky Mountain beeplant (Cleome serrulata) /or American vetch (Vicia americana)	10	1.4
White or purple prairie clover (Dalea candidum, purpureum)	5	0.3
Scarlet Globemallow (Sphaeralcea coccinea) / or Blue flax (Linum lewisii)	5	0.4
Prairie coneflower (Ratibida columnifera)	5	0.8
Totals	100%	12.2 lbs/acre

Shallow Clayey Ecological Sites:

Species	% in Mix	Lbs PLS*
Western Wheatgrass (Pascopyrum smithii)/or Thickspike Wheatgrass (Elymus lanceolatus ssp. lanceolatus)	35	4.2
Green needlegrass (Nassella viridula)	30	4.8
Slender Wheatgrass (Elymus trachycaulus ssp. trachycaulus)	20	1.2
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
Totals	100%	12 lbs/acre

*Pure Live Seed

*Northern Plains adapted species

*Slopes too steep for machinery may be hand broadcast and raked with twice the specified amount of seed. Complete fall seeding after September 15 and prior to prolonged ground frost. To be effective, complete spring seeding after the frost has left the ground and prior to May 15.

- The disturbance areas identified below have limited reclamation potential that shall be stabilized 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. Stabilization efforts include mulching, matting, soil amendments, etc.

- Wells: 13-21, 14-21, 21-21, 41-21, 43-21, and 44-21
 - Road/Pipeline section(s): Road “B” 13-21 Access Road Engineered Upgrade; Road “B” 21-21 Access Road North Engineered Upgrade; Road “B” Access Road South Engineered Upgrade; pipeline corridor between wells 11-14 and 42-14 (N½N½ of Sec. 14); pipeline corridor between wells 12-15 and 21-15 (NE¼NW¼ of Sec. 15).
6. The 21-21 north access road engineered upgrade will affect soils with limited reclamation capability. This area of disturbance will require additional reclamation efforts beyond traditional methods. A site specific reclamation plan describing planned methods and the application of site stabilization measures is required. The site specific plan must be reviewed and approved by the BLM authorized officer prior to starting construction activities at this location. Travel along this segment of access road “B” (21-21 Access Road North Engineered Upgrade) is not authorized until a site specific reclamation plan is reviewed and approved by the BLM authorized officer.
 7. The operator will maintain all existing improved roads in the Highland Unit Gamma POD in accordance with guidelines contained in the BLM/FS Gold Book, 4th Edition “Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development,” and/or the Road Standards in the BLM Manual 9113.
 8. “Roughed-in” or “Pioneer” roads shall be constructed according to the line and grade shown in the approved engineering design. Non-engineered roads shall be constructed to a line and grade established to meet the BLM Gold Book and 9113 guidelines as approved in the SUP, and shaped according to an approved design template for that road. Loop roads and all primary corridors servicing more than four wells shall be surfaced prior to placing these roads into service.
 9. Adequate drainage control must be in place at all stages of construction and culverts installed as soon as feasible.
 10. Pipeline corridor disturbance shall not exceed the approved disturbance width for road construction.
 11. Final grading and surfacing shall occur immediately after utility installation is complete. All rills, gullies, and other surface defects shall be ripped to the full depth of erosion across the entire width of the roadway prior to final grading and surfacing.
 12. Utility corridors will be expediently reclaimed following construction and maintained in a professional and workmanship manner avoiding tire rutting, settling and erosion.
 13. Provide 4” of aggregate where grades exceed 8% for stability and erosion prevention.
 14. 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 water bars shall be placed according to the following spacing:

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

15. The operator is responsible for having the licensed professional engineer certify that the actual construction of the road meets the design criteria and is constructed to Bureau standards.
16. Proposed Template Roads/Spot Upgrade with Utility Corridor will be allowed a maximum working width of 45ft with a blading/clearing width not to exceed 35ft. This working/disturbance width does not apply to access roads "B" and "J" in Section 21, T51N R78W.
17. Access Roads "B" and "J" in Section 21, T51N R78W will be allowed an average disturbance width of 50ft with a blading/clearing width not to exceed 40ft.
18. Proposed Template Roads/Spot Upgrade without Utility Corridor will be allowed a maximum working width of 35ft with a blading/clearing width not to exceed 25ft.
19. To minimize the impacts on sage grouse habitat, the access road and utility corridor to well location 11-14 will be allowed a maximum working width of 40ft with a blading/clearing width not to exceed 25ft.
20. The following pipeline corridors without road access will not exceed a disturbance width of 35ft:
 - Pipeline corridor between wells 11-14 and 42-14 (N $\frac{1}{2}$ N $\frac{1}{2}$ of Sec. 14)
 - Pipeline corridor heading east of well 44-21 (SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Sec. 21)
 - Pipeline corridor between wells 12-15 and 21-15 (NE $\frac{1}{4}$ NW $\frac{1}{4}$ of Sec. 15)
21. The pipeline corridor between wells 11-14 and 42-14 will follow the existing 2-track, primitive road, and will be allowed a maximum bench cut of 3ft. The cut slope will be laid back to a 3:1 slope. During CBM operations, the utility corridor will be used for ranch traffic/access only. Signs blocking CBM traffic will be posted at each end of the primitive road.
22. The BLM primitive 2-track south of the 21-21 well location will be closed to CBM traffic. Signs blocking CBM traffic will be posted at each end of the primitive road.
23. The BLM primitive 2-track north of the 13-21 well location will be reclaimed. The operator will break up the route's sub-surface compaction (approx. up to 4 inches below compacted layer) and drill seed (Shallow Clayey seed mix, COA #3). Signs blocking CBM traffic will be posted at each end of the primitive road.
24. The operator will maintain well drilling, completion and associated construction operations within a 150 foot by 150 foot work area at the following well locations: 22-14, 42-14, 23-15, and 33-21.
25. Reserve pits will be lined at the following locations: 14-15, 23-15, 21-15, and 44-21.
26. All stock water tanks installed on BLM surface will be installed with a rock apron of 4 inch aggregate surrounding the tank and extending a minimum of 8 feet out from the tank.

Water Management

1. The road around the 11-14 dam will go around the upper end of the pool and generally follow the present road configuration. Could require a culvert where it goes around the top of the pool.
2. The 34-15 dam will have construction oversight because of the presence of sandstone in the gully downstream of the dam. Construction oversight would allow for the modification of the structure to adjust for issues identified during building, rather than after problems occur.

Wildlife

1. No surface disturbing activities are permitted in suitable mountain plover habitat (i.e. prairie dog colonies) from March 15-July 31, unless a mountain plover survey has been conducted during the current breeding season. This condition will be implemented on an annual basis for the duration of surface disturbing activities. The surveys will be conducted in suitable habitat (i.e. prairie dog colonies, roads, pipelines, reservoirs under construction and any short grass prairie area) throughout the entire project area. This timing limitation will affect the following proposed wells and their associated infrastructure:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	3	All access roads/pipelines in this section.
T51N, R78W	4	Access road/pipeline in the southern half of this section.
T51N, R78W	9	Access road/pipeline in the center of this section; Pit 44-09 and associated infrastructure
T51N, R78W	10	Access road/pipeline in the northeast quarter of this section; access road/pipeline in southwest quarter of this section.
T51N, R78W	11	Pit 13-11 and its associated infrastructure; access road/pipeline in the western half of this section.
T51N, R78W	14	Wells 12-14, 11-14 and their associated infrastructure; access road/pipeline in the northeast quarter of this section; Pit 11-14 and its associated infrastructure; access road /pipeline in the western half of this section.
T51N, R78W	15	Wells 12-15, 23-15, 21-15, 32-15, 41-15 and their associated infrastructure; Reservoir P32-15 and its associated infrastructure; access road/pipeline in northwest quarter of this section; access road/pipeline in the central portion of this section.

- a. Mountain plover surveys shall be conducted by a biologist following the most current U.S. Fish and Wildlife Service 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.
 - b. If a mountain plover is identified, then a seasonal disturbance-free buffer of ¼ mile shall be maintained between March 15 and July 31. If no mountain plovers are identified, then surface disturbing activities may be permitted within suitable habitat until the following breeding season (March 15).
2. No surface disturbing activity shall occur within ½ mile of all identified raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season. This condition will be implemented on an annual basis for the duration of surface disturbing activities. This timing limitation will affect the following proposed wells and their associated infrastructure:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	3	All access roads/utility corridors in the southeast ¼ of this section.
T51N, R78W	10	All access roads/utility corridors in the NENE ¼ ¼ of this section.
T51N, R78W	15	Well 44-15 and its associated infrastructure.
T51N, R78W	16	All access roads/utility corridors in this section.
T51N, R78W	21	Well 21-21 and all associated infrastructure within the NW ¼.

- a. 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 disturbance activities. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a ½ mile timing buffer will be implemented. The timing buffer restricts surface disturbance activities within ½ mile of occupied raptor nests from February 1 to July 31.
- b. Nest productivity checks shall be completed for the first five years following project completion. The productivity checks shall be conducted no earlier than June 1 or later than June 30 and any evidence of nesting success or production shall be recorded. Survey results will be submitted to a Buffalo BLM biologist in writing no later than July 31 of each survey year. Nests to be checked are within a ½ mile or less of the proposed development. The nests are listed below:

BLM ID #	UTM N	UTM E	Legal
2607	4922234N	403285E	SESW Sec 26, T52N, R78W
3840	4915509N	405818E	NENE Sec 24, T51N, R78W
3040	4920802N	404068E	SESE Sec 35, T52N, R78W
3046	4921680N	402848E	SWNW Sec 35, T52N, R78W
3839	4915216N	405833E	NENE Sec 24, T51N, R78W
3868	4922669N	402066E	NWSE Sec 27, T52N, R78W
3869	4919431N	402643E	NESE Sec 3, T51N, R78W
3871	4917804N	404307E	NESE Sec 11, T51N, R78W
509	4925100N	402456E	NENE Sec 2, T52N, R78W
4949	4914827N	402527E	SENE Sec 2, T51N, R78W
4950	4915141N	402881E	SWNW Sec 23, T51N, R78W
4951	4915526N	403029E	NWNW Sec 23, T51N, R78W
4952	4913646N	403536E	NENW Sec 26, T51N, R78W
4953	4913998N	403774E	SWSE Sec 23, T51N, R78W
3537	4915618N	400408E	NENW Sec 21, T51N, R78W
4954	4912136N	405076E	NENW Sec 36, T51N, R78W
4955	4923933N	401783E	SWNW Sec 23, T52N, R78W
4956	4924706N	403046E	SENE Sec 27, T52N, R78W
4957	4920267N	403886E	NENW Sec 2, T51N, R78W
4948	4912991N	405241E	NWSE Sec 25, T51N, R78W
4364	4917725N	404392E	NESE Sec 11, T51N, R78W

- c. 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. The following conditions will reduce impacts to sage grouse: No surface disturbing activities are permitted within 2 miles of the following leks: Kinney Draw 1, Kinney Draw 2, and Nurse Draw between March 1 and June 15, prior to completion of a greater sage-grouse lek survey. This condition will be implemented on an annual basis for the duration of surface disturbing activities. This timing limitation will affect the following wells and infrastructure:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	3	Proposed culvert in the northwest ½ of this section; All access roads/utility corridors in the southern ½ of this section and the staging area in the center portion of this section.
T51N, R78W	4	All access roads/utility corridors in the southern ½ of this section;
T51N, R78W	9	All access roads/utility corridors in the eastern ½ of this section; Pit 44-09 and its associated infrastructure.
T51N, R78W	10	Proposed utility corridors in the southwest ¼ of this section; all access roads/utility corridors in the eastern ½ of this section.
T51N, R78W	11	Pit 13-11 and its associated infrastructure; all access roads/utility corridors in the western ¼ of this section.
T51N, R78W	14	Wells 12-14, 11-14, 42-14, 22-14 and their associated infrastructure; all access roads/utility corridors in the northern ½ of this section. Reservoir 11-14 and its associated infrastructure.
T51N, R78W	15	Reservoirs 41-15 and 32-15 and their associated infrastructure; wells 41-15, 21-15, 12-15, 14-15 and their associated infrastructure; all access roads/ utility corridors in this section.
T51N, R78W	16	All proposed access roads/utility corridors in this section.
T51N, R78W	21	Well 21-21 and 41-21 and their associated infrastructure; access road/utility corridor from Section 16 to the 21-21 well.
T51N, R78W	22	Proposed overhead power in the NENE ¼ ¼ of this section.

- a. If an active sage grouse lek is identified during the survey, the 2 mile timing restriction (March 1-June 15) 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 2 mile buffer until the following breeding season (March 1). 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. Creation of raptor hunting perches will be avoided within 0.5 mile of documented sage grouse and sharp-tailed grouse lek sites. Perch inhibitors will be installed to deter avian predators from preying on sage grouse.
4. A sharp-tailed grouse survey is required annually for the duration of surface-disturbing activities. If a new sharp-tailed grouse lek is identified during the survey, the 0.67 mile timing restriction (March 1 to June 15) 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 buffer until the following breeding season. The required 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.
 5. All overhead powerlines shall be built to protect raptors, including bald eagles from accidental electrocution using the most recent “suggested practices for raptor protection” by the Avian Power

Line Interaction Committee (current version 2006) and any additional practices provided by the US Fish and Wildlife Service. It should be noted that raptor protection can be achieved through insulation and or wire spacing and that there are multiple configurations capable of protecting raptors (CM5 Biological Opinion 2007).

6. No surface disturbing activities are permitted in suitable burrowing owl habitat (i.e. prairie dog colonies) from April 15 to August 31, annually, unless a burrowing owl survey has been conducted during the current breeding season. Survey period is April 15 to June 15. This condition will be implemented on an annual basis for the duration of surface disturbing activities. **This timing limitation will affect all prairie dog colonies within the project area.** The surveys will be conducted in active and inactive prairie dog colonies throughout the entire project area. This timing limitation will affect the following proposed wells and their associated infrastructure:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	3	All access roads/pipelines in this section.
T51N, R78W	4	Access road/pipeline in the southern half of this section.
T51N, R78W	9	Access road/pipeline in the center of this section; Pit 44-09 and associated infrastructure
T51N, R78W	10	Access road/pipeline in the northeast quarter of this section; access road/pipeline in southwest quarter of this section.
T51N, R78W	11	Pit 13-11 and its associated infrastructure; access road/pipeline in the western half of this section.
T51N, R78W	14	Wells 12-14, 11-14 and their associated infrastructure; access road/pipeline in the northeast quarter of this section; Pit 11-14 and its associated infrastructure; access road /pipeline in the western half of this section.
T51N, R78W	15	Wells 12-15, 23-15, 21-15, 32-15, 41-15 and their associated infrastructure; Reservoir P32-15 and its associated infrastructure; access road/pipeline in northwest quarter of this section; access road/pipeline in the central portion of this section.

7. No surface disturbing activities are permitted in suitable swift fox habitat (i.e. prairie dog colonies) from March 1 to August 31, annually, unless a survey for swift foxes has been conducted during the current breeding season. Survey period is April 15 to June 15. This condition will be implemented on an annual basis for the duration of surface disturbing activities. **This timing limitation will affect all prairie dog colonies within the project area.** The surveys will be conducted in active and inactive prairie dog colonies throughout the entire project area. This timing limitation will affect the following proposed wells and their associated infrastructure:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	3	All access roads/pipelines in this section.
T51N, R78W	4	Access road/pipeline in the southern half of this section.
T51N, R78W	9	Access road/pipeline in the center of this section; Pit 44-09 and associated infrastructure
T51N, R78W	10	Access road/pipeline in the northeast quarter of this section; access road/pipeline in southwest quarter of this section.
T51N, R78W	11	Pit 13-11 and its associated infrastructure; access road/pipeline in the western half of this section.
T51N, R78W	14	Wells 12-14, 11-14 and their associated infrastructure; access

Township/Range	Section	Affected Wells and Infrastructure
		road/pipeline in the northeast quarter of this section; Pit 11-14 and its associated infrastructure; access road /pipeline in the western half of this section.
T51N, R78W	15	Wells 12-15, 23-15, 21-15, 32-15, 41-15 and their associated infrastructure; Reservoir P32-15 and its associated infrastructure; access road/pipeline in northwest quarter of this section; access road/pipeline in the central portion of this section.

8. All other conservation measures and terms and conditions identified in the Powder River Basin Oil and Gas Project Biological Opinion (WY07F0075) shall be complied with.

2.4. Alternatives considered but not analyzed in detail

The operator, beginning on page 10 of the Water Management Plan, considered direct discharge of raw water, reinjection of produced water within the POD boundaries, and land application disposal. See the Water Management Plan for a complete discussion of these alternatives and why they were rejected.

3. DESCRIPTION OF AFFECTED ENVIRONMENT

Applications to drill were received on April 6, 2007. Field inspections of the proposed Highland Unit Gamma CBNG project were conducted on 06/27/2007 and 06/28/2007. The following individuals participated:

NAME	TITLE	AGENCY
Ben Adams	Hydrologist	Bureau of Land Management
Gina Becker	Permitting Coordinator	Lance Oil & Gas / Anadarko Petroleum
Carol Chadwick	Civil Engineer	Independent Contractor
Guymen Easdale	Wildlife Biologist	Bureau of Land Management
Arnie Irwin	Soil Scientist	Bureau of Land Management
Ethan Jahnke	Federal Permitting Coordinator	Lance Oil & Gas / Anadarko Petroleum
Joy Kennedy	Permitting Specialist	Lance Oil & Gas / Anadarko Petroleum
Craig Klahsen	Pipeline Foreman	Lance Oil & Gas / Anadarko Petroleum
Dan Lawrence	Surface Owner	Representing Chas Lawrence
Nick Mathis	Mapping	Lance Oil & Gas / Anadarko Petroleum
Joaquin Michelena	Surface Owner	Surface Owner
Chris Perry	Civil Engineer	Bureau of Land Management
Colt Rodeman	Drilling Supervisor	Lance Oil & Gas / Anadarko Petroleum
Brad Rogers	Wildlife Biologist	US Fish & Wildlife Service
Julian Serafin	Natural Resource Specialist	Bureau of Land Management
Patrick Smalley	Surveyor	LSI
Wendy Sutton	Archeologist	Bureau of Land Management

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			Guymen Easdale
Floodplains	X			Ben Adams
Wilderness Values			X	Julian Serafin
ACECs			X	Julian Serafin
Water Resources	X			Ben Adams
Air Quality	X			Julian Serafin
Cultural or Historical Values	X			G.L."Buck" Damone III
Prime or Unique Farmlands			X	Julian Serafin
Wild & Scenic Rivers			X	Julian Serafin
Wetland/Riparian	X			Ben Adams
Native American Religious Concerns			X	G.L."Buck" Damone III
Hazardous Wastes or Solids			X	Julian Serafin
Invasive, Nonnative Species	X			Julian Serafin
Environmental Justice			X	Julian Serafin

3.1. Topographic Characteristics of Project Area

The Highland Unit Gamma POD is located in T51N R78W, Johnson County; approximately 21 miles east of Buffalo, WY. Elevations within the project area range from 3900ft to 4500ft above sea level. The topography consists of rugged draws separated by numerous ridges with slopes at times exceeding 25%. Large flat areas are found mainly in the central region of the POD. Numerous ephemeral draws drain the project area, including Kinney Draw, Nurse Draw, and Deer Gulch. Kinney Draw and associated drainages dissect much of the areas with proposed development, while Nurse Draw parallels the main access route in the northern section of the POD. The major waterways in the general area are the Powder River to the east and Crazy Woman Creek to the west. Both are outside the POD boundary. The climate is semi-arid averaging less than 15 inches of precipitation per year. More than half of the annual precipitation normally occurs during the growing season, with April, May, and June typically accounting for the majority of this moisture. Both Federal and Fee CBNG development exists around and within the proposed Highland Unit Gamma POD. This, in conjunction with livestock grazing, are the major land uses within the general area.

3.2. Vegetation & Soils

General vegetation communities within the project area consist of short-grass prairie grassland, fragmented sagebrush steppe, and ephemeral stream bottomlands. Wyoming Big Sagebrush (*Artemisia tridentata wyomingensis*) intermixed with various native bunch grasses dominates the vegetative composition of the POD. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grass, and miscellaneous forbs. Common grasses noted during the onsite inspection included western wheatgrass, prairie junegrass, cheatgrass, Sandberg’s bluegrass, thickspike wheatgrass, and bluebunch wheatgrass. Cheatgrass heavily dominates the landscape throughout the project area. Broom snakeweed, rubber rabbitbrush and prickly pear are found interspersed throughout the general area. Differences in dominant species within the project area vary with soil type, aspect and topography.

Soils within the project area were identified from the *North Johnson County Survey Area, Wyoming (WY710)*. 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.

The map units identified for the soils within this project area are listed in the table below along with the individual acreage and the percentage of the total area identified within the POD boundary.

Table 3.2 – Soil Map Unit Types

Map Unit	Map Unit Name	Acres	Percent
607	Haverdad loam, 0 to 3 percent slopes	5	0.06%
609	Ulm-Bidman complex, 0 to 6 percent slopes	34	0.41%
614	Forkwood loam, 0 to 6 percent slopes	265	3.20%
615	Cambria-Kishona-Zigweid loams, 6 to 15 percent slopes	81	0.98%
624	Shingle-Haverdad association, 0 to 80 percent slopes	17	0.21%
639	Forkwood-Cushman loams, 0 to 6 percent slopes	742	8.95%
640	Forkwood-Cushman loams, 6 to 15 percent slopes	722	8.71%
659	Hiland-Vonalee fine sandy loams, 6 to 15 percent slope	117	1.41%
684	Samday-Shingle-Badland complex, 10 to 45 percent slope	3755	45.30%
685	Kishona-Cambria-Zigweid loams, 6 to 15 percent slopes	3	0.04%
708	Theedle-Kishona-Shingle loams, 3 to 30 percent slopes	1505	18.16%
709	Theedle-Shingle loams, 3 to 30 percent slopes	761	9.18%
718	Vonalee-Terro-Taluce fine sandy loams, 3 to 30 percent	267	3.22%
938	Water	15	0.18%

Additional site specific soil information is included in the Ecological Site interpretations which follow in Section 3.2.1.

Soils differ with topographic location, slope and elevation. Topsoil depths to be salvaged for reclamation range from 0 to 4 inches on ridges to 8+ inches in bottomland. Erosion potential varies from moderate to severe depending on the soil type, vegetative cover and slope. Reclamation potential of soils also varies throughout the project area. Areas with limited reclamation capability and/or highly erosive soils were identified by BLM specialists and the operator during the pre-approval onsite inspection.

The main soil limitations in the project area include: depth to bedrock, low organic matter content, soil droughtiness, low water holding capacity, and high erosion potential especially in areas of steep slopes. Approximately 3,755 acres within the POD boundary have been identified by BLM as being susceptible to degradation due to steep slopes and/or highly erosive soil utilizing Soil Survey Geographical Data (SSURGO). The low annual precipitation should be considered when planning a seeding.

3.2.1. Dominant Ecological Sites and Plant Communities by dominant soil series

Ecological Site Descriptions are used to provide soils and vegetation information needed for resource identification, management and reclamation recommendations. To determine the appropriate Ecological Sites for the area contained within this proposed action, BLM specialists analyzed data from onsite field reconnaissance and Natural Resources Conservation Service published soil survey soils information. The map unit symbols identified for the soils and the associated ecological sites found within the POD boundary are listed in the table below.

Table 3.2.1 – Map Units and Ecological Sites

Map Unit Symbol	Ecological Site
607	LOWLAND (10-14NP)
609	CLAYEY (10-14NP)
614	LOAMY (10-14NP)
615	LOAMY (10-14NP)
624	SHALLOW LOAMY (10-14NP)
639	LOAMY (10-14NP)

Map Unit Symbol	Ecological Site
640	LOAMY (10-14NP)
659	SANDY (10-14NP)
684	SHALLOW CLAYEY (10-14NP)
685	LOAMY (10-14NP)
708	LOAMY (10-14NP)
709	LOAMY (10-14NP)
718	SANDY (10-14NP)
938	WATER

Dominant Ecological Sites and Plant Communities identified in this POD and its infrastructure, by dominant soil series are:

Loamy Sites: This site occurs on gently undulating to rolling land on landforms which include hill sides, alluvial fans, ridges and stream terraces, in the 10-14 inch precipitation zone. The soils of this site are moderately deep to deep (greater than 20" to bedrock), well drained soils that formed in alluvium and residuum derived from sandstone and shale. These soils have moderate permeability.

The Historic Climax Plant Community (HCPC - defined as the plant community that was best adapted to the unique combination of factors associated with this ecological site) for this site would be a Rhizomatous Wheatgrasses, Needleandthread, Blue Grama Plant Community. The potential vegetation is about 75% grasses or grass-like plants, 15% forbs, and 10% woody plants.

The present plant community is a *Mixed Sagebrush/Grass*. Compared to the HCPC, cheatgrass has invaded with western wheatgrass and thickspike wheatgrass maintains at a similar or slightly higher level. Virtually all other cool-season mid-grasses are severely decreased. Blue grama is the same or slightly less than found in the HCPC. Plant diversity is low.

Wyoming big sagebrush is a significant component of this Mixed Sagebrush/Grass plant community. Cool-season grasses make up the majority of the understory with the balance made up of short warm-season grasses, annual cool-season grass, and miscellaneous forbs.

Shallow Clayey Sites:

This site occurs on slopes and ridge tops on landforms which include hill sides, ridges and escarpments in the 10-14" precipitation zone. The soils of this site are shallow (less than 20" to bedrock) well drained soils that formed in alluvium or residuum derived from unspecified shale. These soils have moderate to slow permeability and may occur on all slopes. The bedrock is clay shale which is virtually impenetrable to plant roots. The main soil limitations include depth to bedrock and clay content.

The Historic HCPC for this site would be a Rhizomatous Wheatgrass, Green Needlegrass community. Potential vegetation is about 80% grasses or grasslike plants, 10% forbs, and 10% woody plants. The state is dominated by cool season midgrasses. The major grasses include rhizomatous wheatgrasses, green needlegrasses, and bluebunch wheatgrass.

A summary of the ecological sites within the project area are listed in the table below along with the individual acreage and the percentage of the total area identified within the POD boundary.

Table 3.4 – Summary of Ecological Sites

Ecological Site	Acres	Percent
LOAMY (10-14NP)	4079	49%

Ecological Site	Acres	Percent
SHALLOW CLAYEY (10-14NP)	3772	46%
SANDY (10-14NP)	384	5%
CLAYEY (10-14NP)	34	0%
WATER	15	0%
LOWLAND (10-14NP)	5	0%

3.2.2. Wetlands/Riparian

In general, well developed wetlands and riparian areas do not exist within the project boundary. However, incidental small wetland areas may exist within this ephemeral system where runoff water is slowed or ponded by topographic features such as flat swales or landslides.

3.2.3. Invasive Species

A search of inventory maps and databases provided by the Johnson County Weed and Pest Control District identified several state-listed noxious weeds that are known to occur within the general area of the project. Specific species of concern include leafy spurge (*Euphorbia esula*), salt cedar (*Tamarix ramosissima*), Canada thistle (*Cirsium arvens*), cocklebur (*Xanthium strumarium*), and buffalo bur (*Solanum rostratum*). The operator has also identified Russian knapweed (*Centaurea repens L.*) and Scotch thistle (*Onopordum acanthium L.*) infestations throughout the project area.

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).

3.3. 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 maps, and the Wyoming Natural Diversity Database (WYNDD).

A habitat assessment and wildlife inventory surveys were performed by Big Horn Environmental Consultants (2007). Bald eagle surveys were conducted on December 5, 13, 2006 and on January 12, 16, 23, 31 and February 13, 2007. Aerial surveys for sage and sharp-tailed grouse were conducted on March 29, April 25 and May 3, 2007 and ground surveys were conducted on April 1, 9, and May 5, 2007. Raptor surveys were conducted on April 18, 29, May 11, 18, 21, 24, and June 5, 6, 12, 2007. Mountain plover surveys were conducted on May 4, 18 and June 4, 2007. No Ute ladies'-tresses orchid survey was conducted.

A BLM biologist conducted field visits on June 27 and 28, 2007. During this time, the biologist reviewed the wildlife survey information for accuracy, evaluated impacts to wildlife resources, and provided project adjustment recommendations where wildlife issues arose.

Wildlife species common to the habitat types present are identified in the Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project (PRB FEIS 3-114). Species that have been identified in the project area or that have been noted as being of special importance are described below.

3.3.1. Big Game

Big game species expected to be within the project area include pronghorn, mule deer, white-tailed deer and elk. The WGFD has determined that the entire project area is Winter/Yearlong range for mule deer and Yearlong range for pronghorn antelope. Yearlong range for white-tailed deer occurs along Crazy

Woman Creek on the northern boundary of the project area. The Highland Unit Gamma project area is located west of Fortification Creek elk ranges, the project area is approximately 3.7 miles from Parturition Areas, 4.6 miles from Crucial Winter range, 3.0 miles from Yearlong range, and 4 miles from Winter Yearlong range.

Crucial Range is any particular seasonal range or habitat component, but describes that component which has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. **Winter** use is when a population or portion of a population of animals uses the documented suitable habitat sites within this range annually, in substantial numbers only during the winter period. **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. Big game range maps are available in the PRB FEIS (3-119-143), the project file, and from the WGFD.

3.3.2. Aquatics

The project area is drained by ephemeral tributaries to the Upper Powder River.

Two springs permitted with the WSEO were identified by the operator. Fish Spring is located in the NENE portion of section 29, T51N, R78W. CKL #8 spring is located in the SWNE portion of section 16, T51N, R78W. Lance/Anadarko has three strategies for dealing with produced water from coal bed natural gas development: (1) water will be discharged into 5 full containment reservoirs, (2) water will be piped to Midwest for reinjection, and (3) water will be treated at the Kinney Draw water treatment facility and then discharged into the Powder River.

The Powder River Basin 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. Due to this, the Powder River still 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, plains killifish, 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 Wyoming Game and Fish Department 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 Wyoming Game and Fish Department 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 for them. Wyoming Game and Fish Department initiated a detailed amphibian survey of the main-stem Powder River in 2004 to determine baseline species composition and distribution in the Basin.

Fish that have been identified in the **Upper Powder River** watershed are listed in the PRB FEIS (3-156-159).

3.3.3. 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. Migratory bird species of management concern that may occur in the project area are listed in the PRB FEIS (3-151).

3.3.4. 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, and burrowing owls. 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 (PRB FEIS 3-145-148).

Twenty one raptor nests are located within or adjacent to the project area. Nine were active in during the 2007 breeding season.

Table 3.3.4.1. Documented raptor nests within the Highland Unit Gamma project area in 2007 (UTM Zone 13, NAD83).

BLM ID#	SPECIES	UTM	LEGAL LOCATION	SUBSTRATE	CONDITION	STATUS IN 2007
2607	Red-tailed hawk	403285E 4922234N	SESW Sec 26 T52N, R78W	Juniper tree live	Unk.	Unk.
3040	Unknown	404068E 4920802N	SESE Sec 35 T52N, R78W	Cottonwood tree dead	Good	Inactive
3046	Unknown	402848E 4921680N	SWNW Sec 35 T52N, R78W	Cottonwood tree dead	Gone	Gone
3839	Golden Eagle	405833E 4915216N	NENE Sec 24 T51N, R78W	Cottonwood tree live	Fair	Active, but nest failed
3868	Red-tailed hawk	402066E 4922669N	NWSE Sec 27 T52N, R78W	Cottonwood tree live	Good	Active
3869	Red-tailed hawk	402643E 4919431N	NESE Sec 3 T51N, R78W	Cottonwood tree live	Good	Active
3871	Unknown	404307E 4917804N	NESE Sec 11 T51N, R78W	Juniper tree live	Fair	Inactive
509	Golden eagle	402456E 4925100N	NENE Sec 22 T52N, R78W	Cottonwood tree live	Good	Active
4949	Red-tailed hawk	402527E 4914827N	SENE Sec 2 T51N, R78W	Power pole	Fair	Active
4950	Unknown	402881E 4915141N	SWNW Sec 23 T51N, R78W	Juniper tree live	Fair	Inactive
4951	Unknown	403029E 4915526N	NWNW Sec 23 T51N, R78W	Juniper tree live	Good	Inactive
4952	Northern harrier	403536E 4913646N	NENW Sec 26 T51N, R78W	Ground/hillside	Good	Active
4953	Long-eared owl	403774E 4913998N	SWSE Sec 23 T51N, R78W	Juniper tree live	Good	Active
3537	Golden eagle	400408E 4915618N	NENW Sec 21 T51N, R78W	Cottonwood tree live	Good	Active
4954	Unknown	405076E 4912136N	NENW Sec 36 T51N, R78W	Juniper tree live	Fair	Inactive
4955	Long-eared owl	401783E 4923933N	SWNW Sec 23 T52N, R78W	Juniper tree live	Good	Active
4956	Unknown	403046E 4924706N	SESW Sec 27 T52N, R78W	Juniper tree live	Good	Inactive
4957	Unknown	403886E 4920267N	NENW Sec 2 T51N, R78W	Cottonwood tree live	Fair	Inactive
4948	American kestrel	405241E 4912991N	NWSE Sec 25 T51N, R78W	Creek bank	Unk	Inactive
4364	Red-tailed hawk	404392E 4917725N	NESE Sec 11 T51N, R78W	Cottonwood tree live	Good	Inactive

3.3.5. Threatened and Endangered and Sensitive Species

3.3.5.1. Threatened and Endangered Species

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

3.3.5.1.1. 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 1988, the WGFD identified four prairie dog complexes (Arvada, Recluse, Thunder Basin National Grasslands, and Midwest) partially or wholly within the BLM Buffalo Field Office administrative area as potential black-footed ferret reintroduction sites (Oakleaf 1988).

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 1000 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).

Twenty eight active and densely populated prairie dog colonies were identified by Big Horn Environmental Consultants (2007) within and adjacent to the Highland Unit Gamma project area, total acreage is 1,207.6 acres. The colonies range in size from 0.4 to 890 acres and the average distance between colonies is 0.66 miles (1.11 kilometers). According to Arcadis (2007) wildlife surveys for Crazy Woman North and South, and Nurse Draw projects, there are 16 active and densely populated prairie dog colonies along Crazy Woman Creek within six miles of the project area. The colonies range in size from 1 to 229 acres, the total acreage is 623 acres and the average distance between colonies is 0.66 miles (1.11 kilometers). Prairie dog colonies within the project area are listed below:

Prairie Dog Colonies within the Highland Unit Gamma POD (2007).

Legal Location	SIZE (ACRES)
SW Sec 2 T51N, R78W	3.5
Northern ½ Sec3 T51N, R78W	21.6
Northern ½ Sec 3 T51N, R78W	14.7, 0.7, 0.4 1.7
Central portion Sec3 T51N, R78W	21
SWNE Sec 3 T51N, R78W	4.6
SENE Sec 3 T51N, R78W	5
SE Sec 4, SW Sec3, W1/2 Sec10, E1/2 Sec 9 T51N, R78W	890
E1/2 Sec 8 T51N, R78W	6.1

Legal Location	SIZE (ACRES)
NENE Sec 10 T51N, R78W	6
SESE Sec 10 T51N, R78W	24.1
NW Sec 14 T51N, R78W	20, 2.3
W1/2 Sec 15 T51N, R78W	62.2
Center Sec 15 T51N, R78W	31.6
NENE Sec 15 T51N, R78W	2.2
NENE Sec 26 T51N, R78W	6.1
SE Sec 21 T52N, R78W	17.6, 4.6, 0.7, 2.9
NW Sec 22	24.8
NENW Sec 27 T52N, R78W	5.7
SESW Sec 28 T52N, R78W	6.9
Central portion Sec 33 T52N, R78W	3.1
Total	1,207.6

According to the BLM Buffalo Field Office historical data base, there were 10 historic prairie dog colonies within 6 miles of the project area along Crazy Woman Creek. The colonies ranged in size from 55 to 2,055 acres. The total acreage along Crazy Woman Creek was 5, 706 acres. The Arvada potential reintroduction site is approximately nine miles northeast of the project area.

3.3.5.1.2. Ute's Ladies Tresses Orchid

This orchid 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. Prior to 2005, only four orchid populations had been documented within Wyoming. Five additional sites were located in 2005 (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 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.

Numerous ephemeral draws drain the project area, including Kinney Draw, Nurse Draw and Deer Gulch. These ephemeral drainages drain into the Powder River to the east and Crazy Woman Creek to the north. All proposed infrastructure within the project area is located in dry upland vegetation with no perennial water source. Two springs have been identified within or adjacent to the project area. Fish Spring is located in the NENE portion of section 29, T51N, R78W it is outside of the project area and no development is proposed within a half mile of the spring. The CKL #8 spring is located in the SWNE portion of section 16, T51N, R78W and is approximately 0.2 miles from proposed construction activity.

3.3.5.2. Sensitive Species

The USDI Bureau of Land Management (BLM) Wyoming has prepared a list of sensitive species to focus species management efforts towards maintaining habitats under a multiple use mandate. 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.

Prairie dogs colonies create a biological niche or habitat for many species of wildlife (King 1955, Reading 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 1989) suggest that richness of associated species on black-tailed prairie dog colonies increases with colony size and regional colony density. Prairie dog colonies attract many insectivorous and carnivorous birds and mammals because of the concentration of numerous 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, Mac Cracken 1985, Agnew 1986, Uresk 1986, Deisch 1989). Of those species regularly associated with prairie dog colonies, six are on the Wyoming BLM sensitive species list. The species of concern are swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), long-billed curlew (*Numenius americanus*).

Swift foxes were found to have their dens in or within 0.8 kilometers of prairie dog colonies (Hillman and Sharps 1978). The major portion of the swift fox diet is prairie dogs, 49% and insects, 27% (Uresk and Sharps 1986).

3.3.5.2.1. 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 protection by 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) shall be complied with.

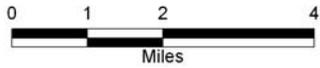
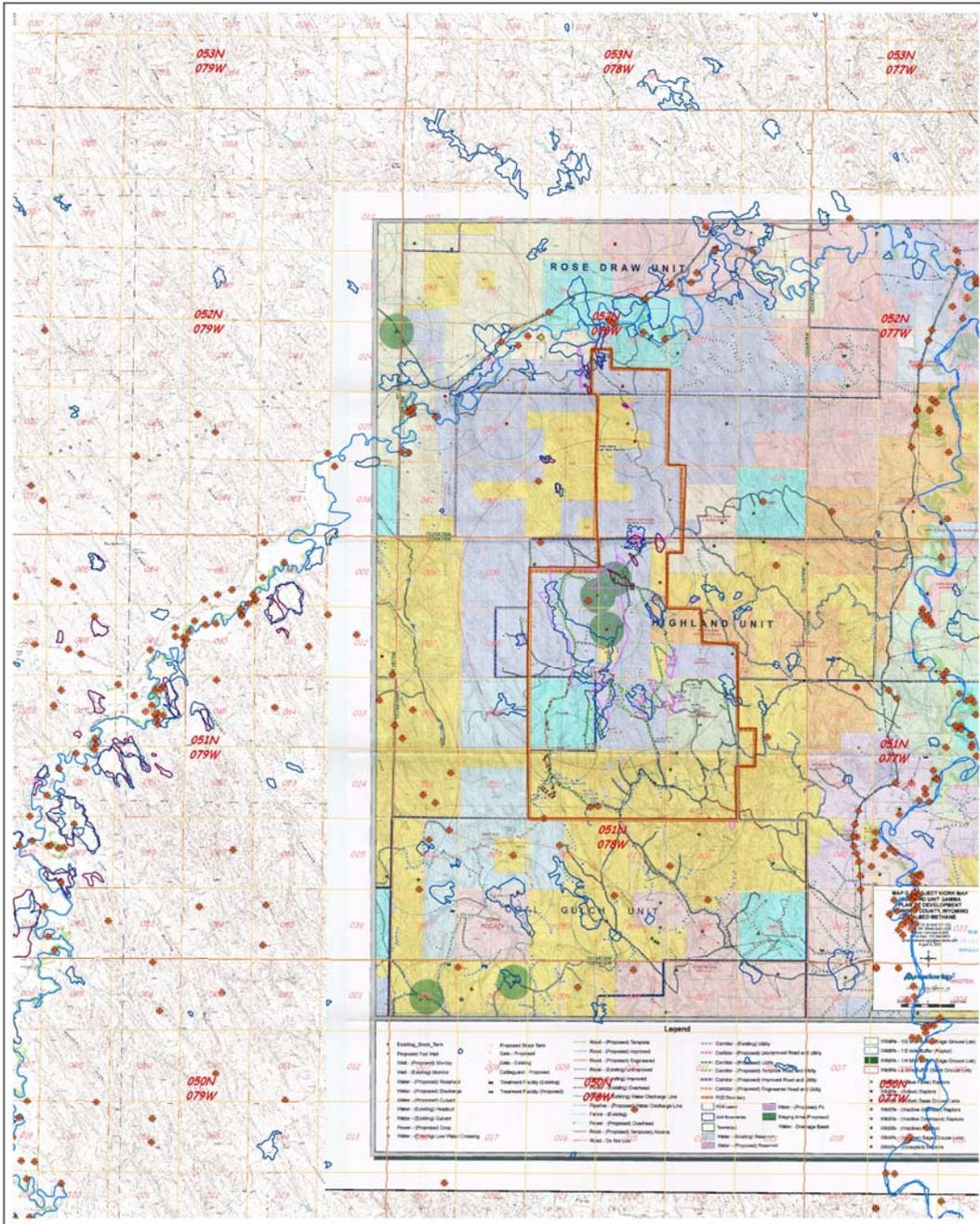
Bald eagle nesting habitat is generally found along lakes, rivers, and other areas that support large mature trees. Eagles typically will build their nests in the crown of mature trees that are close to a reliable prey source. This species feeds primarily on fish, waterfowl, and carrion. In more arid 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 can be more varied. In addition to prairie dogs, ground squirrels, and lagomorphs, domestic sheep and big game carcasses 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.

Bald eagle nesting and roosting habitat is 0.13 miles from the project area. Dense stands of mature cottonwood (*Populus spp*) trees occur along Crazy Woman Creek in Sections 29, Township 52 North, Range 79 West and Sections 14, 15, 16, 20, 21, 22, 23, 29 and 30, Township 52 North, Range 78 West.

The project area has a reliable year round prey base in the form of prairie dogs, lagomorphs (hares and rabbits), and fish. Within and adjacent to the project area there are 1,207.6 acres of active and densely populated prairie dog colonies. As the reservoirs are developed and begin taking water, waterfowl will likely be attracted to the project area and provide an additional prey source for bald eagles.

According to the BLM Buffalo Field Office data base, bald eagles regularly use the cottonwood trees along Crazy Woman Creek for winter roosting. Refer to attached map.

Highland Unit Gamma (Lance)- Bald Eagles



Legend

- EagleSurvey-All091307
- ARCADIS_PDog_Towns
- wgfd_btpeogs_2007
- HUG_BTDP



Map created on: 9/21/2007 11:51:56 AM
G. Esdlove

3.3.5.2.2. Black-tailed prairie dog

On August 12, 2004, the U.S. Fish and Wildlife Service removed the black-tailed prairie dog's Candidate status. The Buffalo Field Office however will consider prairie dogs as a sensitive species and continue to afford this species the protections described in the FEIS. The black-tailed prairie dog is a diurnal rodent inhabiting prairie and desert grasslands of the Great Plains. Their decline is related to multiple factors including, habitat destruction, poisoning, and Sylvatic plague.

The black-tailed prairie dog is a burrowing rodent that feeds primarily on grasses. The black-tailed prairie dog is the only species of prairie dog that is found on the short and mid-grass plains east of the Rockies. Black-tailed prairie dogs avoid areas with tall grass, heavy sagebrush and other thick vegetative cover which interfere with detection of predators (Krueger 1986, Clark and Stromberg 19987).

Early historical records suggest black-tailed prairie dogs may have been the most abundant mammals in North America at the time of the first Euro-American explorations of the west. Merriam calculated that prairie dogs occupied some 700 million acres of the West in the late 1800's (Cully 1989). Since the turn of the century, it is estimated that prairie dog numbers have been reduced by 98-99% of their former numbers across the West (Miller 1994).

Due to human-caused factors, black-tailed prairie dog populations are now highly fragmented, and isolated (Miller1994). Most colonies are small and subject to potential extirpation due to inbreeding, population fluctuations, and other problems that affect long term population viability (Primack 1993, Meffe and Carroll 1994, Noss and Cooperrider 1994). An additional threat is posed by Sylvatic plague (Cully1989) which, combined with other human-caused mortality, may hasten the extirpation of the rodent from the Great Plains.

The black-tailed prairie dog is considered common in Wyoming, although its abundance fluctuates with activity levels of Sylvatic plague and control efforts by landowners. Mapping conducted by the Wyoming Game and Fish Department between 1982 and 1987 indicated a minimum of 131,000 acres of black-tailed prairie dog colonies with a maximum estimate of 204,000 acres. Comparisons with 1994 Digital Ortho Quads indicated that black-tailed prairie dog acreage remained stable from 1994 through 2001. However, aerial surveys conducted in 2003 to determine the status of all known colonies indicated that a significant portion (approximately 47%) of the prairie dog acreage was impacted by Sylvatic plague and/or control efforts (Grenier 2005).

Twenty eight active and densely populated prairie dog colonies were identified by Big Horn Environmental Consultants (2007) within and adjacent to the Highland Unit Gamma project area, total acreage is 1,207.6 acres. The colonies range in size from 0.4 to 890 acres and the average distance between colonies is 0.66 miles (1.11 kilometers). According to Arcadis (2007) wildlife surveys for Crazy Woman North and South, and Nurse Draw projects, there are 16 active and densely populated prairie dog colonies along Crazy Woman Creek within six miles of the project area. The colonies range in size from 1 to 229 acres, the total acreage is 623 acres and the average distance between colonies is 0.66 miles (1.11 kilometers). Prairie dog colonies within the project area are listed below:

Prairie Dog Colonies within to the Highland Unit Gamma (2007).

Legal Location	SIZE (ACRES)
SW Sec 2 T51N, R78W	3.5
Northern ½ Sec3 T51N, R78W	21.6

Legal Location	SIZE (ACRES)
Northern ½ Sec 3 T51N, R78W	14.7, 0.7, 0.4 1.7
Central portion Sec3 T51N, R78W	21
SWNE Sec 3 T51N, R78W	4.6
SENE Sec 3 T51N, R78W	5
SE Sec 4, SW Sec3, W1/2 Sec10, E1/2 Sec 9 T51N, R78W	890
E1/2 Sec 8 T51N, R78W	6.1
NENE Sec 10 T51N, R78W	6
SESE Sec 10 T51N, R78W	24.1
NW Sec 14 T51N, R78W	20, 2.3
W1/2 Sec 15 T51N, R78W	62.2
Center Sec 15 T51N, R78W	31.6
NENE Sec 15 T51N, R78W	2.2
NENE Sec 26 T51N, R78W	6.1
SE Sec 21 T52N, R78W	17.6, 4.6, 0.7, 2.9
NW Sec 22	24.8
NENW Sec 27 T52N, R78W	5.7
SESW Sec 28 T52N, R78W	6.9
Central portion Sec 33 T52N, R78W	3.1
Total	1,207.6

According to the BLM Buffalo Field Office historical data base, there were 10 historic prairie dog colonies within 6 miles of the project area along Crazy Woman Creek. The colonies ranged in size from 55 to 2,055 acres. The total acreage along Crazy Woman Creek was 5, 706 acres.

3.3.5.2.3. Burrowing owl

The western burrowing owl has declined significantly throughout its range in North America. Current population estimates for the United States are not well known but trend data suggest significant declines across their range. The last official population estimate placed them at less than 10,000 breeding pairs. In the 1990's the number of burrowing owl breeding pairs in Canada declined at a rate of over 20% per year (Skeel, Wellicome and Holroyd 2001). The burrowing owl is listed as Endangered in Canada and

Threatened in Mexico. The majority of the mid-western and western states within the owl's range have recognized that western burrowing owls are in trouble: it is state listed as Endangered in Minnesota and Iowa, Threatened in Colorado, and as a state Species of Special Concern in Kansas, Nebraska, Oklahoma, South Dakota, North Dakota, Montana, Idaho, Utah, Washington, Oregon, and California. It is listed as a sensitive species by the Bureau of Land Management throughout the west and by the U.S. Fish and Wildlife Service (Defenders of Wildlife).

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 (*Cynomys ludovicianus*) and Richardson's ground squirrel (*Spermophilus richardsonii*) colonies provide the primary and secondary habitat for burrowing owls (Klute 2003). Black-tailed prairie dog colonies provide burrows for burrowing owls to nest in, a reliable prey base (insects, small mammals, birds, reptiles and amphibians), provide an alarm system against potential predators (prairie dog sentinels) and a clear view for easier hunting (Butts 1973, Desmond 1991).

Burrowing owls are present in North America, and breed across the grassland regions of southeastern Alberta, Saskatchewan and Manitoba. They occur in all states west of the Mississippi Valley, breed south through the western and mid-western States. They extend south into Mexico, Central America, and South America. Most spend the winter in southern Mexico and Central America (Konig, Weick and Becking 1999).

Due to the extensive amount of prairie dog colonies within the project area, good burrowing owl habitat exists throughout the central portion of the project area.

3.3.5.2.4. Grouse

3.3.5.2.4.1. Greater sage-grouse

Sage-grouse are listed as a sensitive species by BLM (Wyoming). In recent years, seven petitions have been submitted to the U.S. Fish and Wildlife Service (FWS) 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 sage-grouse conservation efforts.

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). Land cover within the project area consists of sagebrush and native grasses. This vegetation type includes a combination of sparse (0-5%), light (5-10%), moderately dense (10-15%) and dense (15-25%) big sagebrush crown closure with a variety of understory grasses and forbs. Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) is the dominant shrub interspersed with short native grasses including blue grama (*Bouteloua gracilis*). Large patches of cheatgrass occur throughout the project area (Maechtle 2007). Suitable sage-grouse habitat is present throughout the project area.

The Highland Unit Gamma project area is close to four lek complexes (Kinney Draw, Fleetwood Draw, Alvaro and Bear Draw). A lek complex is a group of leks in close proximity between which male sage grouse may be expected to interchange from one day to the next. Wyoming Game and Fish Department records identified five sage-grouse leks within 3.0 miles of the Highland Unit Gamma project area. These lek sites are identified below (Table 6).

Table 6. Documented sage-grouse leks within 3 miles of the project in 2007.

Lek ID	UTM NAD83	Legal Location	Status (Peak Males)	Distance From Project Area (Miles)
Kinney Draw I	401223E 4919134N	SESE Sec 4 T51N, R78W	2007 Inactive 0 2006 Active 6 2005 Active 36 2004 Active 20	Within the project area.
Kinney Draw II	401423E 4918361N	SWNW Sec 10 T51N, R78W	2007 Active 68 2006 Active 55 2005 Active 35 2004 Active 7	Within the project area.
Nurse Draw	401598E 4919511N	NWSW Sec 3 T51N, R78W	2007 Inactive 0 2006 Active 32	Within the project area.
Coal Gulch	399299E 4910250N	SENE Sec 5 T50N, R78W	2007 Active 95 2006 Active 124 2005 Active 34 2004 Active 32	2.4 miles south of the project area.
Fleetwood	394833E 4915051N	SENE Sec 23 T51N, R79W	2007 Active 19 2006 Active 30 2005 Active 19 2004 Active 16	2.0 miles west of the project area.

3.3.5.2.4.2. Sharp-tailed grouse

The Plains sharp-tailed grouse habitat is native grasslands composed of wheatgrasses, needlegrasses, grama grasses, and blue steam with some shrubby areas to serve as roosting cover and winter habitat. Plains sharp-tailed grouse are expected to occur throughout northeastern Wyoming. Suitable habitat for the Plains sharp-tailed grouse exists throughout the project area. There are two sharp-tailed grouse leks within 5 miles of the project area. The lek are 3.4 and 4.8 miles southwest of the project area. During the surveys for sage and sharp-tailed grouse, no sharp-tailed grouse were observed within or near the project area.

3.3.5.2.5. Mountain plover

In September 2003, the U.S. Fish and Wildlife Service withdrew the proposal to list the mountain plover. However, the mountain plover remains a Sensitive Species within both the Bureau of Land Management and the Forest Service. The mountain plover originated on the plains, nesting on arid, level terrain (0-5% slope) with short vegetation (less than 6 inches tall). Prairie dog colonies are an important habitat component. According to the U.S. Geological Survey, prairie dogs currently exist on less than one percent of their former range, and their numbers have declined by 98 percent (Turbak 2004). Mountain plover numbers have declined-possibly from millions-to only about 10,000 birds today (Turbak 2004).

There are 28 active and densely populated prairie dog colonies within and adjacent to the project area. Good mountain plover habitat exists throughout the project area occurring primarily in the prairie dog colonies. For prairie dog colony locations, refer to the prairie dog section of this document.

3.3.5.2.6. Swift fox

The swift fox was removed from the Federal list of candidate species in January 2001. The swift fox is a BLM sensitive species.

The swift fox is native to the grassland prairies of the Great Plains of North America. The original range of the species was influenced primarily by the extent of the shortgrass prairie and midgrass prairie ecosystem. Historic swift fox range is reported to have included 624,000 square miles of the grassland prairie in central North America (Scott-Brown 1987), extending north-south from central Alberta to central Texas and east-west between western Iowa and Minnesota to central Colorado (Hall 1981, Hall and Kelson 1959, Samuel and Nelson 1982, Scott-Brown 1987). The swift fox range primarily follows the distribution of the black-tailed prairie dog.

Swift foxes were found to have their dens on or within 0.8 kilometers of prairie dog colonies (Hillman and Sharps 1978). The major portion of the swift fox diet is prairie dogs, 49% and insects, 27% (Uresk and Sharps 1986).

Swift fox populations have been reduced to about 40 percent of their former range. The swift fox was extirpated in Canada, but has recently been reintroduced in Saskatchewan.

Good swift fox habitat exists throughout the project area with the prairie grasslands and prairie dog colonies. For prairie dog colony locations, refer to the prairie dog section of this document.

3.4. 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 3.4 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

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.

3.5. Water Resources

The project area is within the Upper Powder River drainage system. The northern access proposed as part of this project drains to Crazy Woman Creek, one of very few perennial tributaries to the Powder River system.

3.5.1. 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.

As stated in the MMRP, an Interagency Working Group has been established to implement an adaptive management approach. BLM is working with the WDEQ and the Interagency Working Group regarding the monitoring information being collected and assessed to determine if changes in mitigation are warranted.

The BLM 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 had a battery of nineteen wells which were installed and monitored jointly by the BLM and USGS starting in August of 2003. Water quality data has been sampled from these wells on a regular basis. That impoundment site, which has since been reclaimed, 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 indicated 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.

The WDEQ implemented requirements for monitoring shallow groundwater of Class III or better quality under unlined CBNG water impoundments effective August 1, 2004. The intent is to identify locations where the impoundment of water could potentially degrade existing [shallow groundwater aquifers](#). These investigations are conducted where discharged water will be detained in existing or proposed impoundments. If shallow groundwater is detected and the water quality is determined to fall within the Class III or better [class of use](#) (WDEQ Chapter 8 classifications for livestock use), operators are required to install batteries [of 1 to 3 wells](#), develop a monitoring plan and monitor water levels and quality. The results of these investigations have yet to be analyzed and interpreted.

A search of the Wyoming State Engineer Office (WSEO) Ground Water Rights Database for this area showed one registered stock water well within a 1 mile radius of this development area, and a completion depth of 620 feet below ground surface. For additional information on water, please refer to the PRB

FEIS (January 2003), Chapter 3, Affected Environment pages 3-1 through 3-36 (groundwater).

3.5.2. Surface Water

The project area lies within Kinney Draw, Bowman Draw, Deer Gulch, North Fork of Coal Gulch and Coal Gulch, all tributaries to the Upper Powder River watershed. The proposed northern access route lies within Nurse Draw and other unnamed tributaries to Crazy Woman Creek, also a tributary to the Upper Powder River. All of the drainages in the area except Crazy Woman Creek are ephemeral (flowing only in response to a precipitation event or snow melt – PRB FEIS Chapter 9 Glossary). Crazy Woman Creek is one of the very few intermittent to perennial tributaries to the Powder River system. The channels range from very steep, deeply incised gullies to well vegetated grassy swales without defined beds and banks.

The PRB FEIS presents the historic mean Electrical Conductivity (EC, in $\mu\text{mhos/cm}$) 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 Project Area. 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 watershed, the EC ranges from 1797 $\mu\text{mhos/cm}$ at Maximum monthly flow to 3400 $\mu\text{mhos/cm}$ 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 on the Powder River at Arvada, Wyoming. For the Crazy Woman Creek watershed, the EC ranges from 1066 $\mu\text{mhos/cm}$ at Maximum monthly flow to 1937 $\mu\text{mhos/cm}$ at Low monthly flow and the SAR ranges from 1.29 at Maximum monthly flow to 2.26 at Low monthly flow. These values were determined at the USGS station named “Crazy Woman Creek at Upper Station near Arvada, Wyoming. (PRB FEIS page 3-49).

The operator has identified two permitted natural springs within this POD boundary. Fish Spring is located in the NENE portion of section 29, T51N, R78W. The estimated flow of the spring was estimated at 5-15 gallons per minute and the water quality was 4990 $\mu\text{mhos/cm}$ conductivity, 4940 mg/l TDS and 3 SAR. The second spring, CKL #8, was located in the SWNE portion of section 16, T51N, R78W, but was not flowing at the time of the field investigations. Therefore, no flow rate was estimated and no sample was collected. The operator committed to monitoring the spring and collecting samples and flow rates when it does again become active.

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

3.6. Cultural Resources

Class III cultural resource inventories were conducted for the Highland Unit Gamma POD project prior to on-the-ground project work (BFO project no. 070070119). North Platte Archaeological Services conducted a Class III cultural resource inventory following the Archeology and Historic Preservation, Secretary of the Interior's Standards and Guidelines (48CFR190) for the project. G.L. “Buck” Damone III, BLM Archaeologist, reviewed the report for technical adequacy and compliance with Bureau of Land Management (BLM) standards, and determined it to be adequate. The following cultural resources are located in or near the area of potential effect.

Table 3.5 Cultural Resources Inventory Results

Site Number	Site Type	National Register Eligibility
48JO119	Prehistoric Site	Unevaluated
48JO3474	Prehistoric Site	Eligible
48JO3794	Prehistoric Site	Unevaluated
48JO3795	Prehistoric Site	Not Eligible
48JO3796	Historic and Prehistoric Site	Not Eligible
48JO3820	Historic and Prehistoric Site	Not Eligible
48JO3821	Historic Site	Not Eligible
48JO3822	Historic Site	Not Eligible
48JO3823	Historic Site	Not Eligible

3.7. Foot Rot

Foot rot, also called infectious pododermatitis, foul claw, or hoof rot, is an acute or chronic infection of cattle characterized by lameness, swelling, and inflammation of the skin of the coronary band and the skin between the claws. The disease is seen most commonly in feedlot cattle or in the winter and spring months when mud, urine, and manure are the greatest problem. There is no indication that incidence of foot rot has occurred or increased anywhere in the Powder River Basin in association with coal bed methane development. It is extremely unlikely foot rot problems will occur or increase as a result of this project, therefore it will not be discussed further in this analysis.

4. ENVIRONMENTAL CONSEQUENCES

The changes to the proposed action POD, which resulted in development of Alternative C as the preferred alternative, have reduced the potential impact to the environment which will result from this action. The environmental consequences of Alternative C are described below.

4.1. Vegetation & Soils Direct and Indirect Effects

Impacts to vegetation and soils from surface disturbance will be reduced, by following the operator’s plans and BLM applied mitigation. Of the 19 proposed well locations, 4 can be drilled without a well pad being constructed, 11 can be drilled using a 30 x 120 foot rig slot, and 4 will require a designed/constructed (cut & fill) well pad. Surface disturbance associated with the drilling of the 4 wells without a rig slot or designed/constructed pad would involve digging-out of rig wheel wells (for leveling drill rig on minor slopes), reserve pit construction (2 pits/per location, estimated approximate size of 32 x 20 x 18 feet), and compaction (from vehicles driving/parking at the drill site). Estimated disturbance is approximately 0.91 acre/well (200 x 200 feet) for the 4 wells for a total 3.6 acres. The 11 wells where a rig slot is proposed would involve leveling a 30 x 120 foot space with a maximum of 4 foot excavation depth. The work area will be approximately the same as the non-constructed pads, 0.91 acre/well for a total 10.01 acres. The other 4 wells requiring cut & fill pad construction would disturb an average of 0.61 acre/well pad for an approximate total of 2.42 acres. The total estimated disturbance for all 19 wells would be 16.1 acres.

Approximately 14.45 miles of improved roads would be constructed to provide access to various well locations. Approximately 4.11 miles of new and existing two-track trails would be utilized to access well

sites The majority of 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 0.33 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 or Miles	Factor	Acreage of Disturbance	Duration of Disturbance
Nonconstructed Pad	4	0.91/acre	3.64	Long Term
Rig Slots	11	0.91/acre	10.01	
Constructed Pad	4	Site Specific	2.42	
Gather/Metering Facilities	0	Site Specific	0.0	Long Term
Screw Compressors	0	Site Specific	0.0	Long Term
Monitor Wells	0	0.1/acre	0.0	Long Term
Impoundments				Long Term
On-channel	3	Site Specific	32.0	
Off-channel	2	Site Specific	12.0	
Water Discharge Points	5	Site Specific or 0.01 ac/WDP	0.5	
Channel Disturbance				
Headcut Mitigation*	0	Site Specific	0.0	
Channel Modification	0	Site Specific	0.0	
Improved Roads:				Long Term
• No Corridor		35' Width for Template Roads w/o Utility Corridor		
Engineered	0.0		0.0	
Template	0.16	45' Width for Template Roads with a Utility Corridor	0.69	
• With Corridor				
Engineered	1.23	An average 60' Width for all Engineered roads	8.95	
Template	13.06		71.28	
2-Track Roads:		35' Width for Template		Long Term

Facility	Number or Miles	Factor	Acreage of Disturbance	Duration of Disturbance
No Corridor With Corridor	3.03 1.08	Roads w/o Utility Corridor 45' Width for Template Roads with a Utility Corridor	12.86 5.89	
Pipelines No Corridor	0.33	35' Width	1.37	Short Term
Buried Power Cable No Corridor	0.0	12' Width or Site Specific	0.0	Short Term
Overhead Powerlines	2.75	30' Width	10.0	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”.

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 recommended seed mix.
 - Loss of soil vegetation cover, biologic crusts, organic matter and productivity.
 - Soil Erosion would also affect soil health and productivity. Erosion rates are site specific and are dependant on soil, climate, topography and cover.
 - Soil Compaction is the collapse of soil pores resulting 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.

These impacts would increase the potential for valuable soil loss due to increased water and wind erosion, invasive plant spread establishment, and increased sedimentation and salt loads to the watershed system.

The operator will follow the guidance provided in the Wyoming Policy on Reclamation (IM WY-90-231). BLM reclamation goals emphasize eventual ecosystem reconstruction, which means returning the land to a condition approximate to or better than that which existed before it was disturbed. Final reclamation measures are used to achieve this goal. BLM reclamation goals also include the short-term goal of quickly stabilizing disturbed areas to protect both disturbed and adjacent undisturbed areas from unnecessary degradation. Interim reclamation measures are used to achieve this short-term goal.

There are many areas which will be reclaimed by traditional methods. However, some areas will be challenging for reclamation due to soil properties and other site characteristics. The Bureau of Land Management has an obligation to protect these lands from disturbance which could lead to irretrievable and irreversible impacts. Disturbances within these areas require the programmatic/standard COA's be

complimented with a site specific performance based reclamation related COA. In the Highland Unit Gamma POD, specific areas with low reclamation potential have been identified during the onsite inspection. The operator has agreed to design and implement site specific reclamation strategies to address these areas of concern. In addition, the operator will adhere to COAs which limit the surface disturbance allowable for construction and improvements.

Cumulative Effects: Most soil disturbances would be short term, and have minor impacts with expedient, successful interim reclamation and site stabilization, as committed to by the operator in their POD Surface Use Plan and as required by BLM in COAs.

4.1.1. Wetland/Riparian

No cottonwood forests exist within the boundaries of the proposed project. Individual and small groups of trees may be present in some of the gully systems where water has historically ponded and provided additional moisture. The Powder River, downstream of the project area, does have galleries of mature cottonwood trees. However, the amount of water that could be produced, treated and discharged from this action would likely not have any impact on them.

The PRB FEIS assumes that 15% of the impounded water will re-surface as channel flow (PRB FEIS pg 4-74). Re-surfacing water from the impoundments may lead to wetland-riparian species establishment downstream of proposed impoundments.

4.1.2. Invasive Species

Based on the investigations performed during the POD planning process, the operator has committed to the control of noxious weeds and species of concern using the following measures in an Integrated Pest Management Plan (IPMP) included in the proposal:

1. Control Methods such as mowing, tillage, herbicide applications, as well as grazing and/or the application of biological agents.
2. Preventive practices including sanitary procedures for equipment, identification and delineation of new weed infestations, and the use of certified weed-free seed for revegetation projects.
3. Education and awareness programs for field employees and contractors through county weed districts, state and federal agencies and educational institutions.

Cheatgrass or downy brome (*Bromus tectorum*) and to a lesser extent, Japanese brome (*B. japonicus*) are known to exist in the affected environment. These two species are found in such high densities and numerous locations throughout NE Wyoming that a control program is not considered feasible.

The use of existing facilities along with the surface disturbance associated with construction of proposed access roads, pipelines, water management infrastructure, produced water discharge points and related facilities would present opportunities for weed invasion and spread. Produced CBNG water would likely continue to modify existing soil moisture and soil chemistry regimes in the areas of water release and storage. The activities related to the performance of the proposed project would create a favorable environment for the establishment and spread of noxious weeds/invasive plants such as salt cedar, Canada thistle and perennial pepperweed. However, mitigation as required by BLM applied COAs will reduce potential impacts from noxious weeds and invasive plants.

4.1.3. Cumulative Effects

The PRB FEIS stated that cumulative impacts to soils could occur due to sedimentation from water erosion that could change water quality and fluvial characteristics of streams and rivers in the sub-watersheds of the Project Area. SAR in water in the sub-watersheds could be altered by saline soils because disturbed soils with a conductivity of 16 mmhos/cm could release as much as 0.8 tons/acre/year

of sodium (BLM 1999c). Soils in floodplains and streambeds may also be affected by produced water high in SAR and TDS. (PRB FEIS page 4-151).

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

- They are proportional to the actual amount of cumulatively produced water in the **Upper Powder River** drainage and the total amount that was predicted in the PRB FEIS, which is approximately 17% of that total (see section 4.4.2.1).
- The WDEQ enforcement of the terms and conditions of the WYPDES permit that are designed to protect irrigation downstream.
- The commitment by the operator to monitor the volume of water flowing into the Powder River and to modify its water management strategy, if necessary, to prevent significant volumes of water from flowing into it.

No additional mitigation measures are required.

4.2. Wildlife

4.2.1. Big Game Direct and Indirect Effects

The project area is outside the Fortification Creek elk range, there should be no effects to the population. Elk moving through would likely avoid the project area during the construction phase and other times when mineral activities are occurring.

Under the environmentally preferred alternative, yearlong range for mule deer and winter yearlong range for antelope and yearlong range for white-tailed deer would be directly disturbed with the construction of wells, reservoirs, pipelines and roads. Table 4.1 summarized the proposed activities; items identified as long term disturbance would be direct habitat loss. Short-term disturbances also result in direct habitat loss; however, they should provide some habitat value as these areas are reclaimed and native vegetation becomes established.

In addition to the direct habitat loss, big game would 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 WGFDD feels 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 (WGFDD 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 accepted the disturbance (Madson 2005).

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).

Winter big game diets are sub-maintenance, meaning they lose weight and body condition as the winter progresses. In order to survive 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.

4.2.1.1. 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 4-211.

4.2.2. Aquatics Direct and Indirect Effects

Produced water is to be discharged into full containment (infiltration and evaporation) impoundments, treated at two treatment facilities and discharged to the Powder River, and/or pumped to Midwest and injected into the Madison formation. The Wyoming Department of Environmental Quality (DEQ) regulates effluent discharge through the National Pollution Discharge Elimination System in compliance with the Federal Water Pollution Control Act and the Wyoming Environmental Quality Act. The Wyoming DEQ has established effluent limits for the protection of game and non-game fish, aquatic life other than fish, wildlife, and other water uses.

Re-injecting produced water into the Madison formation will have no effects to aquatic species. Full containment impoundments should also have no effect on aquatic species if functioning properly, fully-containing the produced water. Neither re-injection nor full containment impoundments would discharge produced water into aquatic habitats. Direct discharge to the Powder River following treatment or an overflow of untreated water from full containment impoundments reaching the Powder River could affect aquatic species in the following manners:

Altering water temperatures, flow timing and magnitude, turbidity and chemical composition of the Powder River could harm native fish species which inhabit the Powder River. Alterations could also allow for non native species to become established. Any water development that alters discharge patterns, reduces turbidity, changes water quality, modifies sediment transport, or blocks migratory routes for fish is likely to result in changes in the fish community. Additionally, altering of tributaries may have adverse effects to aquatic species. Tributaries provide spawning and nursery habitat for riverine fishes and they support unique fish assemblages. Seasonal movements of riverine fishes into tributaries may be essential to several species found in the Powder River (Hubert, 1993).

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.

Wyoming Game and Fish Department 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 established by the interagency work 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 reported high salinities and electrical conductivities, possibly due to CBNG water, for the Spotted Horse drainage in their recently released report on the Powder River. This report indicated that CBNG discharges could

affect native species in the drainage.

The water treated by the EMIT facility has a conductivity of 626 $\mu\text{mhos/cm}$ and an SAR of 5.5. Water treated by the Reverse Osmosis (RO) facility has a conductivity 99 $\mu\text{mhos/cm}$ and an SAR of 20.4. These treated discharge streams may be blended with treatment facility input water to quality levels that do not exceed WDEQ standards for water discharged into the Powder River.

Change in Water Quantity

Native fauna in the Powder River drainage have evolved and adapted to a very dynamic hydrograph 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 will 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. This is a monitoring and adaptive management issue for CBNG development.

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 treated 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. An addition of approximately 5 cfs of project treated water to an average flow of 30 cfs into the Powder River is not likely to affect its hydraulic regime or alter surface water quality. 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. Channel erosion, and/or channel sedimentation would be very unlikely to occur due to treated water discharges from this project. Addition of the treated 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.

Wyoming Game and Fish (G&F) submitted comments to WDEQ on **EMIT Technologies'** application for NPDES. Initially, **EMIT Technologies** applied for a treated discharge volume of 50 cfs to accommodate much of their development along the Powder River. Because of G&F concerns, WDEQ settled on a much reduced permitted volume of 12.5cfs. WDEQ felt that that reduced volume would protect aquatic life standards until additional information could be collected to provide a better understanding of the dynamics of the aquatic system.

4.2.2.1. Cumulative effects

WDEQ is aware of the concerns about the effects of water quality and flows relative to discharge of treated water directly into the Powder River. They are taking a conservative approach to permitting until more information can be obtained and their watershed based permitting approach is fully implemented. Long term water quality and flow monitoring that would be required in the WYPDES 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. No additional mitigation measures are required.

4.2.3. 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, pipelines and reservoirs. Prompt revegetation 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).

Density of breeding Brewer's sparrows declined by 36% within 100 m of dirt roads within a natural gas field. Effects occurred along roads with light traffic volume (<12 vehicles per day). Findings suggest that indirect habitat losses from energy development may be substantially larger than direct habitat losses (Ingelfinger 2004).

Density of breeding sage sparrows was reduced by 57% within a 100-m buffer of dirt roads regardless of traffic volume. The density of roads constructed in natural gas fields exacerbated the problem and the area of impact was substantial (Ingelfinger 2004).

Overhead power lines may affect migratory birds in several ways. Power poles provide raptors with perch sites and may increase predation on migratory birds. Power lines placed in flight corridors may result in collision mortalities. Some species may avoid suitable habitat near power lines in an effort to avoid predation.

Existing and newly constructed reservoirs may have either a positive or negative effect on waterfowl. The reservoirs may provide winter forage and nesting habitat for migrating waterfowl and shore birds. Concentrations of salts and metals, particularly barium and selenium, may increase in the containment reservoirs receiving coalbed natural gas produced water discharges, as water evaporates overtime. Direct effects (toxicity) to waterfowl could occur, depending on the quality of the produced water.

With numerous existing reservoirs surrounding the project area and five proposed reservoirs within the project area, the potential for mosquito breeding areas will increase. With the creation of more reservoirs within the sagebrush community more species are being exposed to West Nile virus. Mortality rates are likely to increase and reproductive success is likely to decrease in susceptible bird species. Additional direct and indirect effects to migratory birds are discussed in the PRB FEIS (4-231-235).

4.2.3.1. 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.

4.2.4. 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 over heating or chilling of eggs or chicks. The 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. Additional direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS (4-216-221).

Table 5. Infrastructure within close proximity to documented raptor nests within the Highland Unit Gamma project area (Timing limitations will apply to this infrastructure).

BLM ID#	SPECIES	UTM (NAD 83)	STATUS	WELL / PIT NUMBER	DISTANCE
2607	Red-tailed	403285E	Unknown	Main proposed improved	0.49 miles

BLM ID#	SPECIES	UTM (NAD 83)	STATUS	WELL / PIT NUMBER	DISTANCE
	hawk	4922234N		access road in SWSW Sec 26, T52N, R78W.	
3046	Unknown	402848E 4921680N	Gone	Main proposed access road in the NW Sec 35, T52N, R78W	0.11 miles
3839	Golden eagle	405833E 4915216N	Active, but nest failed, dead chick on ground	On the edge of an existing road NE Sec24, T51N, R78W More than 0.5 miles from proposed development.	
3868	Red-tailed hawk	402066E 4922669N	Active	Main proposed improved road, center Sec 27, T52N, R78W	0.1 miles
3869	Red-tailed hawk	402643E 4919431N	Active	Proposed access road/pipeline in SE Sec 3, T51N,R78W	0.35 miles
3871	Unknown	404307E 4917804N	Inactive	Proposed access road/pipeline SE Sec 11, T51N, R78W	0.51 miles
509	Golden eagle	402456E 4925100N	Active	Proposed access road/pipeline SW Sec 22,T52N, R78W	0.89 miles
4949	Red-tailed hawk	402527E 4914827N	Active	Well 44-15 and associated infrastructure.	0.54 miles
4950	Unknown	402881E 4915141N	Inactive	Well 44-15 and associated infrastructure.	0.41 miles
4951	Unknown	403029E 4915526N	Inactive	Well 44-15 and associated infrastructure.	0.33 miles
4953	Long-eared owl	403774E 4913998N	Active	More than 0.5 miles from proposed development.	
3537	Golden eagle	400408E 4915618N	Active	Well 41-21 and associated infrastructure Well 21-21 and associated infrastructure. Access road /pipeline from well 22-21 to well 21-21	0.22 miles 0.31 miles 0.30
4955	Long-eared owl	401783E 4923933N	Active	Access road in SW Sec 22, T52N, R78W	0.06 miles

There is an improved access road from the county road to Black Diamond's Nurse Draw and Lance's Highland Unit Gamma (the two companies will be sharing this road). The road is 0.13 miles from a golden eagle nest (BLM # 3047). The golden eagle nest was active in 2007. Also, the road is 0.06 miles from red-tailed nest (BLM 2826). The nest was not surveyed in 2007. There are 48 wells between the two projects. During the construction and drilling phases of these two projects, there will be continuous traffic within 0.13 miles of the golden eagle nest. Traffic will consist of pickup trucks, all types of heavy construction equipment (i.e. bulldozers, scrapers, trackhoes, graders, backhoes, trenchers, 2000 to 5000 gallon water trucks, cement trucks, drilling rigs, pipe trucks human presence, etc.). Continuous traffic and human presence along this section of road may prevent eagles from using the nest; the traffic may cause adult birds to remain away from the nest and their chicks for the duration of the activities. This absence can lead to over heating or chilling of eggs or chicks. The prolonged disturbance can also lead to the abandonment of the nest by the adults. Traffic and activities during the production phase, although less, would have similar effects.

The golden eagle nest (BLM #3051) is 0.3 mile from the main access road into both projects. The nest was active in 2007. Traffic (pickup trucks, all types of heavy construction equipment (i.e. bulldozers, scrapers, trackhoes, graders, backhoes, trenchers, 2000 to 5000 gallon water trucks, cement trucks, drilling rigs, pipe trucks, human presence, etc.) along this section of road is likely to affect golden eagles at this nest location. Stopping traffic on the main access road (Sections 30, 29 and 20 Township 52 North, Range 78 West) between February 1 and July 31 would reduce the potential for golden eagle take.

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act. The taking of a golden eagle would violate the Bald and Golden Eagle Protection Act.

The Bald and Golden Eagle Protection Act (16U.S.C. 668-668c) prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” eagles, including their parts, nests, or eggs. The Act provides criminal penalties for persons who “take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or manner, any bald or golden eagle, alive or dead, or any part, nest, or egg thereof.” The Act defines “take” as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.”

The term “disturb” under the Bald and Golden Eagle Protection Act was recently defined via a final rule published in the Federal Register on June 5, 2007 (72 Fed. Reg. 31332). “Disturb” means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.)

An active golden eagle nest (BLM # 3869) is located 0.35 miles from access road in Section 3, Township 52 North, Range 78 West, the nest is in a tree within a deep drainage and is out of view of the access road.

An active golden eagle nest (BLM # 3537) is within 0.22 miles of well 41-21, the nest is located in a cottonwood tree in a deep drainage, two major drainages are between the well and the nest and the nest is out of view of well 41-21. The nest is 0.22 miles from well 21-21. Nest information was not available at the time of the onsite. Based photographs, topographic maps and field notes, moving the well would require an engineered pad and would cause considerable more surface disturbance than the current location. The well was not moved. However, the well appears to be in view of the nest. Project related activities (i.e. road/pipeline, overhead powerline, reservoir construction, well drilling and all activities associated with bringing the wells into production, vehicle traffic and human presence) during nesting the activity 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 over heating or chilling of eggs or chicks. The prolonged disturbance can also lead to the abandonment of the nest by the adults. Both actions can result in egg or chick mortality. Golden eagles are protected under the Bald and Golden Eagle Protection Act. Causing the death of a golden eagle is in violation Bald and Golden Eagle Protection Act.

Red-tailed hawk nest (BLM# 3868) is 0.1 miles from the main access road in Section 27, Township 52 North, Range 78 West. The nest is in view of the proposed access road. Due to steep and very rough topography there was no other location for the road. If there is activity (pickup trucks, all types of heavy construction equipment (i.e. bulldozers, scrapers, trackhoes, graders, backhoes, trenchers, 2000 to 5000 gallon water trucks, cement trucks, drilling rigs, pipe trucks, human presence, etc.) along this section of road during nesting, the activity 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 over heating or chilling of eggs or chicks. The prolonged disturbance can also lead to the abandonment of the nest by the adults. Both actions can result in egg or chick mortality.

Restricting development activities (i.e. road/pipeline, overhead powerline, reservoir construction, well drilling and all activities associated with bringing the wells into production, vehicle traffic and human presence) within ½ mile of an occupied raptor nest between February 1 and July 31 will reduce the potential for nest abandonment and egg/chick mortalities.

Inactive raptor nests (BLM # 4950 and 4951) are located in juniper trees in a deep drainage and both nests are out of view of well 44-15. Twelve of the eighteen raptor nests are more than 0.5 miles from proposed development.

Although nine of the eighteen nests were inactive in 2007, some or all of them may become active in the future. Despite commitments such as telemetry metering to limit well visits, well visits during the nesting season would likely be necessary which could be disruptive to nesting raptors possibly to the extent of nest failure from nest abandonment or predation.

All raptors are protected under the Migratory Bird Treaty Act (MBTA).

The Migratory Bird Treaty Act (MBTA)

The MBTA (16 U.S.C. 703-712), prohibits the taking of any migratory bird or any part, nest, or egg, except as permitted regulation. Implementing regulations define “take” under the MBTA as “pursue, hunt, shoot, wound, kill, trap, capture, possess, or collect.”

4.2.4.1. 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. No additional mitigation measures are required.

4.2.5. Threatened and Endangered and Sensitive Species

Within the BLM Buffalo Field Office there are two species that are Threatened or Endangered under the Endangered Species Act. Potential project effects on Threatened and Endangered Species were analyzed in a Biological Assessment and a summary is provided in Table 4.3. Threatened and Endangered Species potentially affected by the proposed project area are further discussed following the table.

4.2.5.1. Threatened and Endangered and Sensitive Species

Table 4.3 Summary of Threatened and Endangered Species Habitat and Project Effects.

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Endangered				
Black-footed ferret (<i>Mustela nigripes</i>)	Black-tailed prairie dog colonies or complexes > 1,000 acres.	NS	NLAA	1,207.6 acres of active and densely populated prairie dog colonies occur within and adjacent to the project area.
Threatened				
Ute ladies'-tresses orchid (<i>Spiranthes diluvialis</i>)	Riparian areas with permanent water	NP	NE	No suitable habitat 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.

Effect Determinations

Effect Determinations

LAA Likely to adversely affect

NE No Effect.

NLAA May Affect, not likely to adversely effect individuals or habitat.

4.2.5.1.1. Black-footed ferret

With twenty-eight active and densely populated prairie dog colonies (totaling 1,207.6 acres) within and adjacent to the project area, habitat is of sufficient size to support a black-footed ferret population. The Arvada potential reintroduction site is approximately nine miles northeast of the project area.

There are 4 proposed wells, approximately 6 miles of access/pipeline, and 4 reservoirs/pits within active prairie dog colonies. The wells and reservoirs are listed below:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	4	Access road/pipeline in the southern half of this section.
T51N, R78W	9	Access road/pipeline in the center of this section; Pit 44-09 and associated infrastructure
T51N, R78W	10	Access road/pipeline in the northeast quarter of this section; access road/pipeline in southwest quarter of this section.
T51N, R78W	11	Pit 13-11 and its associated infrastructure; access road/pipeline in the western half of this section. Access road/pipeline in the SWSW quarter of this section.
T51N, R78W	14	Wells 12-14, 11-14 and their associated infrastructure; access road/pipeline in the northeast quarter of this section; Pit 11-14 and its associated infrastructure; access road /pipeline in the western half of this section.
T51N, R78W	15	Wells 12-15, 23-15, 21-15, 32-15, 41-15 and their associated infrastructure; Reservoir P32-15 and its associated infrastructure; access road/pipeline in northwest quarter of this section; access road/pipeline in the central portion of this section.

Approximately 54 acres of black-footed ferret habitat will be lost due to well pad, road/pipeline and reservoir construction. The construction of well pads, roads, pipelines and reservoirs causes direct prairie dog mortalities and an immediate loss of prairie dog burrows, thus causing direct habitat loss for the black-footed ferret.

The majority of the project area is within a large and relatively gently rolling bench (0 to 8% slope) on roads that already exists, moving the infrastructure would cause considerable more surface disturbance.

Because suitable habitat is of sufficient size to support a black-footed ferret population, but no ferrets are present implementation of the proposed development *“may affect, but is not likely to adversely affect”* the black-footed ferret. However, if ferrets were to become present, the proposed action will likely make portions of the project area unsuitable for inhabitation.

4.2.5.1.2. Ute’s Ladies Tresses Orchid

All proposed infrastructure within the Highland Unit Gamma project area is located in dry upland vegetation with no perennial water source. Suitable habitat is not present within the Highland Unit Gamma project area. Implementation of the proposed coal bed natural gas project should have ***“no effect”*** on the Ute ladies’- tresses orchid as suitable habitat is not present.

4.2.5.2. Sensitive Species Direct and Indirect Effects

Table 4.4 Summary of Sensitive Species Habitat and Project Effects.

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

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

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
Plants				
Porter's sagebrush (<i>Artemisia porteri</i>)	Sparsely vegetated badlands of ashy or tufaceous mudstone and clay slopes 5300-6500 ft.	NP	NI	Habitat not present.
William's wafer parsnip (<i>Cymopterus williamsii</i>)	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.
- MIH** 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

4.2.5.2.1. Bald eagle

According to the BLM Buffalo Field Office database bald eagles have been observed roosting in cottonwood at four locations during four different surveys. The locations of these observations were in the northwest quarter of Section 30, Township 52 North, Range 78 West along Crazy Woman Creek. These sightings were 0.5 mile from the existing improved access road into the project area. Bald eagles were observed at two different locations during two different surveys in the northwest quarter of Section 21, Township 52 North, Range 78 West. The access road follows Crazy Woman Creek for 1.3 miles and is approximately 200 feet to 0.25 miles from bald eagle nesting and roosting habitat. This is the main access road for Black Diamond's Nurse Draw and Lance's Highland Unit Gamma project areas. There are 48 wells between the two projects. During the construction and drilling phases of these two projects, there will be continuous traffic along 1.3 miles of Crazy Woman Creek on the south side. Traffic will consist of pickup trucks, all types of heavy construction equipment (i.e. bulldozers, scrapers, trackhoes, graders, backhoes, trenchers, 2000 to 5000 gallon water trucks, cement trucks, drilling rigs, pipe trucks human presence, etc.). Activity along this section of Crazy Woman Creek will impact bald eagles in the following ways: (1) 1.3 miles of access road is likely to prevent bald eagles from using good roosting and nesting habitat in the NE quarter of Section 30, NWNW quarter of Section 29, and the southern portion of Section 20, Township 52 North, Range 78 West along Crazy Woman Creek; (2) vehicle and equipment activity is likely to flush eagles perching in the area as well as flushing eagles from prey; (3) activity in the area is likely to increase stress on eagles and reduce their health and potential reproductive success; (4) road related mortalities (vehicle strikes) may occur as eagles move from Crazy Woman Creek south to the large prairie dog colonies containing project roads. These impacts will continue into the production phase of the project, but impacts should be reduced proportional to the reduction in human activity. The bald eagle is protected under the Bald and Golden Eagle Protection Act. The take of a bald eagle is in violation of the Bald and Golden Eagle Protection Act.

Restricting development activities (i.e. road/pipeline, overhead powerline, reservoir construction, well drilling and all activities associated with bringing the wells into production, vehicle traffic and human presence) within one mile of bald eagle roosting habitat between November 1 and April 1 will reduce the impacts to bald eagles foraging and roosting along this section of Crazy Woman Creek during the winter.

Roads present a collision hazard, primarily from bald eagles scavenging on carcasses resulting from other road related wildlife mortalities. Collision risk increases with automobile travel speed. 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 Highland Unit Gamma project area is surround by extensive natural gas development, existing 3-phase overhead powerlines can be found surrounding the project area. There are approximately 4 miles of existing overhead three-phase distribution lines within and/or adjacent to the project area. The wire spacing is likely in compliance with the Avian Power Line Interaction Committee's (1996) suggested practices and with the Service's standards (USFWS 2002); however other features may not be in compliance. Anadarko/Lance will be constructing 2.7 miles of 3 phase overhead power lines within the project area.

The presence of overhead power lines will adversely affect foraging bald eagles. Bald eagles forage opportunistically throughout the Powder River Basin particularly during the winter when migrant eagles join the small number of resident eagles. Power poles provide attractive perch sites in areas where mature trees and other natural perches are lacking. From May 2003, through August 14, 2007, Service Law Enforcement salvage records for northeast Wyoming identified that 180 raptors, including 1 bald eagle,

106 golden eagles, 1 unidentified eagle, 28 hawks, 44 owls and 8 unidentified raptors and 1 great-blue heron were electrocuted on power poles within the Powder River Basin Oil and Gas Project area (USFWS 2007). Of the 180 raptors electrocuted 58 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.

Produced water will be stored in five reservoirs which may attract eagles if reliable prey is present, most likely in the form of waterfowl. The effect of the reservoirs on eagles is unknown. The reservoirs 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.

4.2.5.2.2. Black-tailed prairie dog

There are 4 proposed wells, approximately 6 miles of access/pipeline, and 4 reservoirs/pits within active prairie dog colonies. The wells and reservoirs are listed below:

Township/Range	Section	Affected Wells and Infrastructure
T51N, R78W	4	Access road/pipeline in the southern half of this section.
T51N, R78W	9	Access road/pipeline in the center of this section; Pit 44-09 and associated infrastructure
T51N, R78W	10	Access road/pipeline in the northeast quarter of this section; access road/pipeline in southwest quarter of this section.
T51N, R78W	11	Pit 13-11 and its associated infrastructure; access road/pipeline in the western half of this section. Access road/pipeline in the SWSW quarter of this section.
T51N, R78W	14	Wells 12-14, 11-14 and their associated infrastructure; access road/pipeline in the northeast quarter of this section; Pit 11-14 and its associated infrastructure; access road /pipeline in the western half of this section.
T51N, R78W	15	Wells 12-15, 23-15, 21-15, 32-15, 41-15 and their associated infrastructure; Reservoir P32-15 and its associated infrastructure; access road/pipeline in northwest quarter of this section; access road/pipeline in the central portion of this section.

Approximately 53.3 acres of active and densely populated black-tailed colony will be lost due to well pad, road/pipeline and reservoir construction. The construction of well pads, roads, pipelines and reservoirs causes direct prairie dog mortalities and an immediate loss of prairie dog burrows.

The majority of the project area is within a large and relatively gently rolling bench (0to 8% slope) using roads that already exist, moving the infrastructure would cause considerable more surface disturbance.

When construction begins on reservoirs, roads, pipelines and pads the earth moving equipment can remove several feet of dirt at one time destroying prairie dog burrows and foraging habitat. 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.

Individuals that survive the excavation process will likely be displaced. As the prairie dog town grows in size, prairie dogs move from an area of high population density to an area of low population density. The expansion of the colony/town is from the center out to the edges. Male prairie dogs resort to either long-distance dispersal to new colonies (mostly as yearlings, rarely as adults) or short distance within the home colony. Female prairie dogs disperse over long distances to other colonies (as either yearlings or adults). Short-distance dispersal of females within the home colony almost never occurs (Hoogland 1995). Dispersal of prairie dogs occurs as single individuals. Both male and female prairie dogs prefer to move into an existing colony or one that has been abandoned rather than start a completely new colony. Coterie (small family group within the colony) members resist invasions by conspecifics. 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. Both males and females actively protect their coterie territories from invading males and females (Hoogland 1995).

Four of the reservoirs occur in the middle of densely populated active prairie dog colonies. Mass immigration to surrounding colonies from those destroyed by the reservoirs would expose the prairie dogs to a higher rate of predation and an increase in stress resulting in higher mortality rate. Depending on when the construction occurs, the prairie dogs may be forced to disperse at the wrong time of the year when their body condition is below peak health levels, thus creating more stress on the animals and resulting in a higher mortality rate. Another problem with displacement of the prairie dogs into the surrounding area is that the soil and vegetation may not be conducive to prairie dog survival.

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 well house and nearby power poles may provide habitats for mammal and avian predators increasing prairie dog predation. Mineral related traffic on the adjacent roads will result in prairie dog road mortalities.

4.2.5.2.3. Burrowing owls

With twenty-eight active and densely populated prairie dog colonies (totaling 1,207.6 acres) within and adjacent to the project area, good burrowing owl nesting habitat is present throughout the project area. Earth moving equipment can remove several feet of dirt at one time destroying prairie dog burrows (nesting habitat) and foraging habitat. During construction of CBNG facilities, there is the possibility that burrowing owls 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 burrowing owls and will likely cause an increase in burrowing owl mortalities. During the construction of these facilities individuals are exposed more frequently to predators and have less protective cover.

The presence of overhead power lines and roads within the project area may impact burrowing owls. Overhead power lines create hunting perches for larger raptors, thus increasing the potential for predation on burrowing owls. They are also a collision hazard for burrowing owls flying through the area. Mineral related traffic on the adjacent roads may result in burrowing owl collisions with vehicles.

Restricting all project related activities (i.e. road/pipeline, reservoir and well pad construction, vehicle traffic, well drilling, human presence, overhead powerline construction, etc.) within one quarter mile of an active burrowing owl nest during the breeding season (April 15 through August 31) will help to reduce nest failure and would prevent road related mortalities.

4.2.5.2.4. Grouse

4.2.5.2.4.1. Greater sage-grouse

Suitable sage-grouse habitat is present through out the Highland Unit Gamma project area.

Existing access road with a proposed utility corridor in Sections 3 and 4, Township 51 N, Range 78 West, goes through the middle of the quarter mile buffer of two sage grouse leks (Nurse Draw and Kinney Draw 1). The two leks are located in a large prairie dog colony. The prairie dog colony occupies most southwest quarter of Section 3, the southern half of Section 4, the eastern half of Section 9, and the western half of Section 10, Township 51 North, Range 78 West. The prairie dog colony is primarily grassland with small pockets of sagebrush scattered throughout the area. Sage grouse are using the majority of the prairie dog colony as their leking ground. Moving the road/utility corridor a quarter mile away from the lek area would casue considerable more surface disturbance and the loss of sagebrush pockets within the lek area. These pockets of sagebrush within and around the lek area provide protective cover for sage grouse while attending the lek. The access road/utility corridor was not moved. Timing limitations will apply.

The proposed utility corridor from the 11-14 well to the 42-14 well will stay within the existing two-track road that connects the two wells. The existing two-track road goes through good nesting habitat (15-25% sagebrush cover). By keeping the utility corridor within the existing roadway, it will reduce the direct loss of good sage grouse nesting habitat. The maximum disturbance width will not exceed 20 feet. Access road/utility corridor from the 22-21 well to the 13-21 was rerouted out of sage grouse nesting habitat (10-25% sagebrush cover) to area of sparse sagebrush (0-5% cover).

An area of approximately 60 feet X 60 feet will be cleared of sagebrush around well 33-21. Mowing the area will result in the loss of approximately 0.08 acres of good sage grouse nesting habitat. The 33-21 well is located on a flat ridge approximately 60 feet wide. Surrounding the ridge is steep and rough topography, relocating the well would require an engineered pad and an engineered access road. This would cause considerable more surface disturbance and reclamation would be more difficult. The well was not moved.

The 41-21 well and its access road/utility corridor goes through approximately 0.7 miles of good sage grouse nesting habitat (15-25% sagebrush cover). The maximum disturbance width for the road/utility corridor will not exceed 30 feet. Approximately three acres of good sage grouse nesting habitat will be directly lost.

The 21-14 well was moved approximately 75 feet west out of sagebrush (10-25% cover) to a grassy clearing. The 21-14 well is now named the 11-14 well. The access road/utility corridor will be routed to avoid sagebrush (10-25% cover). The 23-14 well was moved approximately 500 feet west out of good sage grouse nesting habitat (15-25% cover) to a large flat grassy flat (prairie dog colony). Due to the well move the 23-14 well is now the 22-14. Moving the well eliminated approximately 0.6 miles of access road/utility corridor in good sage grouse nesting habitat. Approximately 2.5 acres of good sage grouse nesting habitat (15-25 % cover) has been preserved. The new road is in grassland (an active prairie dog colony). The 32-14 well was moved approximately 400 feet south out of good sage grouse nesting habitat (10-25% sagebrush cover) to a grassy clearing. The new well name is the 42-14. Maximum disturbance width for the access road/utility corridor will not exceed 35 feet.

Greater sage-grouse habitat is being directly lost with the addition of well sites, roads, pipelines, power lines, reservoirs and other infrastructure (Theiele 2005, Oedekoven 2004). Sage grouse avoidance of CBNG infrastructure results in even greater indirect habitat loss. The Wyoming Game and Fish

Department (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).

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The presence of overhead power lines and roads within the project area may adversely affect sage grouse. Overhead power lines create hunting perches for raptors, thus increasing the potential for predation on sage grouse. Increased predation from overhead power near leks may cause a decrease in lek attendance and possibly lek abandonment. Overhead power lines are also a collision hazard for sage grouse flying through the area. Increased roads and mineral related traffic can affect grouse activity and reduce survival (Braun et al. 2002). Activity along roads may cause nearby leks to become inactive over time (WGFD 2003).

Noise can affect sage grouse by preventing vocalizations that influence reproduction and other behaviors (WGFD 2003). Sage grouse attendance on leks within one mile of compressors is lower than for sites farther from compressors locations (Braun et al. 2002).

Another concern with CBNG is that reservoirs created for water disposal provide habitat for mosquitoes associated with West Nile virus (Oedekoven 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). Powder River Basin 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 Buffalo Field Office (BFO) Resources 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), which includes the WGFD, 1977 sage-grouse guidelines (Bennett 2004). Under pressure for standardization BLM Wyoming adopted the two-mile recommendation in 1990, and instructed the field offices to incorporate the measure into their land use plans (Bennett 2004, Murkin 1990).

The two-mile recommendation was based on research which indicated between 59 and 87 percent of sage-grouse nests were located within two-miles of a lek (Bennett 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 lek of breeding (Bennett 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 36% of their grouse nesting within 3 km of the capture leks. 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. In press).

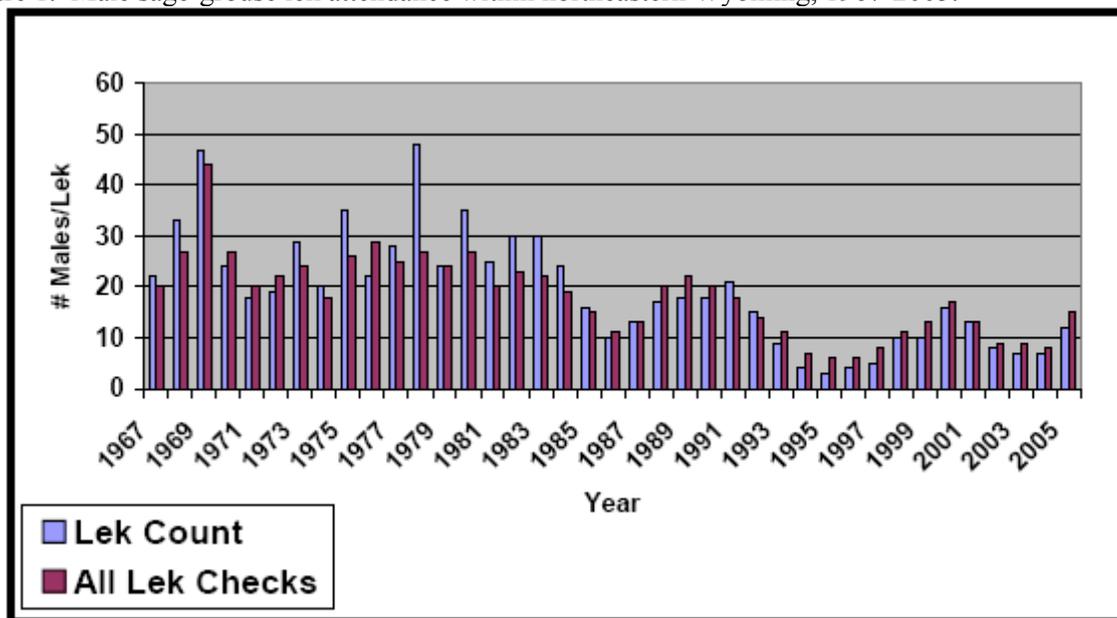
Percentage of sage-grouse nesting within a certain distance from their breeding lek is unavailable for the

Powder River Basin. The Buffalo and Miles City field offices through the University of Montana with assistance from other partners including the U.S. Department of Energy and industry are currently researching nest location and other sage-grouse questions and relationships between grouse and coalbed natural gas development. Habitat conditions and sage grouse biology within the Buffalo Field Office is probably most similar to Moynahan’s north-central Montana study area.

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. Without contiguous habitat available to nesting grouse it is likely a smaller percentage of grouse nest within two-miles of a lek within the PRB than grouse within those areas studied in the development of the 1977 WAFWA recommendations and even the Holloran and Moynahan study areas. Holloran and Moynahan both studied grouse in areas of contiguous sagebrush habitats without large scale fragmentation and habitat conversion (Moynahan et al In press, Holloran and Anderson 2005). A recent sagebrush cover assessment within Wyoming basins estimated sagebrush coverage within Holloran and Anderson’s Upper Green River Basin study area to be 58% with an average patch size greater than 1200 acres; meanwhile Powder River Basin sagebrush coverage was estimated to be 35% with an average patch size less than 300 acres (Rowland et al. 2005). The Powder River Basin patch size decreased by more than 63% in forty years, from 820 acre patches and an overall coverage of 41% in 1964 (Rowland et al. 2005). Recognizing that many populations live within fragmented habitats and nest much farther than two miles from the lek of breeding WAFWA revised their sage grouse management guidelines (Connelly et. al. 2000) and now recommends the protection of suitable habitats within 5 km (3.1 mi) of leks where habitats are not distributed uniformly such as the Powder River Basin.

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

Figure 1. Male sage-grouse lek attendance within northeastern Wyoming, 1967-2005.



Sage-grouse populations within the PRB are declining independent of coalbed natural gas development.

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 (Oedekoven 2004). The Powder River Basin Oil and Gas Project Final Environmental Impact Statement estimated 51,000 additional CBNG wells to be drilled over a ten year period beginning in 2003 (BFO 2003). Impacts from CBNG development are likely to be significant and additive to the long-term impacts afflicting the sage-grouse population (Oedekoven 2004). In other terms, CBNG development is expected to accelerate the downward sage-grouse population trend.

A two-mile timing limitation given the long-term population decline and that less than 50% of grouse are expected to nest within the limitation area is likely 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. 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. As stated earlier, a well density of eight wells per section creates sage-grouse avoidance zones which overlap creating contiguous avoidance areas (WGFD 2004).

An integrated approach including habitat restoration, grazing management, temporal and spatial mineral limitations etc. is necessary to reverse the population decline. The Wyoming Game and Fish Department (WGFD) has initiated such a program within the Buffalo Field Office area (Jellison 2005). The WGFD program is modeled after a successful program on the Deseret Ranch in southwestern Wyoming and northeastern Utah. The Deseret Ranch has demonstrated a six-fold increase in their sage-grouse population while surrounding areas exhibited decreasing populations (Danvir 2002).

4.2.5.2.4.2. Sharp-tailed grouse

The effects are similar to sage grouse, although may not be to the same extent.

4.2.5.2.5. Mountain plover

The central portion of the project area is good mountain plover habitat. Mineral development may have 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. Use of roads and pipe line corridors by mountain plovers may increase their vulnerability to vehicle collision. Overhead power lines provide perch sites for raptors that could potentially result in increased mountain plover predation. CBNG infrastructure such as well houses, roads, pipe line corridors, and nearby metering facilities may provide shelter and den sites for ground predators such as skunks and foxes.

With the loss or alteration of their natural breeding habitat (predominately prairie dog colonies), mountain plovers have been forced to seek habitat with similar qualities that may be poor quality habitat 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 and 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 US Fish and Wildlife Service (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 1995).

Restricting all development activities (i.e. road/pipeline, overhead powerline, reservoir construction, well drilling and all activities associated with bringing the wells into production, vehicle traffic and human presence) within one quarter mile of occupied mountain plover nesting habitat between March 15 and July 31 will reduce direct impacts such as vehicle/equipment related mortalities. The mountain plover is protected under the Migratory Bird Treaty Act.

4.2.5.2.6. Swift fox

The construction of well pads, roads, pipelines and reservoirs causes direct habitat loss (i.e. loss of prairie dogs and prairie dog burrows). During construction of these facilities, there is the possibility that swift foxes, particularly kits, 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 is likely to cause an increase in swift fox mortalities. During the construction of these facilities individuals are exposed more frequently to predators and have less protective cover. Mineral related traffic on the adjacent roads will likely result in swift fox road mortalities.

Restricting all development activities (i.e. road/pipeline, overhead powerline, reservoir construction, well drilling and all activities associated with bringing the wells into production, vehicle traffic and human presence) within a quarter mile of active swift fox dens between March 1 and August 31 will reduce direct impacts to swift foxes.

4.2.5.3. 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.

4.3. West Nile Virus Direct and Indirect Effects

This project will 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.

4.4. 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** watershed and a commitment to comply with Wyoming State water laws/regulations. It also addresses potential impacts to the environment and landowner concerns. Qualified hydrologists 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 to be 20.0 gpm per well or 380.0 gpm (0.85 cfs or 615 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 163,521 acre-feet in 2007 (maximum production was estimated to occur in 2006 at 171,423 acre-feet). As such, the volume of water resulting from the production of these wells is 0.4% of the total volume projected for 2007.. This volume of produced water is also within the predicted parameters of the PRB FEIS.

4.4.1. 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, if all water were discharged and contained within the impoundments, it may be assumed that a maximum of 152 gpm will infiltrate at or near the discharge points and impoundments (245 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). However, there is potential for infiltration of produced water to influence the quality of the antecedent groundwater. 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. The proposed action, however, chooses a combination of discharge to impoundments, treatment at two facilities with discharge from them directly into the Powder River, and the possibility of piping water to Anadarko's Madison formation injection field near Midwest, Wyoming.

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 stockwater well produces from a depth of 620 feet compared to 1700-2000 feet to the Big George. 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 (½ mile radius of a federal CBNG producing well) 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.

Shallow ground water monitoring is ongoing at impoundment sites across the basin. Due to the limited data available from these sites, the still uncertain overall fate or extent of change that is occurring due to infiltration at those sites, and the extensive variability in site characteristics, both surface and subsurface, it is not reliable at this time to infer that findings from these monitoring wells should be directly applied to other impoundment locations across the basin.

In order to address the potential impacts from infiltration on shallow ground water, the Wyoming DEQ has developed a guidance document, “Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments” (June 14, 2004) which can be accessed on their website. This guidance document became effective August 1, 2004, and is currently being revised as the “Compliance Monitoring and Siting Requirements for Unlined Coalbed Methane Produced Water Impoundments” which should be approved by June, 2006. Approximately 800 new impoundments have been investigated to date with 102 impoundments in 52 permits that have gone into compliance monitoring. The Wyoming DEQ has established an Impoundment Task Force which is in the process of drafting an “Impoundment Monitoring Plan” to investigate the potential for existing impoundments to have impacted shallow groundwater. Drilling at selected existing impoundments should begin in the spring of 2006. For WYPDES permits received by DEQ after the August 1st effective date, the BLM will require that operators comply with the requirements outlined in the current approved DEQ compliance monitoring guidance document prior to discharge of federally-produced water into newly constructed or upgraded impoundments.

4.4.1.1. 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.

4.4.2. Surface Water

The following table shows Wyoming proposed numeric limits for the watershed for SAR, and EC, the average value measured at selected USGS gaging 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 operator’s WYPDES permit, and the levels found in the POD’s representative water sample.

Table 4.5 Comparison of Regulated Water Quality Parameters to Predicted Water Quality

Predicted Values	TDS, mg/l	SAR	EC, µmhos/cm
Most Restrictive Proposed Limit –		2	1000
Least Restrictive Proposed Limit		10	3200

Predicted Values	TDS, mg/l	SAR	EC, µmhos/cm
Powder River at Arvada			
Historic Data Average at Maximum Flow		4.76	1797
Historic Data Average at Minimum Flow		7.83	3400
WDEQ Quality Standards for Wyoming Groundwater (Chapter 8)			
Drinking Water (Class I)	500		
Agricultural Use (Class II)	2,000	8	
Livestock Use (Class III)	5,000		
WDEQ Water Quality Requirement for WYPDES Permit # WY0052167			
October 1 through July 31		9	3000
August 1 through September 30		5	2000
WYPDES Permit # WY0048381			
Outfalls 011-013, March-October	5000	7.5	2500
Outfalls 011-013, November-February	5000	9.75	2500
Outfall 010	5000	N/A	7500
Outfalls 001-009	5000	N/A	7500
Predicted Produced Water Quality			
Big George	2550	52.9	4050
EMIT Treated		5.5	626
RO Treated	75	20.4	99

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 2550.0 mg/l TDS which is not within the WDEQ criteria for agricultural use (2000 mg/l TDS). 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 Big George target coal zone from these wells is predicted to be similar to the sample water quality collected from a location near the POD. A maximum of 20.0 gallons per minute (gpm) is projected to be produced from these 19 wells, for a total of 380.0 gpm for the POD. See Table 4.5 .

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

There are 7 discharge points proposed for this project. They have been appropriately sited and utilize appropriate water erosion dissipation designs. Existing and proposed water management facilities were evaluated for compliance with best management practices during the onsite.

To manage the produced water, 5 impoundments (130 acre-feet) would potentially be constructed/rehabilitated within the project area. These impoundments will disturb approximately 32 acres including the dam structures. Of these water impoundments, 3 would be on-channel reservoirs disturbing approximately 12 acres, and 2 would be off-channel ponds disturbing approximately 20 acres. All 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) was 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). Existing impoundments will be upgraded and proposed impoundments will be constructed 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, if it were all discharged into impoundments, could result in the addition of 0.13 cfs below the lowest reservoir (after infiltration and evapotranspiration losses). 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 19 wells is anticipated to be a total of 380 gpm or .85 cfs to impoundments, treatment and discharge, and possibly to deep injection to the Madison formation via Anadarko’s Midwest pipeline. Using an assumed conveyance loss of 20% (PRB FEIS pg 4-74) and full containment the produced water re-surfacing in the tributaries to the Powder River from this action (0.13 cfs) may add a maximum 0.1 cfs to the Upper Powder River flows, or 0.1% of the predicted total CBNG produced water contribution. This incremental volume is statistically below the measurement capabilities for the volume of flow of the Upper Powder River (refer to Statistical Methods in Water Resources U.S. Geological Survey, Techniques of Water-Resources Investigations Book 4, Chapter A3 2002, D.R. Helsel and R.M. Hirsch authors). 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).

The operator did not provide an analysis of the potential development in the watershed above the project area. However, based on the area of the Kinney Draw watershed (13 sq mi) and an assumed density of one well per location every 80 acres, the potential exists for the development of 104 wells which could produce a maximum flow rate of 2080 gpm (4.6 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 proposed method for surface discharge 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 Wyoming Pollutant Discharge Elimination System (WYPDES) permits for the discharge of water produced from this project from the WDEQ.

Permit WY0052167 was issued for the Kinney Draw treatment facility’s discharge directly to the Powder River. Effluent limits applicable to this discharge are given in the WYPDES permit on Part I, page 7 and are also tabulated below:

Chlorides, mg/l	46
Dissolved Iron, µg/l	300
Dissolved Manganese, µg/l	630
pH, standard units	6.5 - 8.5
Sodium Absorption Ratio - calculated as unadjusted ratio, Oct-Jul	9
Sodium Absorption Ratio - calculated as unadjusted ratio, Aug-Sept	5
Specific Conductance, µS/cm, October-July	3000
Specific Conductance, µS/cm, August-September	2000
Sulfates, mg/l	3000
Total Arsenic, µg/l	7
Total Barium, µg/l	1800
Total Dissolved Solids, mg/l	5000
Total Radium 226+ Total Radium 228, pCi/l	1
Total Petroleum Hydrocarbons (TPH), mg/l	10
Total Flow, Million Gallons per Day (MGD)	0.65

Permit WY0048381 was issued for facilities in Deer Gulch for 13 outfalls and lists varying limits, depending on the outfall. These limits are listed below:

WY0048381--Outfalls 011-013 (discharging to Powder)	Daily Max	Monthly Average
-----	at the outfall	at the outfall
Chlorides, mg/l	46	
Dissolved Iron, µg/l	300	
Dissolved Manganese, µg/l	630	
pH, standard units	6.5 - 8.5	
Sodium Absorption Ratio - calculated, March-October	7.5	5
Sodium Absorption Ratio - calculated, November-February	9.75	6.5
Specific Conductance, µS/cm, March-October	2500	2000
Specific Conductance, µS/cm, November-February	2500	2500
Sulfates, mg/l	3000	
Total Arsenic, µg/l	7	
Total Barium, µg/l	1800	
Total Dissolved Solids, mg/l	5000	
Total Radium 226, pCi/l	1	
Total Petroleum Hydrocarbons (TPH), mg/l	10	
Total Flow, Million Gallons per Day (MGD)	2.71	

WY0048381--Outfall 010 (< 1 mi from and not discharging to Powder)	Daily Max
-----	at the outfall
Chlorides, mg/l	46
Dissolved Iron, µg/l	300
Dissolved Manganese, µg/l	630
pH, standard units	6.5 - 8.5
Specific Conductance	7500
Sulfates, mg/l	3000
Total Arsenic, µg/l	7
Total Barium, µg/l	1800
Total Dissolved Solids, mg/l	5000

Total Radium 226, pCi/l	1
Total Petroleum Hydrocarbons (TPH), mg/l	10
Total Flow, Million Gallons per Day (MGD)	2.71

WY0048381--Outfalls 001-009, >1 mi from and not discharging to Powder	Daily Max
-----	at the outfall
Chlorides, mg/l	46
Dissolved Iron, µg/l	1000
Dissolved Manganese, µg/l	630
pH, standard units	6.5 - 8.5
Specific Conductance	7500
Sulfates, mg/l	3000
Total Arsenic, µg/l	7
Total Barium, µg/l	1800
Total Dissolved Solids, mg/l	5000
Total Radium 226, pCi/l	1
Total Petroleum Hydrocarbons (TPH), mg/l	10
Total Flow, Million Gallons per Day (MGD)	2.71

By setting the effluent limits of water discharged to the Powder River, the WYPDES permit addresses existing downstream concerns, such as irrigation use. The designated point of compliance identified for this permit is **the end of the discharge pipe**.

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 and analyzed for WDEQ analytes 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.

The development of coal bed natural gas and the production and discharge of water in the area surrounding the existing natural springs may affect the flow rate and/or water quality of the spring.

In-channel downstream impacts are addressed in the WMP for the **Highland Unit Gamma** POD prepared by WWC Engineering for **Lance Oil and Gas Company, Incorporated, an Anadarko Company**.

4.4.2.1. Surface Water Cumulative Effects

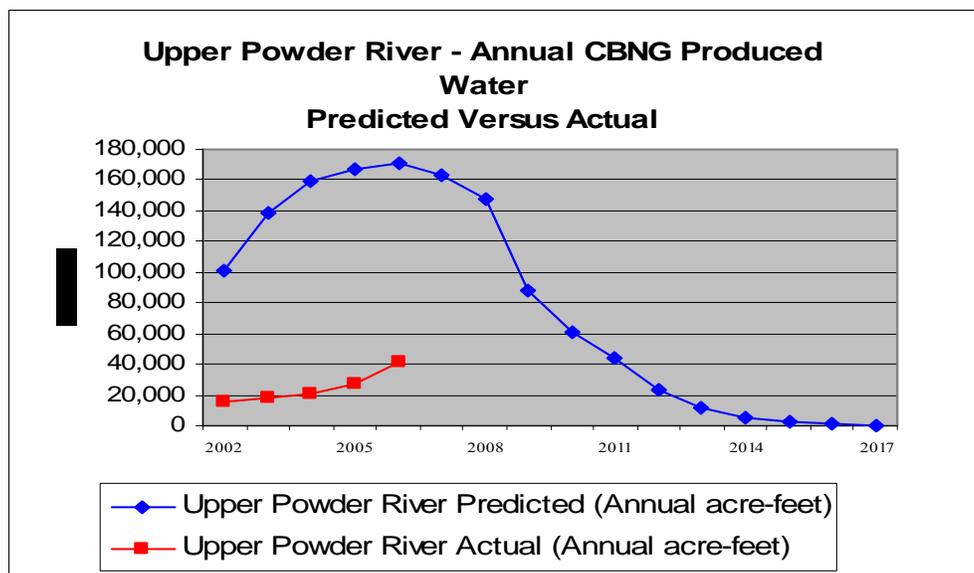
The analysis in this section includes cumulative data from Fee, State and Federal CBNG development in the **Upper Powder River** watershed. These data were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC).

As of December 2006 all producing CBNG wells in the **Upper Powder River** watershed have discharged a cumulative volume of **123,984** acre-ft of water compared to the predicted **736,519** acre-ft disclosed in the PRB FEIS (Table 2-8 page 2-26). These figures are presented graphically in Figure 4.1 and Table 4.6 following. This volume is **17** % of the total predicted produced water analyzed in the PRB FEIS for the **Upper Powder River** watershed.

Table 4.6 Actual vs predicted water production in the Upper Powder River watershed 2006 Data Update 3-16-07

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
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				
2008	147,481	1,047,521				
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		123,984			

Figure 4.1 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. As the two states develop a better understanding of the effects of CBM discharges through the enhanced monitoring required by the MOC, they can adjust the permitting approaches to allow more or less discharges to the Powder River drainage. 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) However, ongoing litigation between Wyoming and Montana will eventually determine the water quality and quantity parameters which will be applied to CBNG produced water disposal in the PRB.

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 and the total amount that was predicted in the PRB FEIS, which is approximately 17% of that total (see section 4.4.2.1).
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.

4.5. Cultural Resources

Non eligible sites 48JO3795, 48JO3820, 48JO3821 and 48JO3822 will be impacted by the project. There are no eligible sites within the APE of 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 9/7/07 that no historic properties exist within the APE.

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).

5. CONSULTATION/COORDINATION

Contact	Title	Organization	Present at Onsite
Frank & Jan Fisher	Surface Owners	Powder River Livestock	No
Anne Harris	Principal Lands Management Representative	State of Wyoming, Office of State Lands	No
Tammi Hitt	Regulatory Analyst	Lance Oil & Gas / Anadarko Petroleum	Yes
Mary Hopkins	Interim Wyoming SHPO	Wyoming SHPO	No
Ethan Jahnke	Federal Permit Coordinator	Lance Oil & Gas / Anadarko Petroleum	Yes
Joy Kennedy	Permitting Specialist	Lance Oil & Gas / Anadarko Petroleum	Yes
Dan Lawrence	Surface Owner	Representing Chas Lawrence	Yes
Joaquin Michelena	Surface Owner	Surface Owner	Yes
Mary Mondragon	Permitting Manager	Lance Oil & Gas / Anadarko Petroleum	No
Brad Rogers	Wildlife Biologist	US Fish & Wildlife Service	Yes

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.

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