

**FINDING OF NO SIGNIFICANT IMPACT & DECISION RECORD**  
**FOR**  
**Anadarko Petroleum Corp**  
**Double Tank Phase II**  
**ENVIRONMENTAL ASSESSMENT –WY-070-07-015**

**DECISION:** Approve Alternative C as described in the attached Environmental Assessment (EA) and authorize **Anadarko Petroleum Corp’s Double Tank Phase II** Coal Bed Natural Gas (CBNG) Plan of Development comprised of the following nine Applications for Permit to Drill (APDs):

	<b>Well Name</b>	<b>Well #</b>	<b>Qtr/Qtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease #</b>
1	Double Tank 2	12-22	SW NW	22	47	75	WYW66409
2	Double Tank 2	14-22	SW SW	22	47	75	WYW66409
3	Double Tank 2	21-22	NE NW	22	47	75	WYW66409
4	Double Tank 2	23-22	NE SW	22	47	75	WYW66409
5	Double Tank 2	32-22	SW NE	22	47	75	WYW66409
6	Double Tank 2	34-22	SW SE	22	47	75	WYW66409
7	Double Tank 2	43-22	NE SE	22	47	75	WYW66409
8	Double Tank 2	14-23	SW SW	23	47	75	WYW56585A
9	Double Tank 2	12-26	SW NW	26	47	75	WYW172632

**DAMS AND RESERVOIRS AUTHORIZED FOR PRODUCED WATER STORAGE**

	<b>Dam Name</b>	<b>QtrQtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease #</b>
1	Davis 43-34-75-47	SENE	34	47	75	WYW0325487
2	Davis 11-35-75-47	NWNW	35	47	75	WYW0325487
3	Little Buffalo	SENE	26	47	75	WYW172632
4	Dorothy	SENE	35	47	75	WYW0325487

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 Plan of Development, 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.
  - Provide water well agreements to the owners of record for permitted water wells within the area of influence of the action.
  - 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 environmental impacts.
6. 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 potential environmental impacts from the proposed action, I have determined that NO significant impacts are expected 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  
 Anadarko Petroleum Corp  
 Double Tank Phase II  
 PLAN OF DEVELOPMENT  
 WY-070 07 015**

**INTRODUCTION**

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

**PURPOSE AND NEED**

The purpose for the proposal is to produce coal bed natural gas (CBNG) on **three (3)** federal oil and gas mineral leases issued to the applicant by the BLM. 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.

**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

**ALTERNATIVES INCLUDING THE PROPOSED ACTION**

**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.

**Alternative B Proposed Action**

Proposed Action Title/Type: **Anadarko Petroleum Corporation, Double Tank Phase II** Plan of Development (POD) for coal bed natural gas well APD’s and associated infrastructure.

Proposed Well Information: There are nine wells proposed within this POD, as follows:

	<b>Well Name</b>	<b>Well #</b>	<b>Qtr/Qtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease #</b>
1	Double Tank 2	12-22	SW NW	22	47	75	WYW66409

	<b>Well Name</b>	<b>Well #</b>	<b>Qtr/Qtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease #</b>
2	Double Tank 2	14-22	SW SW	22	47	75	WYW66409
3	Double Tank 2	21-22	NE NW	22	47	75	WYW66409
4	Double Tank 2	23-22	NE SW	22	47	75	WYW66409
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7	Double Tank 2	43-22	NE SE	22	47	75	WYW66409
8	Double Tank 2	14-23	SW SW	23	47	75	WYW56585A
9	Double Tank 2	12-26	SW NW	26	47	75	WYW172632

There are four impoundments proposed for storage of produced water:

	<b>Dam Name</b>	<b>QtrQtr</b>	<b>Section</b>	<b>TWP</b>	<b>RNG</b>	<b>Lease #</b>
1	Davis 43-34-75-47	SENE	34	47	75	WYW0325487
2	Davis 11-35-75-47	NWNW	35	47	75	WYW0325487
3	Little Buffalo	SENW	26	47	75	WYW172632
4	Dorothy	SENE	35	47	75	WYW0325487

County: Campbell

Applicant: Anadarko Petroleum Corporation

Surface Owners: Frank Fisher, Flying T Ranch-Mary Kyle Coltrane-General Partner for Flying T Ranch

The proposed action involves the following:

- Drilling of 9 total federal CBM wells into the Big George coal zone to depths of approximately 1300 feet.
- An unimproved and improved road network.
- A water management plan that involves the following infrastructure and strategy: 5 discharge points and 4 stock water reservoirs within the Upper Powder River.
- A buried gas, water, and power line network, and one compression facility.

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, Drilling Plan, and Water Management Plan in the Plan of Development (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 Master Surface Use Plan, Drilling Program and Water Management Plan, in addition to the Standard Conditions of Approval contained in the PRB FEIS Record of Decision Appendix A, are incorporated and analyzed in this alternative.

Additionally, the Operator, in their Plan of Development, 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 Provide water well agreements to the owners of record for permitted water wells within the area of influence of the action.
- 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.

### **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 **Double Tank Phase II** POD are listed below under 2.3.1:

#### **Changes as a result of the on-sites**

1. Well 23-22 was relocated to increase the distance and reduce impacts to a raptor nest.

#### **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 *Conditions of Approval* (COAs) and will be in addition to stipulations applied at the time of lease issuance and any standard conditions of approval.

#### **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.

#### **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 road and pipelines will be constructed perpendicular to flow. Culverts will be installed at appropriate locations for streams and channels crossed by roads as specified in the

BLM Manual 9112-Bridges and Major Culverts and Manual 9113-Roads. Streams will be crossed perpendicular to flow, where possible, and all stream crossing structures will be designed to carry the 25-year discharge event or other capacities as directed by the BLM.

- 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 CBM water on downstream irrigation use may require operators to increase the amount of storage of CBM water during the irrigation months and allow more surface discharge during the non-irrigation months.

#### **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 CBM discharges at concentrations exceeding detectable limits.

#### **Vegetation**

1. Temporarily fence reseeded areas, if not already fenced, for at least two complete growing seasons to insure reclamation success on problematic sites (e.g. close to livestock watering source, erosive soils etc.).

#### **Wildlife**

1. For any surface-disturbing activities proposed in sagebrush shrublands, the Companies will conduct clearance surveys for sage-grouse breeding activity during the sage-grouse's breeding season before initiating the activities. The surveys must encompass all sagebrush shrublands within 0.5 mile of the proposed activities.
2. 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.
3. 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.
4. 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.

#### **Threatened, Endangered, or Sensitive Species**

##### **Bald Eagle**

1. Special habitats for raptors, including bald eagles, will be identified and considered during the review of Sundry Notices.
2. Surveys for active bald eagle nests and winter roost sites will be conducted within suitable habitat by a BLM approved biologist. Surface disturbing activities will not be permitted within one mile of suitable habitat prior to survey completion.

3. 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 minimum disturbance buffer zone of one mile will be established for all bald eagle nest sites (February 15 – August 15). These buffer zones and timing may be adjusted based on site-specific information through coordination with, and written approval from, the USFWS.
4. A disturbance-free buffer zone of 0.5 mile (i.e., no surface occupancy) will be established year-round for all bald eagle roost sites. A seasonal minimum 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.
5. Within 1 mile of bald eagle winter roost sites additional measures such as remote monitoring and restricting maintenance visitation to between 9:00 and 3:00 may be necessary to prevent disturbance (November 1 – April 1).
6. 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.

#### **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.

#### **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.

#### **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.

#### **Site specific mitigation measures**

##### **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 Double Tank Phase 2 POD, Carlsbad Canyon (2.5Y 6/2), from the Munsell Soil Color Chart.
2. There were two major ecological sites identified at the onsite inspection within this POD. In order to expediently re-claim and re-vegetate the disturbed surfaces, two seed mixes have been identified for

the specific ecological site areas. These mixes will be applied to any surface disturbance related to the project on Federal surface. 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 at Well Sites Locations**

Seed Mix A		Seed Mix B
Clay Loam		Silty Loam
12-22	14-22	14-23
21-22	23-22	
32-22	34-22	
43-22	12-26	

**Seed Mix A - Clayey Eco Site**

Species	% in Mix	Lbs PLS*
<i>Western Wheatgrass</i> (Pascopyrum smithii)	35	4.2
<i>Green needlegrass</i> (Nassella viridula)	40	4.8
<i>Bluebunch wheatgrass</i> (Pseudoroegneria spicata ssp. Spicata)	10	1.2
<i>Prairie coneflower</i> (Ratibida columnifera)	5	0.6
<i>White or purple prairie clover</i> (Dalea candidum, purpureum)	5	0.6
<i>Rocky Mountain beeplant</i> (Cleome serrulata)/or <i>American vetch</i> (Vicia americana)	5	0.6
<b>Totals</b>	<b>100%</b>	<b>12 lbs/acre</b>

**Seed Mix B – Silty / Sandy Loam Eco Site**

Species	% in Mix	Lbs PLS*
<i>Thickspike Wheatgrass</i> (Elymus lanceolatus ssp. lanceolatus)	20	2.4
<i>Bluebunch Wheatgrass</i> (Pseudoroegneria spicata ssp. Spicata)	15	1.8
<i>Prairie sandreed</i> (Calamovilfa longifolia)	30	3.6

Species	% in Mix	Lbs PLS*
<i>Needleandthread</i> ( <i>Hesperostipa comata</i> ssp. <i>comata</i> )	20	2.4
<i>Prairie coneflower</i> ( <i>Ratibida columnifera</i> )	5	0.6
<i>White or Purple Prairie Clover</i> ( <i>Dalea candidum</i> , <i>purpureum</i> )	5	0.6
<i>Scarlet Globemallow</i> ( <i>Sphaeralcea coccinea</i> ) / or <i>Blue flax</i> ( <i>Linum lewisii</i> )	5	0.6
1 Totals	<b>100%</b>	<b>12 lbs/acre</b>

\*PLS = pure live seed

\*Northern Plains adapted species

\*Double this rate if broadcast seeding

This is a recommended seed mix based on the native plant species listed in the NRCS Ecological Site descriptions, U.W. College of Ag., and seed market availability. A site-specific inventory will allow the resource specialist to suggest the most appropriate species, percent composition, and seeding rate for reclamation purposes.

\*PLS = pure live seed

- In order to insure that 90% pure seed mixes are applied, the operator will provide the seed stock labels for any seed applied on Federal surface to the Authorized Officer in the BFO.
- The culvert locations will be staked prior to construction. The culvert invert grade and finished road grade will be clearly indicated on the stakes. Culverts will be installed on natural ground, or on a designed flow line of a ditch. The minimum cover over culverts will be 12" or one-half the diameter whichever is greater. Drainage laterals in the form of culverts or waterbars shall be placed according to the following spacing:

<u>Grade</u>	<u>Drainage Spacing</u>
2-4%	310 ft
5-8%	260 ft
9-12%	200 ft

- Provide 4" of aggregate where grades exceed 8%.
- Low water crossings will be inspected after any precipitation event. Any damage caused by running water (erosion, rock re-location, etc.) will be repaired/remediated to the landowner's satisfaction as soon as practicable following the event/inspection.

### Wildlife

- No surface disturbing activity will be allowed within ½ mile of documented active raptor nests from February 1 through July 31, annually, prior to a raptor nest occupancy survey for the current breeding season. This timing restriction affects the following:

BLM ID	Species	Wells & Assoc. Infrastructure
2530	UNK	12-22, 21-22, 32-22,34-22, 14-22, 23-22

673	RTHA	32-22, 23-22, 14-22, 34-22
4597	RTHA	14-23, 43-22, 34-22, 12-26
3884	FEHA	14-22
1449	FEHA	12-26
4596	FEHA	12-26

- a. 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.
  - b. Well metering, maintenance and other site visits within 0.5 miles of raptor nests should be minimized as much as possible during the breeding season (February 1 – July 31).
  - c. Surveys to document nest occupancy shall be conducted by a biologist following BLM protocol, between April 15 and June 30. All survey results shall be submitted in writing to a Buffalo BLM biologist and approved prior to surface disturbing activities. Surveys outside this window may not depict nesting activity. If a survey identifies active raptor nests, a ½ mile timing buffer will be implemented. The timing buffer restricts surface disturbing activities within ½ mile of occupied raptor nests from February 1 to July 31.
  - d. Productivity checks for raptor nests 673, 4596, and 4597 shall be completed for five years following construction completion. The productivity check shall be conducted no earlier than June 1 or later than June 30 and any evidence of nesting success/production or failure shall be recorded. Survey results will be submitted to a Buffalo BLM biologist in writing no later than July 31 of each survey year.
2. The following conditions will reduce impacts to sage-grouse:
    - a. A sage-grouse timing restriction shall apply to the entire Double Tank phase 2 project area. No surface disturbing activities are permitted within 2 miles of the Cottonwood lek (March 1-June 15), until sage-grouse surveys have been completed and determine the lek to be inactive.
    - b. Sage-grouse surveys are required throughout the project area for the current breeding season and results reviewed by a BLM biologist. This condition will be implemented on an annual basis for the duration of surface disturbing activities.
    - c. If an active 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.

### **Water Management**

1. Discharges into valley bottoms with no defined low-flow channels will be confined to as narrow an area as possible in order to minimize impacts to the valley’s vegetation and soils.

### **Cultural Resources**

1. Construction Monitoring / Archeological Monitoring: All earth moving activity in the following areas will be monitored by an archeologist who meets or exceed the qualification standards recommended by the Secretary of the Interior. The Bureau has identified these areas as containing the potential for buried cultural deposits (areas containing deep alluvial deposits). The Bureau will require the submission of two copies of a monitoring report within 30 days of the completion of work.

All earth moving activities within alluvial deposits of Beaver Creek in T47N R75W Sections 22 and 27.

The determination of the exact monitoring areas is based on the discretion of the archeological monitor, although, all alluvial deposits on the terraces and valley bottom must be monitored.

**Alternatives considered but not analyzed in detail**

No alternative water management strategies were evaluated by the operator and discussed in this plan of development.

**DESCRIPTION OF AFFECTED ENVIRONMENT**

Applications to drill were received by the NFO on June 26<sup>th</sup>, 2006. Field inspections of the proposed **Double Tank Phase 2** CBM project were conducted on August 16<sup>th</sup>, 2006 and March 22<sup>nd</sup>, 2007 by:

James Bashor – BLM	Alice Tratebras – BLM
Ben Adams – BLM	Nate West – BLM
Pat Walker – Anadarko Petroleum	Daryl Atbert – Anadarko Petroleum
Chuck Williamson – Rocky Mountain Permitting	Jeff Ramsey – Anadarko Petroleum

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.**

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

**Physical Characteristics**

The proposed Double Tank Phase II POD is located approximately 35 miles southwest of Gillette, Wyoming, within Campbell County. Elevations within the project area range from 4,710 to 4,840

feet above sea level. The topography throughout most of the project area consists of ephemeral stream bottomlands rising to sagebrush and grassland habitats with steep sloping ridges and draws. Beaver Creek and various unnamed tributaries drain the project area. The climate in the area is semi-arid, averaging 10-14 inches of precipitation annually, more than 55% of which occurs between May and September. Coal bed natural gas and conventional oil and gas development along with livestock grazing constitute the major land uses within the general area.

### **Vegetation & Soils**

The project area is dominated by shallow clayey loam 10-14" Northern Plains (10-14 NP) precipitation zone ecological sites. The shallow loamy site occurs on steep slopes and ridge tops, but may occur on all slopes. The soils of this site are shallow (less than 20" to bedrock), well-drained soils formed in alluvium over residuum or residuum. The loamy site occurs on gently undulating rolling land. The soils on this site are deep to moderately deep (more than 20" to bedrock), well drained and moderately permeable. Shallow sandy (10-14 NP) ecological site occurs on nearly level to 50% slopes. The soils of this site are shallow well-drained soils formed in eolian deposits or alluvium over residuum or residuum. Other ecological sites occur within the project area, including sands (10-14 NP), sandy (10-14 NP), clayey (10-14 NP), shallow clayey (10-14 NP), dense clay (10-14 NP) lowland (10-14 NP), and clayey overflow (15-17NP). Off road/trail use may increase the hazard of erosion ranges from slight to moderate within the project area. Reclamation potential varies within the project area.

Vegetation varies among the ecological sites. Commonly occurring species include western wheatgrass, blue grama, prairie junegrass, bluebunch wheatgrass, blue grasses, needle-and-thread, green needlegrass, threadleaf sedge, Wyoming big sagebrush, fringed sagewort, prickly pear, and annual bromes.

### **Wetlands/Riparian**

There are small areas containing hydrophytic vegetation in the pools and downstream of existing dams created by reservoir seepage (Hayden-Wing 2006). Vegetation identified included cordgrass, cattail, and sedges.

The main channel of Beaver Creek through the POD is characterized by a well defined channel incised into a well developed, broad floodplain bordered by relatively low hills. Along certain reaches, the channel passes along the base of these hills, creating nearly vertical cutbanks, highly susceptible to erosion and exhibiting evidence of high wall calving (sloughing). The vegetation in the floodplain is predominantly greasewood and sagebrush, depending on soil conditions. The channel appears stable at this time.

### **Invasive Species**

Kochia, Russian thistle, and cheatgrass infestations were identified by the project proponent.

### **Wildlife**

#### **Big Game**

The project area is a yearlong use area for both mule deer and pronghorn antelope. Yearlong use is defined as when a substantial portion of a population makes general use of the habitat on a year-round basis. Big game range maps are available in the PRB FEIS and from the WGFD.

#### **Aquatics**

The project area does not support any aquatic species habitat.

#### **Migratory Birds**

Migratory birds are those that migrate from one locality to another for the purposes of breeding, and or foraging at some point during the calendar year. Please refer to the PRB FEIS for a list of potential migratory bird species that may occur in the project area.

### **Raptors**

Several species of raptors may potentially be found in the habitat types associated with the proposed POD area. For a list of potential raptor species that may occur in the proposed project area please refer to the PRB FEIS. The BLM database contains seven raptor nests within one-half mile of the Double Tank POD. The status and location of these nests in 2007 are as follows.

<b>BLM #</b>	<b>UTM E</b>	<b>UTM N</b>	<b>SEC</b>	<b>TWN</b>	<b>RNG</b>	<b>SPECIES</b>	<b>SUBSTRATE</b>	<b>ACTIVITY</b>
673	431286	4875586	22	47	75	RTHA	CTL	INDE
1449	432866	4874933	26	47	75	FEHA	GHS	GONE
2530	430711	4875894	22	47	75	UNK	CLF	
3884	430138	4874875	28	47	75	FEHA	CKB	INAC
3885	429995	4874825	28	47	75	FEHA	GHS	INAC
4596	431656	4874618	27	47	75	FEHA	MMS	ACTI
4597	431612	4875238	22	47	75	RTHA	CTL	ACTI

### **Threatened and Endangered and Sensitive Species**

#### **Threatened and Endangered Species**

##### **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 Wyoming Game and Fish Department (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).

No active prairie dog colonies are present in the project area.

##### **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. 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, and a new site in 2006 (Bills 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.

Double Tank POD has limited potential to support Ute ladies'-tresses due to the lack of historical water sources existing in the area. The areas surveyed were determined by Hayden-Wing to be unsuitable habitat for Ute ladies'-tresses due to the presence of: (1) heavy clay and strongly alkaline soils, (2) the water table lower than 12 inches below the soil surface, (3) minimal or non-existent subterranean irrigation, (4) water flow in Beaver Creek and North Prong Pumpkin Creek is ephemeral and dependent

upon precipitation events, and (5) where present, hydrophytic vegetation such as cordgrass, cattail, and sedge is dense and usually more than 24 inches in height (Hayden-Wing 2006).

### **Sensitive Species**

#### **Black-tailed prairie dog**

There are no active prairie dog colonies in the project area.

#### **Greater sage grouse**

The greater sage-grouse is 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 12<sup>th</sup>, 2005, the USFWS issued a decision that the listing of the greater sage-grouse was “not warranted” following a Status Review. The decision document supporting this outcome noted the need to continue or expand all conservation efforts to conserve sage-grouse. A judge recently ordered the USFWS to conduct a new Status Review as a result of a lawsuit and questions surrounding the 2005 review (Winmill Decision Case No. CV-06-277-E-BLW, December 2007).

Greater sage-grouse are found in prairie, sagebrush shrublands, other shrublands, wet meadows, and agricultural areas; they depend upon substantial sagebrush stands for nesting and winter survival (BLM 2003). Sage-grouse attend traditional courtship areas called leks which are in or adjacent to sagebrush dominated habitat.

The project area is predominantly sagebrush/grassland. Suitable sage-grouse habitat is present throughout the project area. The Double Tank project area is suited for sage-grouse breeding, nesting, and wintering grounds. Habitats within the project area, especially the moderately dense stands of sagebrush grasslands scattered throughout the project area have potential to support sage-grouse throughout the year. Moist draws and tributaries within the project area may provide brood rearing and late summer habitat, while other areas of higher sagebrush densities provide potential for nesting sage-grouse. There is one lek within two miles of the project area that is included in the WGFDB database. The Cottonwood lek is just over 0.5 miles northwest of the POD boundary. The lek had a peak count in 2006 of 28 displaying males.

#### **Mountain plover**

The topography is rolling hills with the dominant vegetation being Wyoming big sagebrush. The area is not suitable mountain plover habitat. Dominant shrubs over 12 inches tall and rolling hills preclude the use of the area by mountain plovers.

#### **Bald eagle**

Produced water will flow into one existing reservoir and four proposed reservoirs which may potentially attract eagles if reliable prey is present. The reservoir attracts waterfowl however; other reliable food sources are not present in the project area.

#### **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](http://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

\*Wyoming Department of Health Records September 12, 2007.

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.

### **Water Resources**

The project area lies entirely within the Beaver Creek watershed. Beaver Creek is a direct tributary to the **Upper Powder River approximately 30 stream miles away.**

### **Groundwater**

Wyoming Department of Environmental Quality (WDEQ) water quality parameters for groundwater classifications (Chapter 8 – Quality Standards for Wyoming Groundwater) define the following limits for Total Dissolved Solids (TDS) and the classes of groundwater; 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 PRB EIS Record of Decision 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 related to groundwater, the plan identified the following (PRB EIS ROD page E-4):

- The effects of infiltrating 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 CBNG impoundments
- 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 any 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 Engineers Office Ground Water Rights Database for this area showed 50 registered stock/CBM and 4 registered stock water wells within the POD boundary ranging in depth from 180 to over 1400 feet. For additional information on water, please refer to the PRB FEIS FEIS (January 2003), Chapter 3, Affected Environment pages 3-1 through 3-36 (groundwater) and 3-36 through 3-56 (surface water).

### **Surface Water**

The project area lies entirely within the Beaver Creek watershed which is tributary to the Upper Powder River drainage system. All of the channels in the project area are ephemeral (flowing only in response to a precipitation event or snow melt – PRB FEIS Chapter 9 Glossary). The main channel of Beaver Creek through the POD is characterized by a well defined channel incised into a well developed, broad floodplain bordered by relatively low hills. Along certain reaches, the channel passes along the base of these hills, creating nearly vertical cutbanks, highly susceptible to erosion and exhibiting evidence of high wall calving (sloughing). Vegetation in the floodplain is predominantly greasewood and sagebrush, depending on soil conditions. The channel appears stable at this time. However, it has been some time since the occurrence of a major flooding precipitation event. Those that have occurred over the past decade or so have served to cut down the current channel to its present level.

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, 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 (PRB FEIS page 3-49).

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

The operator has stated that no natural springs were identified within one-half mile of the POD boundary.

### **Cultural Resources**

A Class III cultural resource inventory was conducted for the Double Tank Phase 2 project prior to on-the-ground project work (BFO project no. 70060189). The inventory was conducted for three block areas totaling 1190 acres and linear areas comprising 7.6 acres. Four cultural resource locations were identified and all are considered not eligible to the NRHP (Table 3.4).

ARCADIS-Greystone Environmental Consultants conducted the Class III cultural resource inventory following the Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (48FR190) for the proposed project. Alice Tratebras, Newcastle Field Office archaeologist, reviewed the reports for technical adequacy and compliance with BLM standards, and determined them to be adequate.

**Table 3.4 Sites Identified in the Surveys**

<b>Site Number</b>	<b>Site Type</b>	<b>National Register Eligibility</b>
48CA5939	Multi-component artifact scatter	Not Eligible
48CA5940	Prehistoric lithic scatter	Not Eligible
48CA5941	Prehistoric camp	Not Eligible
48CA5942	Prehistoric camp	Not Eligible

## **ENVIRONMENTAL CONSEQUENCES**

The changes to the proposed action plan of development, 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.

### **Vegetation & Soils Direct and Indirect Effects**

Impacts to vegetation and soils from surface disturbance would be reduced by following the operator's plans and BLM applied mitigation. The 9 proposed wells will not require constructed (cut & fill) well pads. Surface disturbance would involve digging-out of rig wheel wells (for leveling drill rig on minor slopes), reserve pit construction (estimated approximate size of 10 x 30 feet), and compaction (from vehicles driving/parking at the drill site). Estimated disturbance associated with these 9 wells would involve approximately 0.1 acre/well for 0.9 total acres. This would be a short-term impact with expedient, successful reclamation and site-stabilization, as committed to by the operator in their POD Surface Use Plan and as required by BLM in Conditions of Approval (COAs).

Approximately 0.47 miles of improved roads would be constructed to provide access to various well locations. Approximately 1.39 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. No pipelines will 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 Master

Surface Use Plan and the Water Management Plan 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 only 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	9	0.1/acre	0.9	Long Term
Constructed Pad	0	or Site Specific	0	
Gather/Metering Facilities	0	Site Specific	0	Long Term
Screw Compressors	0	Site Specific	0	Long Term
Monitor Wells	0	0.1/acre	0	Long Term
Impoundments				Long Term
On-channel	4	Site Specific	33.0	
Off-channel	0	Site Specific	0.0	
Water Discharge Points	5	Site Specific or 0.01 ac/WDP	0.5	
*Wetlands Filled	----	Site Specific	0.0	
Channel Disturbance				
Headcut Mitigation*	0	Site Specific	0.0	
Channel Modification		Site Specific	0.0	
Pipeline Crossing*	2	Site Spec or 0.01 acres	0.1	
Road Crossing*	2	Site Spec or 0.01 acres	0.66	
Improved Roads		50' Width or Site Specific		Long Term
No Corridor	0		0	
With Corridor	0.47		2.26	
2-Track Roads		12' Width or Site Specific		Long Term
No Corridor	0		0	
With Corridor	1.39	40' Width or Site Specific	6.74	
Pipelines		40' Width or Site Specific		Short Term
No Corridor	0		0	
With Corridor	2.04		9.88	

Facility	Number or Miles	Factor	Acreage of Disturbance	Duration of Disturbance
Buried Power Cable No Corridor	0	12' Width or Site Specific	0	Short Term
Overhead Powerlines	0.0	15' Width	0	Long Term
Additional Disturbance	0.0	Site Specific	0	

\*Already included in other categories of disturbance, but separated here for USCOE General Permit 98-08 reporting.

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”.

### **Wetland/Riparian**

No wells or other facilities have been located within any wetland or riparian areas.

The storage of CBNG produced water in impoundments has the potential to create wetlands around the impoundments and seepage from these dams can create springs and seeps downstream. These springs and seeps will eventually have all the characteristics of wetlands during the time that water is stored behind the dams. It is not clear what will happen to these artificially created wetlands when water is no longer being produced or how long it might take these areas to return to pre-development conditions, if they ever return. Should sufficient seepage occur, or should discharge from reservoirs become practiced, and these upper reaches of Beaver Creek become “perennialized”, damage to the floodplain could occur when ice develops and forces water out of the channel. In addition, perennial flows would cause sloughing of high banks, creating dams and wetlands and adding sediment to the system.

### **Invasive Species**

Utilization of existing facilities and 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. Mitigation as required by BLM applied COAs will reduce potential impacts from noxious weeds and invasive plants.

### **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 would occur to soils and vegetation as a result of discharged produced CBNG water. The cumulative effects on vegetation and soils relative to this project are anticipated to be within the parameters of 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 only approximately 17% of that total (see section 4.4.2.1).

- The WDEQ/WQD enforcement of the terms and conditions of the NPDES permit that are designed to protect irrigation downstream.
- The commitment by the operator to monitor the volume of water flowing into Beaver Creek and to construct additional downstream reservoirs, if necessary, to prevent significant volumes of water from flowing into the Powder River.
- The water management plan for the Double Tank Phase 2 plan of development proposes that produced water will not contribute to significant flows downstream in the Powder River.

## **Wildlife**

### **Big Game Direct and Indirect Effects**

Under the environmentally preferred alternative, habitat for pronghorn antelope and mule 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 likely be displaced from the project area during drilling and construction. A study in central Wyoming reported that mineral drilling activities displaced mule deer by more than 0.5 miles (Hiatt and Baker 1981). The WGFD 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 (WGFD 2004). A multi-year study on the Pinedale Anticline suggests not only do mule deer avoid mineral activities, but after three years of drilling activity the deer have not 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. The Pinedale Anticline study suggests mule deer do not readily habituate to human activities. 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.

### **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. No additional mitigation measures are required.

### **Aquatics Direct and Indirect Effects**

There will be no effect to aquatic species or habitat.

### **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 4-247. No additional mitigation measures are required.

**Migratory Birds Direct and Indirect Effects**

Within the proposed project area both the short-grass prairie and the sagebrush shrubland habitats would be disturbed, which could potentially impact migratory birds. Native habitats are being lost directly with the construction of wells, roads, and pipelines. Prompt re-vegetation of short-term disturbance areas should reduce habitat loss impacts. Human activities likely displace migratory birds farther than simply the physical habitat disturbance. Drilling and construction noise can be troublesome for songbirds by interfering with the males’ ability to attract mates and defend territory, and the ability to recognize calls from conspecifics (BLM 2003).

Stock tanks provide attractive watering sites for migratory birds, which can become trapped within the tanks and drown. Ramps or similar structures within the tanks can provide a means for trapped birds to escape.

Migratory birds and their active nests are protected under the Migratory Bird Treaty Act. Prior to any ground disturbing activities in sagebrush stands searches for active nests should be conducted. Intentional destruction of an active nest is a violation of the Migratory Bird Treaty Act. Additional direct and indirect effects to migratory birds are discussed in the PRB FEIS (4-231-235).

**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. No additional mitigation measures are required.

**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. 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.

To reduce the risk of decreased productivity or nest failure, the BLM BFO commonly requires a one-half mile radius timing limitation during the breeding season around active raptor nests and recommends all infrastructure requiring human visitation to be located greater than one-quarter mile from occupied raptor nests. However future activity associated with maintenance and operation may still have a negative effect on nesting raptors. Disturbances during nest selection periods may result in raptors not selecting the existing nest locations forcing them to relocate to other, possibly less suitable locations. Well 23-22 was relocated to reduce negative effects to raptor nest productivity. Surface disturbing activities will be limited during the nesting season for the following wells and their associated infrastructure (roads, utilities, water management infrastructure, etc.) to reduce negative effects to raptor nesting:

<b>BLM ID</b>	<b>Species</b>	<b>Wells &amp; Assoc. Infrastructure</b>
2530	UNK	12-22, 21-22, 32-22,34-22, 14-22, 23-22
673	RTHA	32-22, 23-22, 14-22, 34-22
4597	RTHA	14-23, 43-22, 34-22, 12-26
3884	FEHA	14-22

1449	FEHA	12-26
4596	FEHA	12-26

Additional direct and indirect impacts to raptors, from oil and gas development, are analyzed in the PRB FEIS (4-216-221).

**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.

**Threatened and Endangered and Sensitive Species**

**Threatened and Endangered Species Direct and Indirect Effects**

**Table 4.2 (T&E table)**

<b>Common Name (scientific name)</b>	<b>Habitat</b>	<b>Presence</b>	<b>Project Effects</b>	<b>Rationale</b>
<b>Endangered</b> Black-footed ferret ( <i>Mustela nigripes</i> )	Black-tailed prairie dog colonies or complexes > 80 acres.	NP	NE	Block clearances for black-footed ferret conducted by WY Game and Fish.
<b>Threatened</b> Utes ladies'-tresses orchid ( <i>Spiranthes diluvialis</i> )	Riparian areas with permanent water	NP	NE	Habitat is lacking due to poor soils, vegetation cover, and lack of perennial water.

**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**

**LAA** Likely to adversely affect

**NE** No Effect.

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

**Black-footed ferret**

There are no active prairie dog colonies in the project boundary.

Because it is highly unlikely ferrets are present and there is no habitat, implementation of the proposed development should have "no effect" on the black-footed ferret.

**Ute's Ladies Tresses Orchid**

Proposed infrastructure and well sites are located in uplands, away from drainages and wet areas. One well access road crosses an ephemeral wash. The wash has upland vegetation characteristics and has no flowing water.

Reservoir seepage may create suitable habitat if historically ephemeral drainages become perennial, however no historic seed source is present within the project area. Implementation of the proposed coal bed natural gas project should have "no effect" on the Ute ladies' - tresses orchid.

## Sensitive Species Direct and Indirect Effects

**Table 4.3 (Sensitive Species table)**

Common Name (scientific name)	Habitat	Presence	Project Effects	Rationale
<b><i>Amphibians</i></b>				
Northern leopard frog ( <i>Rana pipiens</i> )	Beaver ponds, permanent water in plains and foothills	S	MIIH	Additional water will affect existing waterways.
Spotted frog ( <i>Ranus pretiosa</i> )	Ponds, sloughs, small streams	NP	NI	Prairie not mountain habitat.
<b><i>Birds</i></b>				
Baird's sparrow ( <i>Ammodramus bairdii</i> )	Grasslands, weedy fields	S	MIIH	Grassland habitats will be impacted.
Brewer's sparrow ( <i>Spizella breweri</i> )	Basin-prairie shrub	K	MIIH	Sagebrush will be impacted by the proposed action
Burrowing owl ( <i>Athene cunicularia</i> )	Grasslands, basin-prairie shrub	NP	NI	No prairie dog colonies present.
Ferruginous hawk ( <i>Buteo regalis</i> )	Basin-prairie shrub, grasslands, rock outcrops	S	MIIH	Raptor timing will protect raptors.
Greater sage-grouse ( <i>Centrocercus urophasianus</i> )	Basin-prairie shrub, mountain-foothill shrub	K	WIPV	Sagebrush habitats will be disturbed.
Loggerhead shrike ( <i>Lanius ludovicianus</i> )	Basin-prairie shrub, mountain-foothill shrub	K	MIIH	Scattered shrubs may be affected
Long-billed curlew ( <i>Numenius americanus</i> )	Grasslands, plains, foothills, wet meadows	S	MIIH	Grasslands will be affected.
Mountain plover ( <i>Charadrius montanus</i> )	Short-grass prairie with slopes < 5%	NP	NI	Limited habitat patches available.
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.
Bald Eagle ( <i>Haliaeetus leucocephalus</i> )	Conifer and deciduous forests, cottonwood galleries	S	MIIH	Loss of foraging habitat
Sage sparrow ( <i>Amphispiza billneata</i> )	Basin-prairie shrub, mountain-foothill shrub	S	MIIH	Sage brush will be impacted by the action

<b>Common Name (scientific name)</b>	<b>Habitat</b>	<b>Presence</b>	<b>Project Effects</b>	<b>Rationale</b>
Sage thrasher ( <i>Oreoscoptes montanus</i> )	Basin-prairie shrub, mountain-foothill shrub	K	MIIH	Sage brush will be impacted by the action
Trumpeter swan ( <i>Cygnus buccinator</i> )	Lakes, ponds, rivers	S	MIIH	Existing reservoirs present.
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
<b><i>Fish</i></b>				
Yellowstone cutthroat trout ( <i>Oncorhynchus clarki bouvieri</i> )	Mountain streams and rivers in Tongue River drainage	NP	NI	Outside species range.
<b><i>Mammals</i></b>				
Fringed myotis ( <i>Myotis thysanodes</i> )	Habitat is typically dry with mature coniferous and deciduous trees and grassland edge components and abundant snags.	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, basin-prairie shrub	NP	NI	Cliffs & perennial water not present.
Swift fox ( <i>Vulpes velox</i> )	Grasslands	K	MIIH	Observed in the project area, habitat will be impacted.
Townsend's big-eared bat ( <i>Corynorhinus townsendii</i> )	Forests, basin-prairie shrub, caves and mines	NP	NI	Habitat not present.
<b><i>Plants</i></b>				
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

### **Black-tailed prairie dog**

Prairie dogs will not be affected by this project, there are no black-tailed prairie dog colonies in the project area.

### **Greater sage grouse**

Sage-grouse in the Powder River Basin have experienced an 84% decline in their population in the last 16 years. Leks in CBNG fields have experienced a 75% decrease in their population in the last five years (Walker 2006). About 35% of sage-grouse leks in CBNG fields in the Powder River Basin are still active. Active leks in the basin have experienced about ½ the development when compared with leks that are inactive (Walker 2006).

The Partners in Flight's Western Working Group recommend no net loss of sagebrush habitats (Paige and Ritter 1999). BLM Wyoming policy also states that rehabilitation activities will include sagebrush and appropriate forb species (Bennet 2004). Wells and other infrastructure located within sagebrush communities will result in direct habitat loss. Sage-grouse avoidance of these facilities produces even greater indirect habitat loss. The WGFD feels a well density of eight wells per section creates a high level of impact for sage-grouse and that avoidance zones around mineral facilities overlap creating contiguous avoidance areas (WGFD 2004). Well houses and power poles may provide habitats for mammal and avian predators increasing sage grouse predation. Overhead power lines may also present a collision risk for sage-grouse. Sage-grouse may avoid suitable habitat containing overhead power lines to reduce their exposure to predation.

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).

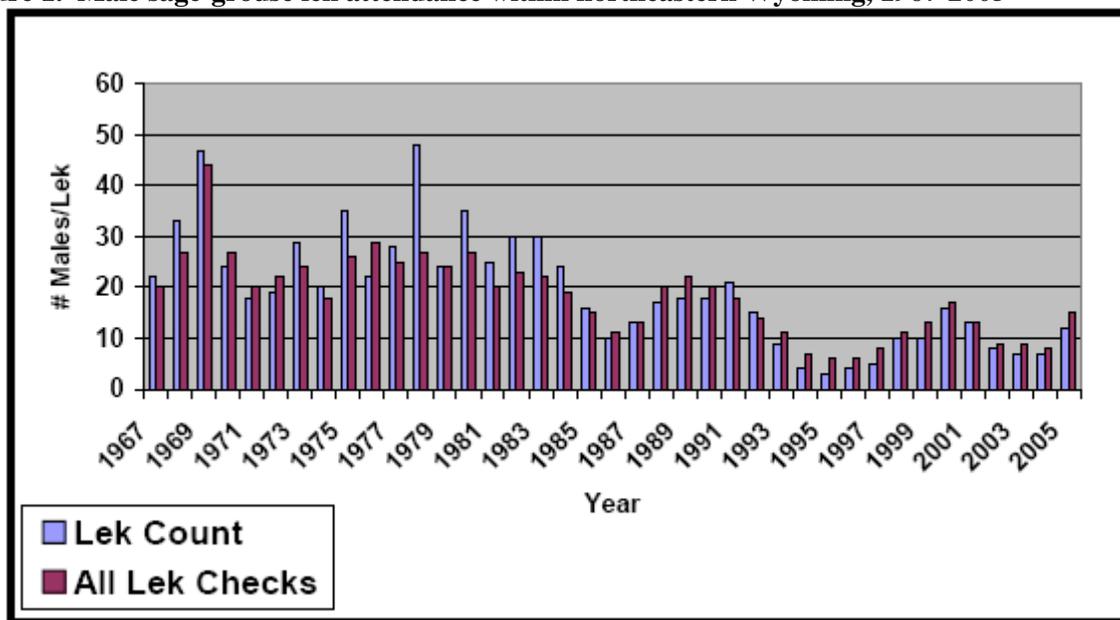
Percentage of sage-grouse nesting within a certain distance from their breeding lek is unavailable for the Powder River Basin. The Buffalo and Miles City field offices through the University of Montana with assistance from other partners including the U.S. Department of Energy and industry are currently 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.

The implementation of this project “*will impact sage-grouse*” 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.”

#### **Mountain plover**

The area is not suitable mountain plover habitat, there will be no effect to this species.

#### **Bald Eagle**

The effect of 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. The surface owner in the project area grazes sheep. The presence of winter killed sheep may provide food source for bald eagles and may influence use in the project area.

#### **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. No additional mitigation measures are required.

#### **West Nile Virus**

The PRB FEIS and ROD included a programmatic mitigation measure that states, “The BLM will consult with appropriate state agencies regarding WNV. If determined to be necessary, a condition of approval will be applied at the time of APD approval to treat mosquitoes for any CBM discharge waters that become stagnant.” This project is likely to result in standing surface water which may potentially increase mosquito breeding habitat. BLM has consulted with applicable state agencies, County Weed and Pest and the State Health Department, per above mitigation in the PRB ROD page 18, regarding the disease and the need to treat. BLM has also consulted with the researchers that are studying the dynamics of WNV species and its effects in Wyoming.

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

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

BLM will keep monitoring this issue by continuing to consult with the State agencies and the researchers working in the area in order to stay abreast of the most current developments and any need to apply mitigation. Based on current information, we determined that no significant impacts in the spread of WNV would occur from the implementation of this project.

#### **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), should alleviate project area and downstream potential 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 Wyoming State Engineers Office (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 30.0 gpm per well or 270.0 gpm (0.6 cfs or 480 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 predicted to have occurred in 2006 at 171,423 acre-feet. As such, the volume of water resulting from the production of these wells is 0.3% of the total volume projected for 2007. This volume of produced water is also within the predicted parameters of the PRB FEIS.

### **Groundwater**

The PRB FEIS, under alternative 2A, predicts an infiltration rate of 40% to groundwater aquifers and coal zones in the Upper Powder River drainage area (PRB FEIS pg 4-5). Therefore, for this action, it may be assumed that a maximum of 108 gpm will infiltrate at or near the discharge points and impoundments (174 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.

Shallow ground water monitoring is ongoing at numerous 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 developed a guidance document, "Compliance Monitoring and Siting Requirements for Unlined Coalbed Methane Produced Water Impoundments" which was approved September, 2006. The Wyoming DEQ's Impoundment Task Force has investigated approximately 800 impoundments over the last year. As a result, 102 impoundments in 52 WYPDES permits have required compliance monitoring. 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

The PRB FEIS predicts that one of the environmental consequences of coal bed natural gas production is 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 water wells in the area. The permitted water wells in the area produce from water bearing zones ranging in depth from 180 to 1400 feet below the ground surface. The targeted Big George coal zone ranges from 1200 to 1330 feet below ground surface. As mitigation, the operator has committed to offer water well

agreements to holders of properly permitted domestic and stock wells within the circle of influence of the proposed wells.

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

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

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

#### **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 CBM 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 CBM 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.

#### **Surface Water**

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 1390.0 mg/l TDS which is within the WDEQ criteria for agricultural use (2000 mg/l TDS). However, land application disposal (irrigation) was not considered as a water management strategy in this plan. 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.

A maximum volume of 30.0 gallons per minute (gpm) per well is projected to be produced from these 9 wells, for a total of 270.0 gpm for the POD. The quality of the water produced from the Big George coal zone by these wells is predicted to be of similar quality to that of the representative water sample collected from a location near the POD. That water quality was determined to be 2140.0 µmhos/cm electrical conductivity (EC), 1390.0 mg/l total dissolved solids (TDS) and 17.3 sodium adsorption ratio (SAR). For more information, please refer to the Water Management Plan (WMP) included in this POD.

Based on the onsite review of discharge points, they have been appropriately sited and utilize appropriate water erosion dissipation designs. The anticipated total maximum volume of water discharged as a result of this POD is 270.0 gpm. Existing and proposed water management facilities were evaluated for compliance with best management practices during the onsite.

#### **Table 4.4 Summary of Water Management Strategy**

##### Primary Watershed

20 % Direct Discharge P  
0 % Containment Pond P  
80 % Infiltration Pond P  
0 % Injection P  
0 % Active Treatment P  
0 % Passive Treatment P  
0 % LAD P  
0 % Other P

To manage the produced water, 4 impoundments (260 acre feet) have been or would potentially be constructed within the project area. These impoundments will disturb approximately 33.0 acres including the dam structures. Of these water impoundments, all 4 are or would be on-channel reservoirs. The existing impoundments will be or have been upgraded to meet the requirements of the WSEO, WDEQ and the needs of the operator and the landowner. All water management facilities were evaluated for compliance with best management practices during the onsite.

The PRB FEIS assumes that 15% of the impounded water will re-surface as channel flow (PRB FEIS pg 4-74). Consequently, the volume of water produced from these wells may result in the addition of 0.08 cfs below the lowest reservoir (after infiltration and evapotranspiration losses). The operator has committed to monitor the condition of the channel and address any problems resulting from this discharge. Discharge from the impoundments could potentially allow for streambed enhancement through wetland-riparian species establishment. The storage of CBNG produced water in impoundments has the potential to create wetlands around the impoundments and seepage from these dams can create springs and seeps downstream. These springs and seeps will eventually have all the characteristics of wetlands during the time that water is stored behind the dams. It is not clear what will happen to these artificially created wetlands when water is no longer being produced or how long it might take these areas to return to pre-development conditions, if they ever return. Should sufficient seepage occur, or should discharge from reservoirs become practiced, and these upper reaches of Beaver Creek become “perennialized”, damage to the floodplain could occur when ice develops and forces water out of the channel. In addition, perennial flows would cause sloughing of high banks, creating dams and wetlands and adding sediment to the system. Sedimentation in the impoundments will occur, 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 necessary for disposal of CBNG water, as required by BLM applied COAs.

Alternative (2A), the approved alternative in the Record of Decision for the PRB FEIS, states that the peak production of water discharged to the surface will occur in 2006 at a total contribution to the mainstem of the Upper Powder River of 68 cfs (PRB FEIS pg 4-86). The predicted maximum discharge rate from these 9 wells is anticipated to be a total of 216 gpm or 0.5 cfs to impoundments along with approximately 54 gpm of direct discharge to Beaver Creek. Using an assumed conveyance loss of 20% (PRB FEIS pg 4-74), the produced water re-surfacing in Beaver Creek from this action (0.08 cfs plus 0.12 cfs direct discharge) may add a maximum 0.2 cfs to the Upper Powder River flows, or 0.3% 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). The POD boundary is approximately 30 stream miles from the Powder River. The addition of the water produced from these wells will not impact the water quantity in the mainstem of the **Upper Powder River**. For more information regarding the maximum predicted water impacts to the Powder River resulting from the discharge of produced water, see Table 4-6 (PRB-FEIS pg 4-85).

In the WMP portion of the POD, the operator did not provide an analysis of the potential development in the watershed above the project area. However, based on the area of the Beaver Creek watershed above the POD (18,514 acres) and an assumed density of one well per location every 80 acres, the potential exists for the development of 231 wells which could produce a maximum water discharge rate of 6930 gpm or 15 cfs. The BLM agrees with the operator that this is not expected to occur because:

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

The potential maximum discharge rate of produced water within the watershed upstream of the project area, 15 cfs, is much less than the estimated of runoff from the 2-year storm event. Therefore, the estimated discharge rate of water produced from the full development in the watershed above the project area is significantly less than the natural runoff from the area.

The proposed method for surface discharge provides passive treatment through the aeration supplied by the energy dissipation configuration at each discharge point's 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 three Wyoming Pollutant Discharge Elimination System (WYPDES) permits for the discharge of water produced from this project from the WDEQ.

Permit effluent limits were set at (WYPDES Part I, page 1):

Total Petroleum Hydrocarbons	10 mg/l max
pH	6.5 to 8.5
Total Dissolved Solids	5000 mg/l max
Specific Conductance	7500 $\mu$ S/cm max
Sulfates	3000 mg/l max
Radium 226	1 pCi/l max
Dissolved iron	248 $\mu$ g/l max
Dissolved manganese	646 $\mu$ g/l max
Total Barium	1800 $\mu$ g/l max
Total Arsenic	7 $\mu$ g/l max
Chlorides	46 mg/l

WYPDES permits WY0049344, WY0049760, and WY0048143, issued by the WDEQ, address existing downstream concerns, such as irrigation use, in the conditions of approval for the permit. The designated points of compliance identified for these permits are at the discharge points.

The WDEQ limits applied to the **Powder River for waters flowing into Montana** are shown in table 4.5 below as most and least restrictive proposed limits. WDEQ water quality parameters for groundwater classifications (Chapter 8 – Quality Standards for Wyoming Groundwater) are also listed and define the

following limits for Total Dissolved Solids.

Also shown in the table is the expected quality of the water for the Big George coal zone in the general vicinity of the POD. This representative sample was collected from Anadarko’s “County Line” project with no location specified.

**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 –		0.5	500
Least Restrictive Proposed Limit		10	2500
Powder River at Arvada, WY			
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 NPDES Permits WY0049344, WY0049760, WY0048143			
At discharge point	5000	Not Stated	7500
At Irrigation Compliance point	Not Stated	Not Stated	Not stated
Predicted Produced Water Quality Big George	1390	13.4	2140

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 well will be sampled for analysis at the wellhead within sixty days of initial production. A copy of the water analysis will be submitted to the BLM Authorized Officer.

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

In-channel downstream impacts are addressed in the Water Management Plan for the Double Tank Phase 2 POD prepared by The RETEC Group, Inc., for Anadarko Petroleum Corporation.

#### Surface Water Cumulative Effects

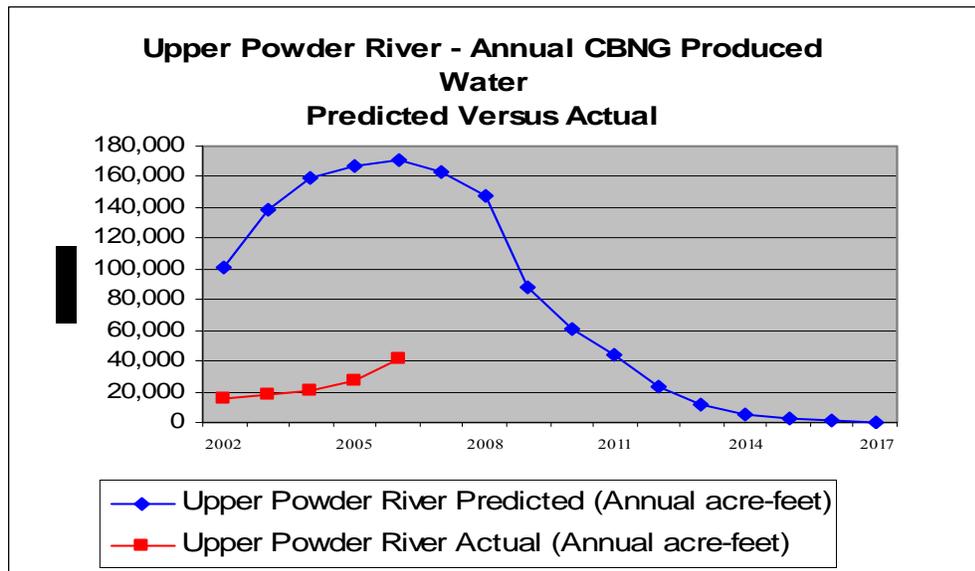
The analysis in this section includes cumulative data from Fee, State and Federal CBNG development in the **Upper Powder River** watershed. These data were obtained from the Wyoming Oil and Gas Conservation Commission (WOGCC).

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 in tabular form in Table 4.4 following. This volume is 84% less than 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				
<b>Total</b>	<b>1,285,233</b>		<b>123,984</b>			

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. Conductivity (EC) and Sodium Adsorption Ratio (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 BLM requires each POD approved under the PRB FEIS to have a designated reference well to be sampled at its wellhead within 60 days of initial production. There is also a series of monitoring wells that are providing additional data. This new data will be evaluated periodically to assess effects.

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). Ongoing litigation may also affect water quality and quantity limits applied to water produced in conjunction with CBNG extraction in Wyoming.

As referenced above, the PRB FEIS did disclose that cumulative impacts would occur to soils and vegetation as a result of discharged produced CBNG water. The cumulative effects relative to this project are anticipated to be within the parameters of 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 only approximately 17% of that total (see section 4.4.2.1).
2. The WDEQ/WQD enforcement of the terms and conditions of the WYPDES permits that are designed to protect irrigation downstream.
3. The commitment by the operator) to monitor the volume of water flowing into Beaver Creek.

The storage of CBNG produced water in impoundments has the potential to create wetlands around the impoundments and seepage from these dams can create springs and seeps downstream. These springs and seeps will eventually have all the characteristics of wetlands during the time that water is stored behind the dams. It is not clear what will happen to these artificially created wetlands when water is no longer being produced or how long it might take these areas to return to pre-development conditions, if they ever return. Should sufficient seepage occur, or should discharge from reservoirs become practiced, and these upper reaches of Beaver Creek become “perennialized”, damage to the floodplain could occur when ice develops and forces water out of the channel. In addition, perennial flows would cause sloughing of high banks, creating dams and wetlands and adding sediment to the system.

Additional mitigation measures may be required as this POD is developed.

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.

### **Cultural Resources**

According to the Wyoming State Protocol Section VII (B)(5) the BLM notified the Wyoming State Historic Preservation Officer (SHPO) that it has determined no historic properties exist within the area potential of effect. No cultural resource sites or historic properties will be impacted by proposed construction.

The project area is characterized by considerable sedimentary fill, including the Beaver Creek floodplain, an upper terrace, aeolian deposits on the uplands, and colluvium on the uplands. Therefore, the Bureau

will require a monitoring requirement for all construction activities within alluvial deposits along the Beaver Creek drainage due to a high potential for buried cultural deposits.

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).

#### CONSULTATION/COORDINATION

Contact	Title	Organization	Present at Onsite?
Sara Needles	Wyoming SHP Officer	Wyoming SHP Office	No
Frank Fisher	Surface Owner		Yes
Pat Walker	Field Foreman	Anadarko Petroleum Corp.	Yes
Eric Noon	Production Foreman	Anadarko Petroleum Corp.	Yes
Chuck Williams	President	Rocky Mountain Permitting	Yes
Carla Ghazizadeh	Sr. Regulatory Analyst	Anadarko Petroleum Corp.	No
Jennifer Radle	Regulatory Analyst	Anadarko Petroleum Corp.	No
Jeff Ramsey	Field Foreman	Anadarko Petroleum Corp.	Yes

#### 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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- Wyoming Department of Environmental Quality (WDEQ), June 14, 2004. Compliance Monitoring for Ground Water Protection Beneath Unlined Coalbed Methane Produced Water Impoundments

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