

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This chapter describes and compares the environmental consequences that may result from implementing the three alternatives presented in Chapter 2. The purpose of this chapter is to present the analyses of the alternative management actions and to disclose the potential impacts of the Federal action on the Fortification Creek Planning Area (FCPA) resources. The Federal action is the Bureau of Land Management's (BLM's) selection of an alternative that will guide the management of the FCPA. The human environment is considered to include both the natural environment (resources) and the BLM multiple-use land management environment (resource uses).

The potential consequences or impacts of each alternative are addressed in the same order of resource topics as was presented in Chapter 3 (i.e., Resources, Resource Uses, Special Designations, and Socioeconomics and Environmental Justice). This parallel organization will allow readers to compare existing resource conditions (Chapter 3) with potential impacts (Chapter 4) for the same resource(s). The impacts analysis of environmental consequences emphasizes key planning issues (see Chapter 1) raised during the scoping process, rather than all possible consequences.

Potential impacts for a particular resource or resource use are discussed primarily in terms of the direct physical change and the indirect consequences of change resulting from the specific management of that resource or resource use under a particular alternative, followed by those impacts from other management on that specific resource or resource use, in turn, resulting from:

- Anticipated level of coal bed natural gas (CBNG) development;
- Elk and special status species management; and
- Management of other resources that may impact the particular resource or resource use under discussion.

The two exceptions to this organization occur in the discussion of Air Quality (Section 4.3.1) and Socioeconomics and Environmental Justice (Section 4.6.). In the case of Air Quality, the impact analysis for CBNG development was conducted in terms of the highest level of potential air quality impacts of the action alternatives (although not at "worst-case" scenario levels).

Therefore, one analysis covers Alternatives I, II, and III and is based on the alternative with the most development.

As discussed in Chapter 2, it is important to remember that the actions described under each alternative would not necessarily be permitted by the adoption of any alternative as a result of the planning process. For example, although new CBNG development may be allowed under some of the alternatives, actual development would only occur after any proposed well locations, road and/or pipeline alignments, and/or other facilities/infrastructure have gone through a permitting process and further National Environmental Policy Act (NEPA) analysis. Furthermore, while the assumptions associated with the alternatives represent reasonable projections of what could occur, it is impossible to predict with certainty the precise location of potential development or a structure, or the precise outcome of any of the alternatives, because of the large number of variables involved.

4.1.1. Analytical Assumptions

The analysis of alternatives describes how each alternative could affect baseline conditions of individual resources in the FCPA. Impacts typically are described by topic, such as surface disturbance, and other resources or resource uses. If a particular allowable use or management action is not discussed for a particular resource, it is because no impacts are expected or the anticipated impact is considered extremely small or highly unlikely to occur.

4.1.2. Types of Effects

When applicable, definitions of the following types of impacts are included in the evaluation of reasonably expected environmental consequences (speculative impacts are not addressed), including:

- **Direct/Indirect Impacts:** In general, direct impacts result from activities authorized by the BLM and generally occur at the same time and place as the management activity or action causing the impact. For example, for the action of building a road, a direct adverse impact is surface disturbance. Surface disturbance is the impact (the effect) of heavy equipment (the cause) removing existing vegetation as it grades the proposed road location. Indirect impacts often occur at some distance or time from the action. In the above example, an indirect impact could occur days after the surface is disturbed, as well as some distance from the disturbance. Heavy precipitation following the removal of vegetation and/or disturbance of the ground surface could erode soil and transport sediment into streams. The impact on stream water quality is considered an indirect adverse impact.
- **Onsite/Offsite Impacts:** Onsite impacts occur within the FCPA. Offsite impacts occur outside the FCPA, but result from an action taken within the FCPA. The degree to which land uses, management actions, and environmental changes under the alternatives would affect other lands depends on the absolute and relative amount of onsite changes, the causal linkage between onsite changes and offsite consequences, and the relationship between changes resulting from the alternative and those that would occur without the alternative.
- **Short- or Long-Term Impacts:** When applicable, the short-term or long-term aspects of impacts are described. Short-term disturbance (pipelines, off-pad disturbance) occurs during or after the activity or action and for this Resource Management Plan Amendment/ Environmental Assessment (RMPA/EA) will be called initial disturbance. While reclamation starts right after the disturbance so that the area is stabilized, revegetation may occur within 5 years. However, vegetation structure, function, and diversity would not return to pre-disturbance status for decades. Long-term impacts last beyond the construction phase, generally beyond the first 2 years (roads, well pads).
- **Cumulative Impacts:** Cumulative impacts result from the interaction of impacts of the alternative along with impacts resulting independently from unrelated non-Federal actions and activities. Cumulative impacts may include private lands within and adjacent to the FCPA (i.e., CBNG development of non-Federal minerals), as well as both private and public lands outside the FCPA. Additionally, cumulative impacts are not necessarily limited to the types of actions and activities affecting BLM lands in the FCPA.

4.1.2.1. Cumulative Impacts

The Council on Environmental Quality (CEQ) regulations state that the cumulative impact analysis should include the anticipated impacts to the environment resulting from “the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time.” (40 CFR 1508.7)

Impacts of the proposed action and alternatives presented in this RMPA/EA are assessed for cumulative impacts with other actions conducted in the region. Unless otherwise specified, the region of influence for each resource in the cumulative analysis is the same as the area defined in Chapter 3. This analysis considers the effects of the management actions considered under each of the alternatives when combined with the effects of other past, present, and future actions in the affected region.

Cumulative actions include CBNG development actions and other proposed land actions and use of those lands, and other reasonably foreseeable future actions. In the Powder River Basin (PRB) these activities include ranching, coal mining, and CBNG and conventional oil and gas development. These activities affect similar elements of the environment, in that they remove surface vegetation, reduce native species and habitat, may introduce invasive species, cause sedimentation to surface water bodies, deplete groundwater aquifers, and introduce hazardous materials to lands and waters.

CBNG development in the FCPA may have an adverse cumulative effect on one or more elements of the environment when combined with other activities in the region. Most significant of these activities is CBNG and conventional oil and gas development on surrounding state, private, and Federal lands.

Quantification of cumulative impacts is difficult for the resources, land uses, and management actions because of:

- Uncertainties regarding the location, scale, and/or rate of changes on BLM lands in the FCPA resulting from the alternatives; and
- Uncertainties about the location, scale, and rate of changes on private lands in, adjacent to, or near the FCPA that would occur irrespective of the alternative.

All of the impacts associated with the implementation of any of the alternatives would be in addition to ongoing existing impacts occurring on Federal lands in the FCPA, private lands within the FCPA, and both public and private lands adjacent to, or near, the FCPA. Even where an estimate of cumulative impacts resulting from offsite causes is available (e.g., the number of CBNG wells in the PRB), it is not known how much long-term surface disturbance would result; to what degree adverse impacts would be avoided or mitigated; or how the impacts would affect other resource values and land uses, such as hunting, visual quality, livestock grazing, and so forth. Therefore, the descriptions of cumulative impacts for the individual resources addressed in Sections 4.3 through 4.6 are necessarily qualitative.

The boundaries used to define impact sources and levels differ by resource. For example:

- For wide-ranging wildlife, such as elk, the cumulative impact area may include offsite habitats that are used by onsite populations and that are subject to impacts from development in the offsite areas; and
- For surface water quality, the cumulative impact area may be one or more watersheds, including all pollutant sources that affect the same water quality parameters potentially impacted by the implemented alternative.

Although these are only examples, they illustrate that cumulative impact boundaries may not only differ considerably among resources, but that the boundaries may be either natural or artificial.

4.2 Methods and Assumptions

The timing and specific location of project-specific actions that could affect resource values are not defined. Moreover, the relationship between cause (future actions) and effect (impact on resources) is not always known or quantifiable. For these reasons, the analysis of alternatives is both qualitative and quantitative and is based on a series of assumptions. The methods and assumptions listed below, and for each resource in the following sections, are presented to provide a basis for the conclusions reached. Assumptions common to all alternatives and all resources are listed below, whereas assumptions unique to specific resources and resource uses are listed under the appropriate resource section.

- All alternatives are implemented in compliance with standard practices, best management practices (BMPs), guidelines for surface-disturbing activities, and applicable laws, standards, policies, and implementation plans, as well as with all BLM polices and regulations.
- An oil and gas lease (including CBNG) grants the lessee the “right and privilege to drill for, mine, extract, remove, and dispose of all oil and gas deposits” in the leased lands, subject to the terms and conditions incorporated in the lease (BLM Form 3100-11, Lease for Oil and Gas). The Secretary of the Interior has the authority and responsibility to protect the environment within Federal oil and gas leases; therefore, restrictions are imposed on the lease terms.
- Provisions in leases that expressly provide the BLM the authority to deny or restrict development, in whole or in part, depend on an opinion provided by the U.S. Fish and Wildlife Service (USFWS) regarding impacts to endangered or threatened species or to habitats of plants and animals that are listed or proposed for listing. If the USFWS concludes that the development likely would jeopardize the continued existence of any endangered or threatened plant or animal species, then the development may be denied in whole or in part.
- Although not defined as a surface-disturbing activity, concentrated livestock and wild ungulate grazing, off-road vehicle use, and fire may remove vegetation and expose the soil surface leading to increased erosion.
- Comparison of impacts among resources is intended to provide an impartial assessment to inform the decision maker and the public. The impact analysis does not imply or assign a value or numerical ranking to impacts. Actions resulting in adverse impacts to one resource may impart a beneficial impact to other resources.
- Key planning issues identified in Chapter 1 provide the focus for the scope of impact analyses in this chapter.

- In general, adverse impacts described in this chapter are considered important if they result from, or relate to:
 - The key planning issues described in Chapter 1;
 - The context and/or intensity of impacts suggests potential impacts to public health and safety;
 - A potential for violating legal standards, laws, and/or protective status of resources; and/or
 - Potential impacts to unique resources.
- The comparison of individual alternatives is qualitative, relative to Alternative I (the No Action Alternative), and based on professional judgment and consideration of the context and intensity of allowable uses and management actions anticipated to impact resources and resource uses.
- Analysis of environmental consequences considered the extent of projected surface disturbance and associated development from BLM actions.
- Analysis of environmental consequences focuses on the anticipated incremental and meaningful impact of management actions and the allowable uses proposed for each alternative. The impact of past and present actions is encompassed within the description of existing conditions in Chapter 3, Affected Environment.
- Split estate lands (e.g., Federal mineral/private surface) will be treated the same as BLM surface lands.
- An 80-acre well spacing, excluding non-Federal minerals and the Wilderness Study Area (WSA).
- Well pads, roads, and ancillary facility disturbances calculated from an 80-acre well spacing, excluding non-Federal minerals and the WSA.
- All BLM BMPs and other BLM mitigation measures and conditions will be conducted on private surface lands overlying Federal mineral estate in the same manner as BLM surface lands.
- Because special status species presence is very limited, only restrictions and limitations for elk (and no other special status species) will be considered in this analysis, unless otherwise noted.

4.2.1. General Levels of Impacts

To reduce the necessarily complex impact analysis process to readily understandable terms, the following subsections use a qualitative approach for summarizing impacts to specific resources, management actions, and uses. For some resources the impacts are defined more quantitatively, while others remain as general levels of impact. In terms of duration, impacts may be initial and related to the construction phase of the project (generally less than two years) or long-term (greater than two years).

4.2.2. Impact Analysis Components

The starting point for analysis of the alternatives is the Analysis of the Management Situation (AMS; BLM 2008a) and the Reasonably Foreseeable Development (RFD) scenario (BLM 2001d) for CBNG development in the FCPA. Because the Powder River Basin Oil and Gas Final Environmental Impact Statement (PRB O&G FEIS; BLM 2003a) and RFD addresses CBNG development for the entire PRB, the BLM developed separate estimates for the much smaller FCPA.

For this analysis, well estimates were calculated from existing and projected roads. The 80-acre blocks were counted if at least 50 percent of the block was Federal mineral estate and could be reached from the road network. Ancillary facilities and disturbance associated with each alternative was calculated using estimates identified in the PRB O&G FEIS (BLM 2003a).

These estimates are not intended to define the specific numbers and locations of wells and well pads needed to develop the CBNG resource. Instead, they allow flexibility during resource development while providing sufficient specificity to support the impact analysis and the alternative selection processes.

The number of wells, well pads, roads, ancillary facilities, and associated disturbance are shown in Table 4-1. Assumptions for the disturbance calculations are included in Appendix D.

4.2.3. Protective Stipulations and Other Restrictions on Surface Use

The RFD does not incorporate all of the land management direction and multiple-use considerations that BLM must take into account as part of its responsibilities under the Federal Land Policy and Management Act (FLPMA). Therefore, in developing the alternatives, assumptions in the RFD were subjected to various “screens” or “filters” representing restrictions designed to protect specific resource values and meet BLM’s multiple-use and sustainability mandates. Protection of specific resources is accomplished by a combination of management actions and the surface use stipulations described in Section 2.2. These include:

- TL (Timing Limitation) – BLM may allow specified activities within the area, and at a proposed location, but not during certain sensitive seasons. Examples include raptor nesting areas, bald eagle winter roosting areas, and big game winter range. It is important to note that TL restrictions can apply to areas with standard restrictions and limitations.

Note that on split estate lands (i.e., Federal minerals but private surface) the TL restrictions would be applied only as stipulations for activities related to mineral exploration and development, such as drilling for oil and gas. This is because the Federal mineral estate creates a nexus by which BLM may regulate aspects of these activities that occur on the surface as well as the subsurface. BLM does not regulate or manage other types of activities on split estate lands (e.g., grazing, recreation, utilities rights-of-way, etc.).

In addition to the restrictions and limitations on surface uses and management activities outlined above, BLM will require BMPs. Examples include the required use of the following:

- Culverts at stream crossings;
- Special road design or dust suppression techniques to reduce impacts from aerial deposition of particulates on nearby streams and vegetation;
- Biodegradable erosion-control fabrics to ensure soil stability and enhance revegetation;

Table 4-1 Estimated New Wells, Facilities, and Disturbance – Fortification Creek Planning Area									
	Projected New Wells and Facilities			Estimated Initial Disturbance (acres)			Estimated Long-Term Disturbance (acres)		
	Alternative I	Alternative II	Alternative III	Alternative I	Alternative II	Alternative III	Alternative I	Alternative II	Alternative III
Number of Wells	726	468	574						
Number of Well Pads	726	468	574	508	328	402	218	140	172
Miles of New Roads									
Improved	125	63	63	727	365	365	363	183	183
Two-track	54	27	27	311	157	157	156	78	78
Total	179	90	90	1,038	522	522	519	261	261
Miles of Pipeline									
3-inch pipe	260	168	206	625	403	494	0	0	0
12-inch pipe	98	63	77	598	385	473	0	0	0
Steel Pipe	26	17	21	316	204	250	0	0	0
Overhead Electric (miles)	73	47	57	263	168	207	37	23	29
Compressors and Facilities									
Booster units	20	13	15						
Reciprocating units	6	4	4						

**Table 4-1 Estimated New Wells, Facilities, and Disturbance –
Fortification Creek Planning Area**

	Projected New Wells and Facilities			Estimated Initial Disturbance (acres)			Estimated Long-Term Disturbance (acres)		
	Alternative I	Alternative II	Alternative III	Alternative I	Alternative II	Alternative III	Alternative I	Alternative II	Alternative III
Booster stations	3	2	3	7	4	5	1	1	1
Reciprocating stations	1	1	1	6	4	4	1	1	1
Central Metering Facilities	72	46	57	14	9	11	7	5	6
Water Facilities	242	156	191	218	140	172	218	140	172
Total Disturbance				3,593	2,168	2,541	1,001	571	641

- Fences to exclude livestock from sensitive habitats; and
- Specialized revegetation using only native species and possibly requiring that woody plants (trees and shrubs) be included in the seed mix or planted as containerized stock (“tubelings”).

These measures, and the protective stipulations cited above, would be applied not just to CBNG development and grazing, but also as appropriate to recreation, aquatic and riparian habitat enhancements, prescribed fires, and construction or routine maintenance in rights-of-way and easements.

4.3 Resources and Resource Uses

The following impact analysis includes evaluation of all resources and resources uses. Wildlife and fluid minerals are the resources or resource uses that would receive the most impact in the FCPA; therefore each is discussed in relation to each resource or resource use, as well as for each alternative. This arrangement may result in some repetition where management actions are similar for all alternatives; however, it allows a better understanding of the impact of important management actions across all resources and resource uses. A summary of impacts is also provided for each resource or resource use. Each resource is discussed in the same order as it was presented in Chapter 3, Affected Environment.

4.3.1. Air Quality

4.3.2. Proposed Alternatives

The number of proposed facilities and estimates of disturbance considered in the RMPA/EA are presented in Table 4-1. A comparison of these alternatives, using Alternative I as the baseline case, will yield the following information:

- Alternative II includes approximately 90 miles of new roads, but no net increase in roads (e.g., old roads are reclaimed as new roads are constructed), and 522 acres of short-term disturbance. Alternative II has fewer wells, pipelines, and facilities than Alternative I.
- Alternative III includes 90 miles of new roads, an approximately 20 percent increase from baseline conditions, resulting in 522 acres of short-term disturbance. However, Alternative III includes fewer wells, pipelines, and facilities than Alternative I.

4.3.3. Air Quality Impacts

The proposed disturbance in Table 4-1 for the FCPA will result in air quality impacts because of the following sources and operations:

- Continuous air emissions for the operation of the temporary diesel generators (typically one for every six wells for two years) that are due to the combustion of fuel by booster and reciprocating units. These emissions will continue for the life of the wells in the FCPA.
- Continuous emissions because of fugitive road dust and tailpipe emissions due to motorized vehicles in the FCPA required to service the booster and reciprocating stations, temporary generators, and water management facilities.
- Temporary air emissions because of construction and transportation in the FCPA. These emissions will consist of fugitive particulate due to wind erosion, and land disturbance activities and tailpipe emissions from motorized vehicles during the construction process.

Gas Compressor Station Emissions

The air emissions from the gas compression stations will be due to the combustion of diesel fuel in the operation of the booster units and reciprocating units as presented in each alternative in Table 4-1.

The operational and emission assumptions are presented in Table 4-2 for the booster units and in Table 4-3 for the reciprocating units. The emissions factors for these units were obtained from U.S. Environmental Protection Agency (EPA) AP-42 and Table 4-4 presents a summary of criteria pollutant emissions and formaldehyde for each alternative.

Transportation Emissions for Final Configuration

As previously stated the transportation emissions for the operational configuration for each alternative are based on tailpipe emissions and roadway fugitive particulate for diesel trucks that will be utilized in the maintenance and servicing of the wells and facilities. These emissions are presented in Table 4-5 and Table 4-6 on a per-well basis, and are summarized for each alternative in Table 4-7 on an annual basis. These emissions are based on the use of light diesel trucks and the conservative assumption that an average of 250 miles per year (based on 5 miles per well once a week for 50 weeks) of travel will be required.

Table 4-2 Well Booster Units Emissions Calculations Fortification Creek Planning Area				
Gas Compression Booster Unit				
Fuel Combustion Source				
Engine design (hp/hr)	350			
Operating Parameters				
Operated:	24 hours/day.	7 days/wk	365 days/year	
Operating hours:	8,760			
Engine rating:	6,601	Btu/hp-hr		
Capacity (%):	100	(while operating)		
Annual load (%):	Winter:	25	Spring:	25
	Summer:	25	Fall:	25
Potential Fuel Combustion for the Year for Unit				
Heat content:	152,000	Btu/gallon		
Hourly heat input rate:	2.31	MMBtu/hr		
Annual fuel consumption:	133,129	gal/yr		

**Table 4-2 Well Booster Units Emissions Calculations
Fortification Creek Planning Area**

Gas Compression Booster Unit				
Emission Data	Emission Factor¹ (lb/MMBtu)	Emissions (lb/hr)	Emissions (tpy)	Method of Determination
NO _x	4.41	10.19	44.62	AP-42
CO	0.95	2.19	9.61	AP-42
SO ₂	0.29	0.67	2.93	AP-42
PM ₁₀ including condensable	0.31	0.72	3.14	AP-42
PM _{2.5} including condensable	0.31	0.72	3.14	AP-42
VOC	0.35	0.81	3.54	AP-42
Formaldehyde	0.07	0.16	0.71	AP-42

¹Based on EF for uncontrolled diesel engine, taken from AP-42 Table 3.3-1 (EPA 2004)

Key:

hp/hr = Horsepower per hour.

Btu/hp-hour = British thermal units per horsepower-hour.

MMBtu/hr = Million British thermal units.

gal/yr = Gallons per year.

lb/MMBtu = Pounds per million British thermal units

lb/hr = Pounds per hours.

tpy = Tons per year.

NO_x = Oxides of nitrogen.

CO = Carbon monoxide.

SO₂ = Sulfur dioxide.

PM₁₀ = Particulate matter of 10 microns or less.

PM_{2.5} = Particulate matter of 2.5 microns or less.

VOCs = Volatile organic compounds.

**Table 4-3 Well Reciprocating Units Emissions Calculations
Fortification Creek Planning Area**

Gas Compression Reciprocating Unit Emission Calculation				
Fuel Combustion Source				
Engine design (hp/hr):	1,650			
Operating Parameters				
Operated:	24 hours/day	7 days/wk.	365 days/year	\
Operating hours:	8,760			
Engine rating:	6,601	Btu/hp-hr		
Capacity (%):	100	(while operating)		
Annual load (%):	Winter:	25	Spring:	25

**Table 4-3 Well Reciprocating Units Emissions Calculations
Fortification Creek Planning Area**

Gas Compression Reciprocating Unit Emission Calculation

	Summer:	25	Fall:	25
Potential Fuel Combustion for the Year for Unit				
Heat content:	152,000	Btu/gallon		
Hourly heat input rate:	10.89	MMBtu/hr		
Volume of natural gas combusted:	627,608	gal/yr		

**Table 4-3 Well Reciprocating Units Emissions Calculations
Fortification Creek Planning Area**

Gas Compression Reciprocating Unit Emission Calculation

Emission Data	Emission Factor¹ (lb/MMBtu)	Emissions (b/hr)	Emissions (tpy)	Method of Determination
NO _x	4.41	48.02	210.35	AP-42
CO	0.95	10.35	45.31	AP-42
SO ₂	0.29	3.16	13.83	AP-42
PM ₁₀ including condensable	0.31	3.38	14.79	AP-42
PM _{2.5} including condensable	0.31	3.38	14.79	AP-42
VOCs	0.35	3.81	16.69	AP-42
Formaldehyde	0.07	0.76	3.34	AP-42

¹ Based on EF for uncontrolled diesel engine, taken from AP-42 Table 3.3-1 (EPA 2004)

Table 4-4 Comparison of Air Quality Impacts Due to Booster Units and Reciprocating Units for Gas Wells									
Pollutants	Alternative I			Alternative II			Alternative III		
	Booster Units (tpy)	Reciprocating Units (tpy)	Total	Booster Units (tpy)	Reciprocating Units (tpy)	Total	Booster Units (tpy)	Reciprocating Units (tpy)	Total
NO_x	825.8	1,167.66	1993.46	536.77	778.44	1,315.21	619.35	778.44	1397.79
CO	64.2	90.72	154.92	41.73	60.48	102.21	48.15	60.48	108.63
VOC	23.88	33.78	57.66	15.522	22.52	38.04	17.91	22.52	40.43
PM₁₀	2	2.838	4.84	1.3	1.892	3.19	1.5	1.892	3.39
SO₂	0.12	0.168	0.29	0.078	0.112	0.19	0.09	0.112	0.20
Formaldehyde	10.68	15.12	25.80	6.942	10.08	17.02	8.01	10.08	18.09

Table 4-5 Tailpipe Emissions Due to Motorized Vehicle for Gas Well Service and Maintenance				
Pollutant	Emission¹ Factor (g/mi)	Average Speed (mph)	Average miles traveled/year/well (mi/yr)	Average Emissions per well (tpy)
CO	14.74	20	250	0.00406
NO _x	11.44	20	250	0.00315
SO ₂ ²	0.32	20	250	0.00009
VOC	5.69	20	250	0.00157

Assumptions:
 1 AP-42 (EPA 2004), Table 2.7.1 "Volume II Mobile Sources" For heavy-duty diesel-engine powered trucks, high altitude, 20 miles per hour, "aged" with 50,000 miles, 1997+ model.
 2 The SO₂ emission factor is calculated assuming 10 mpg fuel consumption, with 0.05% sulfur content of #2 diesel fuel, and fuel density of 7.08 pounds per gallon (lb/gal).

Table 4-6 PM Emissions Due to Roadway Traffic for Gas Well Service and Maintenance				
Pollutant	Emission¹ Factor (lb/VMT)	Vehicle Miles Traveled (VMT/well/yr)	Uncontrolled Emissions (lb/well/yr)	Controlled Emissions (lb/well/yr)
PM ₁₀	1.87	250	467.5	233.75
PM _{2.5}	0.29	250	72.5	36.25

Assumptions:
 1 Haul trucks weight range is 28,000-80,000 pounds (lb). Average weight of 54,000 lbs used for calculations.
 2 AP-42 (EPA 2004), Table 13.2.2-1, "Typical Silt Content Values of Surface Material on Industrial and Rural Unpaved Roads."
 3 AP-42 (EPA 2004), Table 11.9-3, "Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations."
 4 Controlled Emissions based on use of water and 50% efficiency.
 5 AP-42 (EPA 2004), Table 13.2.2 "Unpaved Roads." Equations 1a and 1b.
 6 Calculated as lb/VMT x VMT/well x control efficiency.
 Key:
 VMT = Vehicle miles traveled.

Table 4-7 Summary of Roadway Emissions			
Emission Rate (tpy)			
Pollutant	Alternative I	Alternative II	Alternative III
CO	2.95	1.9	2.33
NO _x	2.29	1.47	1.81
SO ₂	0.06	0.04	0.05

Table 4-7 Summary of Roadway Emissions			
Emission Rate (tpy)			
Pollutant	Alternative I	Alternative II	Alternative III
VOCs	1.14	0.73	0.90
PM ₁₀	84.85	54.70	67.09
PM _{2.5}	13.16	8.48	10.40
Assumptions: Alternative 1 = 726 wells. Alternative 2 = 468 wells. Alternative 3 = 574 wells.			

Construction Emissions

The construction emissions for the planning alternatives are presented in Tables 4-8 and 4-9. Table 4-8 includes the emissions due to the installation of wells, pads, pipelines, and roadways, while Table 4-9 includes the emissions from construction of facilities. The emission factors for these tables were obtained from the Draft Canyons of the Ancients National Monument Resource Management Plan and Draft Environmental Impact Statement (BLM 2007c). These emission factors are based on a per well basis and are probably conservative for this project. The construction emissions are considered temporary, however, and all of the construction will not occur in a given year; therefore, the emissions may be spread over a significant time period.

4.3.3.1. Summary of Air Quality Impacts

Based on the previous discussion and the summary of emissions for each operational alternative, the following conclusions can be made:

- During the operational phase, well gas compression units are the greatest source of criteria pollutant emissions except for particulate. In the case of particulate, roadway sources results in the highest emission rate.
- A comparison of all alternatives shows that Alternative I provides the highest emission rate of all the alternatives; therefore, Alternatives II and III would result in an improvement in air quality.
- A comparison of the construction air emissions in Tables 4-8 and 4-9 for each alternative shows that Alternative I results in the highest emission rate for all criteria pollutants. Although the emissions in Table 4-8 appear higher, they are not expected to occur over a short period of time; therefore, the annual impact may be appreciably less.

Finally, it can be concluded that based on the emission data and the existing air quality, Alternatives II and III should result in moderately improved air quality and no expected violations of National Ambient Air Quality Standards (NAAQS); however, it should be noted that this conclusion is based on an emission inventory and is not substantiated by detailed air quality modeling.

Pollutant	Emission Factor ¹ (ton/well)	Alternative I		Alternative II		Alternative III	
		Number of wells	Tons	Number of wells	Tons	Number of wells	Tons
NO _x	10.2	726	7,405.20	468	4,773.60	574	5,854.80
CO	2.43	726	1,764.18	468	11,37.24	574	1,394.82
SO ₂	0.68	726	493.68	468	318.24	574	390.32
PM ₁₀	1.34	726	972.84	468	627.12	574	769.16
PM _{2.5}	0.81	726	588.06	468	379.08	574	464.94
VOCs	2.00	726	1,452.00	468	936.00	574	1,148.00

¹ Emission factors were obtained from Appendix J of the Draft Canyons of the Ancients National Monument Resource Management Plan and Environmental Impact Statement (BLM 2007c)

Pollutant	Emission Factor ¹ (ton/facility)	Alternative I		Alternative II		Alternative III	
		Number of Facilities ²	Tons	Number of Facilities ²	Tons	Number of Facilities ²	Tons
NO _x	0.64	318	203.52	205	131.20	252	161.28
CO	0.23	318	73.14	205	47.15	252	57.96
SO ₂	0.07	318	22.26	205	14.35	252	17.64
PM ₁₀	3.68	318	1,170.24	205	754.40	252	927.36
PM _{2.5}	0.44	318	139.92	205	90.20	252	110.88
VOCs	0.06	318	19.08	205	12.30	252	15.12

¹ Emission factors obtained from Appendix J of the Draft Canyons of the Ancients National Monument Resource Management Plan and Environmental Impact Statement (BLM 2007c).
² Sum of Booster Stations, Reciprocating Stations, Central Metering Facilities and Water Facilities

4.3.3.2. Cumulative Impacts

Cumulative impacts to air resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Because the FCPA is small (100,655 acres) in comparison to the PRB (8 million acres) (approximately 1.3 percent), cumulative impacts from all three FCPA alternatives would be very small in comparison to the PRB impacts. Cumulative impacts to air resources described in the PRB O&G FEIS (BLM 2003a) indicate that there would be exceedances of nitrogen dioxide (NO₂) and particulate matter of 10 microns or less (PM₁₀) at the

Northern Cheyenne Reservation. However, because the FCPA is south of the reservation and prevailing winds in the FCPA are from the north, northwest, or west, it is unlikely that CBNG development would contribute substantially to these exceedances.

Cumulative impacts from CBNG development to the FCPA would include air resource impacts from CBNG development on non-Federal mineral estate (33,490 acres) within the FCPA and on both Federal and non-Federal mineral estate outside of the FCPA. Regional haze could increase in and near the FCPA and result in a change in visibility.

CBNG development in the FCPA and surrounding area may impact air quality and visibility as the result of substances being released into the atmosphere. The increase in the number of CBNG facilities, especially near county roads, will decrease the visual quality in the area. Dust, precipitated by the continued drought and increase in traffic, has already become a nuisance along county roads.

4.3.4. Soil Resources

The goal for soil resources management in the FCPA is to maintain, improve, or restore soil health and productivity, and to prevent or minimize soil erosion and compaction while supporting a multiple-use management objective. Soil management objectives will ensure that adequate soil protection is consistent with the resource capabilities and objectives for other resources/uses within the 100,655-acre FCPA. Management actions related to this goal that are common to all alternatives include:

- Management actions on BLM lands would be consistent with achieving or maintaining the Standards for Healthy Rangelands (BLM 1995) and Guidelines for Livestock Grazing Management for Public Lands Administered by the BLM in the State of Wyoming (BLM 1997).
- The BLM would use county soil survey information to predict soil behavior, limitations, or suitability for a given activity or action.
- Prior to authorizing any surface-disturbing activity, the BLM would evaluate the activity and, if necessary, apply mitigation measures, relocate the activity to a more suitable soil type, or deny the action.
- Surface-disturbing activities would be subject to an onsite evaluation to develop mitigation, if necessary, apply BMPs, and plan for reclamation. Site-specific measures would be developed for soils susceptible to erosion (e.g., water and wind), high sodium and salt content soils, soils with sparse vegetative cover, droughty soils, and/or shallow soils.
- Areas where the erosion potential cannot be effectively controlled or mitigated for, and reclamation treatments to BLM standards would likely be unsuccessful would be avoided.

4.3.4.1. Evaluation Criteria

Assumptions not included in Section 4.2 used in analyzing impacts to the soil resource include the following:

- Approximately 34 percent (33,694 acres) of lands in the FCPA have slopes greater than 25 percent.

Environmental consequences and alternative comparisons associated with CBNG development within the FCPA are based on an analysis of the most current data available and the best

professional judgment of the preparers. The following terms and definitions will be used to describe the anticipated impacts to soil resources for each of the alternatives, including:

- *Negligible* – The effect on soil resources is barely detectable. Less than 1 percent of the resource.
- *Minor* – The effect on soil resources is slight but detectable, and there would be small changes. Resource indicator thresholds are potentially exceeded, but on a short-term or highly localized basis. This could include surface disturbance that would affect approximately 1 to 5 percent of the FCPA soil resource.
- *Moderate* – The effect on soil resources is readily apparent, and there would be a measurable change that could result in long-term or permanent change to the resource. Some resource indicator thresholds are exceeded. This could include surface disturbance that would affect 5 to 10 percent of the FCPA soil resource.
- *Major* – The effect on soil resources is large, and there would be a highly noticeable, long-term or permanent measurable change. Resource indicator thresholds are clearly exceeded. This could include surface disturbance that would impact more than 10 percent of the resource.

4.3.4.2. Alternative Analysis

Effects to the soil resource are primarily associated with the installation of roads, fluid minerals development of well pad and ancillary facilities, pipelines, water-handling facilities, and electric lines. Soil impacts result from the clearing of vegetation through excavation, stockpiling, compaction, and redistribution of soils during the construction and reclamation operations, the retention or discharge of produced CBNG water, and vehicle traffic rutting and creation of road dust. The following alternative analysis considers direct and indirect impacts, as well as short-term and long-term impacts to the soil resource area wide.

Impacts to soil resources may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from the management of the soil resource, as well as those anticipated to result from the management actions proposed for wildlife and special status species and fluid minerals.

Alternative I (No Action Alternative)

Soil Resources Management

Alternative I, the No Action Alternative, would continue current management goals and objectives, including standard lease terms and conditions. Surface disturbance or occupancy would be prohibited on slopes greater than 25 percent and on highly erodible soils from March 1 through June 15. There could be exceptions to this restriction if the operator proposed adequate site-specific mitigation that met the requirements of the BLM Wyoming Policy on Reclamation standards (BLM 1990).

Under the No Action Alternative, management actions could allow for the development of approximately 726 CBNG well pads within the FCPA. Leases for these wells already have development stipulations for slopes greater than 25 percent. The number of wells was determined from modeling potential road access and restricting road access to areas with less than a 25 percent slope (see Section 4.3.7).

Based on a disturbance estimate of 0.7 acres per well pad, the management action would thus allow approximately 508 acres of localized initial soil impacts within the FCPA (Table 4-1). If reclamation of the temporary impacts were successful, approximately 218 acres (0.3 acres per well) of localized permanent soil resource impacts within the FCPA would be realized with well pad establishment.

The development of CBNG ancillary facilities associated with 726 projected well pads would include three booster stations, one reciprocating station, 72 metering stations, and associated pipelines. Based on an estimated initial and long-term disturbance area of approximately 2 acres per booster station, 5 acres per reciprocating station, and 20 acres for meter stations (0.2 acres per every 10 wells), approximately 27 acres of impacts are projected.

Anticipated impacts associated with the installation of either water or natural gas pipelines in the soil resource within the FCPA would be dependant upon the type/size of pipe installed. Estimated disturbance areas were determined based on a 20-foot-wide corridor for 3-inch pipe; a 50-foot-wide corridor for 12-inch poly pipe; and a 100-foot-wide corridor for 12-inch steel pipe. Based on the corridor widths listed, approximately 625 acres (260 miles) of initial soil impacts would be realized for 3-inch pipe; 598 acres (98 miles) of initial soil impacts would be realized for 12-inch pipe; and 316 acres (26 miles) of initial soil impacts would be realized for 12-inch steel pipe.

Management actions associated with Alternative I would allow approximately 179 miles of new roads within the FCPA. Based on a 48-foot-wide initial disturbance area, impacts to the soil resource would be approximately 1,038 acres. Long-term road impacts were determined based on a 24-foot-wide road width for the 179 miles listed above. It is anticipated that permanent road impacts to the soil resource would be approximately 519 acres.

Under this alternative there would be approximately 73 miles of overhead power lines on non-Federal surface (no overhead electric lines on BLM surface lands), and utilities would be buried in road corridors. The estimated buffer width of these roads follows Table 4-1.

Management actions under Alternative I could also allow the development of approximately 242 new CBNG water-handling facilities. Based on an estimated water impoundment area of 0.3 acres per well, the permanent soil resource impact would be approximately 218 acres area wide. Additional information on water treatment impacts is found in Section 4.3.5, Water Resources.

Approximately 34 percent (33,694 acres) of lands in the FCPA have slopes greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Soil resource management under this alternative would result in minor adverse initial impacts to the soil resources because development of CBNG facilities will temporarily remove the existing vegetative cover on approximately 3,593 acres (3.6 percent) of the FCPA allowing for increased wind and water erosion, and soil compaction, as well as increasing the potential for sediment migration into perennial stream courses.

Soil resource management actions associated with Alternative I would result in minor permanent impacts to the soil resource on approximately 1,001 acres (1 percent) of the FCPA because projected CBNG well pad and ancillary facilities development will permanently alter the soil profile through compaction, alteration, changes to the soil chemistry from produced water storage, and soil loss (e.g., airborne dust, wind, and water).

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, provides TLs in elk habitat. This no action alternative would not result in any impacts to soil because the TLs for elk are temporary. TLs may delay soil disturbance but do not prevent it.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management objectives are to identify stipulations, Conditions of Approval (COAs), and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact other resource values in the FCPA.

Management actions specific to Alternative I include an unrestricted development pace and no geographic restrictions on ancillary and water management facilities. In addition, management actions for CBNG development would include an increase of 179 miles of roads and 73 miles of overhead power lines. The no action alternative would result in minor adverse impacts to soil resources because 1,038 acres of disturbance would be the result of road disturbance. Additional adverse impacts to soil resources from fluid minerals management are discussed in the Soil Resources Management section above.

Alternative II**Soil Resources Management**

Alternative II would not allow any exceptions to the restriction on surface slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and soil with a severe erosion hazard.

Under this alternative, management actions would allow the development of approximately 468 CBNG well pads within the FCPA. Based on a disturbance estimate of 0.7 acres (initial) and 0.3 acres (long-term) per well pad, the management action would allow approximately 328 acres of localized initial soil impacts within the FCPA. If reclamation of the temporary impacts were successful, approximately 140 acres of localized permanent soil resource impacts within the FCPA would be realized with well pad establishment.

The development of CBNG ancillary facilities associated with 468 projected well pads would include two booster stations, one reciprocating station, 46 metering stations, and associated pipelines. Based on an estimated initial and long-term disturbance area of approximately 2 acres per booster station, 5 acres per reciprocating station, and 20 acres for meter stations (0.2 acres per every 10 wells), approximately 17 acres of impacts are projected.

Anticipated impacts associated with the installation of either water or natural gas pipelines to the soil resource within the FCPA would be dependent upon the type/size of pipe installed.

Estimated disturbance areas were determined based on a 20-foot-wide corridor for 3-inch pipe; 50-foot-wide corridor for 12-inch poly pipe; and a 100-foot-wide corridor for 12-inch steel pipe. Based on the corridor widths listed, approximately 403 acres (168 miles) of initial soil impacts would be realized for 3-inch pipe; 385 acres (63 miles) of initial soil impacts would be realized for 12-inch pipe; and 204 acres (17 miles) of temporary soil impacts would be realized for 12-inch steel pipe.

Road development management actions associated with Alternative II would require a 1:1 mitigation for all new road developments. Mitigation would be realized by the removal and reclamation of an equal mileage of existing roads for each mile of new road installed. Once reclamation was effective and complete, the long-term impact would be negligible; however, initial disturbance would last until vegetative habitats were restored.

Additionally, 47 miles of overhead electric lines would be necessary to serve the CBNG infrastructure. Based on an estimated disturbance to the soil resource of 3.6 acres per mile (initial) and 0.3 acres per well pad (long-term), the initial and long-term impacts to the soil resource would be approximately 168 acres and 23 acres, respectively.

Management actions under Alternative II would also allow the development of approximately 156 new CBNG water-handling facilities. Based on an estimated water impoundment area of 0.3 acres per well, the permanent soil resource impact would be approximately 140 acres. Additional information on water treatment impacts is found in Section 4.3.5, Water Resources.

Approximately 34 percent of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Soil resource management under Alternative II would result in minor adverse impacts to the FCPA soils because CBNG facilities would temporarily remove the existing vegetative cover on approximately 2,183 acres (2.2 percent) of the FCPA allowing for increased wind and water erosion, soil compaction, as well as increasing the potential for sediment migration into perennial stream courses.

Soil resource management actions associated with Alternative II would result in minor permanent impacts to the soil resource on approximately 829 acres (0.8 percent) of the FCPA because development of the projected CBNG well pads and ancillary facilities will permanently alter the soil profile through compaction, alteration, changes to the soil chemistry from produced water storage and soil loss (e.g., airborne dust, wind, and water).

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, provides TLs in elk habitat. Livestock grazing could be deferred up to two years post-reclamation prior to proceeding with the next development phase area. Well metering and all Plan of Development (POD) monitoring and maintenance activities would be restricted to weekly visitation within elk crucial winter range and elk calving areas.

Alternative II would result in minor beneficial impacts to soil resources because the site visitation restriction would result in less road erosion, and the restriction of facilities to outside of the yearlong range would result in less erosion in sensitive areas. Additionally, deferring livestock grazing would allow time for vegetation establishment thereby reducing erosion.

Fluid Minerals Management

Management actions specific to Alternative II include restrictions and limitations for wildlife values and erosive soils. These limitations include TLs for elk and special status species.

Additional management actions specific to Alternative II include a performance-based tri-phased approach to CBNG development. Livestock grazing could be deferred up to two years post-reclamation prior to proceeding to next development area. Ancillary and water management facilities for CBNG development would be located outside of the elk yearlong range. Well

metering and POD visitations would be restricted to weekly visitation within elk crucial winter range and elk calving areas during specified times of the year. Under Alternative II, overhead power lines would be allowed in the FCPA along road corridors. The buffer width of these roads follows information presented in Table 4-1, and it is assumed that all pipelines and overhead power lines would be included within this buffer. Management actions would require advance planning of a power line network to maximize use of existing utility corridors and roadways. There would be no net gain in road density under this alternative. Impacts would be minor and beneficial because the site visitation restriction would result in less road erosion, the restriction of facilities to outside of the yearlong range would result in less erosion in sensitive areas, deferring livestock grazing would allow time for vegetation establishment, and fewer surface soil impacts are associated with power pole installation when compared to underground power line installation.

Additional adverse impacts to soil resources from fluid minerals management are discussed in the Soil Resources Management section above.

Alternative III

Soil Resources Management

Alternative III would restrict surface disturbance on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and soil with a severe erosion hazard. There could be exceptions to this restriction if the operator proposed adequate site-specific mitigation that meets the requirements of the BLM Wyoming Policy on Reclamation standards (BLM 1990).

Management actions could allow for the development of approximately 574 CBNG well pads within the FCPA. Based on a disturbance estimate of 0.7 acres (initial) and 0.3 acres (long-term) per well pad, the management action would thus allow approximately 402 acres of localized initial soil impacts within the FCPA. If reclamation of the temporary impacts were successful, approximately 172 acres of localized long-term soil resource impacts within the FCPA would be realized with well pad establishment.

The development of CBNG ancillary facilities associated with the 574 projected well pads would include three booster stations, one reciprocating station, 57 metering stations, and pipelines. Based on an estimated disturbance area of approximately 2 acres per booster station, 5 acres per reciprocating station, and 17 acres for meter stations (0.2 acres per every 10 wells), approximately 20 acres of impacts are projected.

Anticipated impacts associated with the installation of either water or natural gas pipelines to the soil resource within the FCPA would be dependent upon the type/size of pipe installed. Estimated disturbance areas were determined based on a 20-foot-wide corridor for 3-inch pipe; 50-foot-wide corridor for 12-inch poly pipe; and a 100-foot-wide corridor for 12-inch steel pipe. Based on the corridor widths listed, approximately 494 acres (206 miles) of initial soil impacts would be realized for 3-inch pipe; 473 acres (77 miles) of initial soil impacts would be realized for 12-inch pipe; and 250 acres (21 miles) of temporary soil impacts would be realized for 12-inch steel pipe.

Management actions associated with Alternative III would allow for an increase of the existing road infrastructure with a threshold of a 20 percent loss in elk security habitat. Based on the security habitat constraint, approximately 90 miles of new roads (63 miles of improved roads,

and 27 miles of two-track roads) would be allowed within the FCPA. Impacts to the soil resource, based on a 48-foot wide temporary disturbance area, would be approximately 522 acres. It is estimated that long-term road impacts to the soil resource would be approximately 261 acres.

Overhead electric would occupy approximately 57 miles. Based on an estimated initial disturbance to the soil resource of 3.6 acres per mile and an estimated long-term disturbance to the soil resource of 0.5 acres per well pad, the initial and long-term impacts to the soil resource would be approximately 207 acres and 29 acres, respectively.

Management actions under Alternative III could also allow the development of approximately 191 new CBNG water-handling facilities. Based on an estimated water impoundment area of 0.3 acres per well, the permanent soil resource impact would be approximately 172 acres. Additional information on water treatment impacts is found in Section 4.3.5, Water Resources.

Approximately 34 percent of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Soil resource management under Alternative III would result in minor initial impacts to the soil resources because development of CBNG facilities would remove the existing vegetative cover on approximately 2,541 acres (2.5 percent) of the FCPA allowing for increased wind and water erosion as well as increasing the potential for sediment migration into perennial stream courses.

Soil resource management actions associated with Alternative III would result in minor permanent impacts to the soil resource on approximately 641 acres (0.6 percent) of the FCPA because CBNG well pads and ancillary facilities will permanently alter the soil profile through compaction, alteration, changes to the soil chemistry from produced water storage, and soil loss (e.g., airborne dust, wind, and water).

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, provides TLs in elk crucial winter range. Livestock grazing could be deferred up to one year post-reclamation prior to proceeding to next development area. Well metering and all POD monitoring and maintenance activities would be restricted within crucial elk ranges during crucial seasons.

Alternative III would result in minor beneficial impacts to soil resources because the site visitation restriction would result in less road erosion, and the restriction of facilities to outside of the crucial ranges would result in less erosion in sensitive areas. Additionally, deferring livestock grazing would allow time for initial vegetation establishment thereby reducing erosion.

Fluid Minerals Management

Management actions specific to Alternative III include a performance-based tri-phased approach to CBNG development. Livestock grazing could be deferred up to one-year post-reclamation prior to proceeding to next development area. Ancillary and water management facilities for CBNG development would be located outside of elk crucial winter range and calving areas. Well metering and POD visitations would be restricted within elk crucial winter range and elk calving areas during specified times of the year. Under Alternative III, overhead power lines would be allowed along road corridors. The buffer width of these roads follows information presented in Table 4-1 and it is assumed that all power lines would be included within this

buffer. Management actions would require advance planning of a power line network to maximize use of existing utility corridors and roadways. There could be approximately 90 miles of new roads. Impacts would be minor and adverse because the site visitation restriction would result in less road erosion, the restriction of facilities to outside of the crucial ranges would result in less erosion in sensitive areas, deferring livestock grazing would allow time for initial vegetation establishment, and fewer surface area soil impacts are associated with power pole installation when compared to underground power line installation, but soil erosion would still occur.

Additional adverse impacts to soil resources from fluid minerals management are discussed in the Soil Resources Management section above.

Summary

The summary of impacts to soil resources is shown in Table 4-10.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Soil Resources Management	Minor (-) 1,001 acres permanent disturbance	Minor (-) 571 acres permanent disturbance	Minor (-) 641 acres permanent disturbance
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Facilities outside yearlong range	Minor (+) Facilities outside crucial elk ranges
Fluid Minerals Management	Minor (-) 179 miles of new roads	Minor (-) 90 miles of new roads	Minor (-) 90 miles of new roads

4.3.4.3. Cumulative Impacts

Cumulative impacts to soil resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Because the FCPA is small (100,655 acres) in comparison to the PRB (8 million acres) (approximately 1.3 percent), cumulative impacts from all three FCPA alternatives would be very small in comparison to the PRB impacts. The maximum amount of soil disturbance for any of the alternatives is 3,593 acres in the FCPA, which is approximately 9 percent of the disturbance predicted for the entire PRB (BLM 2003a).

Soil resources in the FCPA are protected by a 25 percent slope restriction that will protect highly erosive soils and reduce runoff into streams and the Powder River. However, under all alternatives, wells, roads, utilities, water treatment facilities, and ancillary facilities will be restricted to areas with gentler slopes including stream channels. The proximity of CBNG development could affect downstream and offsite surface water from erosion. Additionally, under Alternatives II and III, water treatment and ancillary facilities are further restricted to areas

outside of elk ranges near the edges of the FCPA and the Powder River and Wild Horse Creek, potentially increasing erosion into these rivers.

4.3.5. Water Resources

The primary goal for water resource management in the FCPA is to maintain or improve surface and groundwater quality throughout eight subwatershed areas associated with the Powder River Basin. The classified subwatersheds and the percent of FCPA land area contained within each include:

- The Powder River – OK Creek watershed (HUC # 1009020206) (1.8 percent);
- The Powder River – Bull Creek watershed (HUC # 1009020206) (33.3 percent);
- The Powder River – Turner Draw watershed (HUC # 1009020206) (7.6 percent);
- The Lower Fortification Creek watershed (HUC # 1009020207) (17.7 percent);
- The Upper Fortification Creek watershed (HUC # 1009020207) (11.7 percent);
- The Wildhorse Creek – Cedar Draw watershed (HUC # 1009020208) (10.0 percent);
- The Wildhorse Creek – Rough Creek watershed (HUC # 1009020208) (12.4 percent); and
- The Wildhorse Creek – Hay Creek watershed (HUC # 1009020208) (5.4 percent).

Water resources management actions will be consistent with existing uses and account for anticipated users as they relate to all applicable state and Federal water quality standards for all watershed areas. Additional goals provide for the availability of water to facilitate all authorized uses, and to minimize harmful consequences caused by erosion and uncontrolled surface runoff from BLM-administered land.

Water management objectives will ensure that current Wyoming Department of Environmental Quality (WDEQ) water discharge standards are maintained within the eight subwatershed areas of the FCPA identified above. Management actions related to this goal and common to all alternatives include:

- The rights to water-related projects on public lands will be filed with the Wyoming State Engineer's Office (WSEO) in order to obtain valid water rights approval.
- A Wyoming Department of Environmental Quality (WDEQ) Wyoming Pollutant Discharge Elimination System (WYPDES) permit is necessary for all water discharge.
- Locate discharge points in areas that will minimize erosion and impacts to the receiving channel, existing improvements, and downstream users.
- Locate discharge points in stable, low-gradient drainage systems and below active headcuts, when possible. If discharge is located above a headcut, mitigation measures will be required by the BLM Authorized Officer on a site-specific basis. Some mitigation measures may require a certified engineering design.
- All discharge points will require energy dissipation measures to be installed.
- Discharge points, regardless of WYPDES status or previous use, may not be authorized by the BLM. Sites may be moved or otherwise mitigated for by the BLM Authorized Officer during onsite inspections where sensitive resource habitat issues exist.

- Cumulative produced water discharges from CBNG developments must not exceed the naturally occurring 2-year peak flow in any reach of the receiving channel.
- Discharge points will not be located in playas or enclosed basins unless it can be demonstrated that they will not result in adverse habitat impacts. Discharges into valley bottoms that have no defined bed and bank (low-flow channel) will generally not be allowed; however, the BLM Authorized Officer may allow such discharges after inspection on a site-by-site basis.
- Channel crossings will be designed to minimize disturbance to the channel bed, to the extent practicable. Pipelines and access road crossings within floodplains or that run parallel to a drainage channel will be avoided. Channel crossings by access road and pipelines will be constructed perpendicular to water flow. Pipelines will be buried to a depth of at least 48 inches below the channel bottom. Culverts may be installed, at appropriate locations, to provide a suitable crossing at washes or streams as specified by BLM Manual 9112 – Bridges and Major Culverts; and BLM Manual 9113 – Roads. At a minimum, all channel crossing structures will be designed to accommodate a 25-year storm event or other capacities as directed by the BLM.
- Low water crossings will be constructed perpendicular to channel flow and in such a manner that will prevent the blockage or restriction of water flows within the channel. All excavated material will be stockpiled adjacent to the water body and outside any associated wetland habitats for later use in restoration.
- Produced CBNG water quality may require operators to increase the amount of storage during downstream irrigation months. For non-irrigation months, additional surface discharges may be considered if the operator has sufficient assimilative capacity credits, or if treated to monthly Powder River water quality standards.
- The operator will be required to provide a reclamation bond for produced CBNG water impoundments over Federal minerals in an amount specified by a qualified professional engineer. Proof of submission for the bond amount will be submitted prior to the approval of a POD. The POD and reclamation bond will require approval by a BLM Authorized Officer prior to commencing construction activities.
- The operator will supply a copy of the completed and approved SW-3, SW-4, or SW-CBNG permit(s) to the BLM as they are issued by WSEO for produced CBNG water impoundments.
- The operator will supply a copy of the complete and approved Chapter 3 - Permit to Construct - water management facilities to the BLM as they are issued by the WDEQ.

Effects to water resources associated with CBNG development include increased produced water discharge, groundwater drawdown, increased sedimentation because of new roads, wells, and ancillary facilities, pipelines, water-handling facilities, and electric lines.

Many different techniques may be used for discharge of produced water. Two common ones in the FCPA are impoundments and pipelines to transport waters to the Powder River. Impoundments would be developed in bottomlands along the Powder River, Fortification Creek, and tributaries. Off-channel impoundments would be used on flat terraces.

Development of impoundments leads to water leakage, which may result in changes to vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges (*Carex* sp.), foxtail barley (*Hordeum jubatum*), and, in places, cattails (*Typha* sp.). Salt cedar (*Tamarix* sp.) has a toehold in the FCPA, and expansion of mesic habitats allows for further invasion by this species. Generally, the area of disturbance is twice the size of the impoundment.

The discharge to channels, although treated if needed as required by WDEQ, would result in increased sedimentation and increased flows. To date, 53 million gallons per day of produced waters have been permitted for discharge. There are no monitoring requirements for the amount of discharge. Increased discharge of CBNG produced water to perennial and intermittent stream channels could result in impacts to stream morphology and biology.

Impacts that could result from surface disturbance include reduction of vegetative cover, soil compaction, and increased erosion and sedimentation. These erosion-related impacts could include changes in surface and groundwater chemistry, in meeting water quality standards, and changes in the quantity and distribution of surface flows or retention areas, and aquifer drawdown.

4.3.5.1. Evaluation Criteria

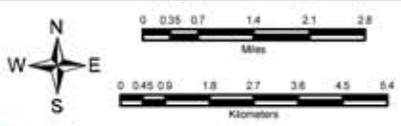
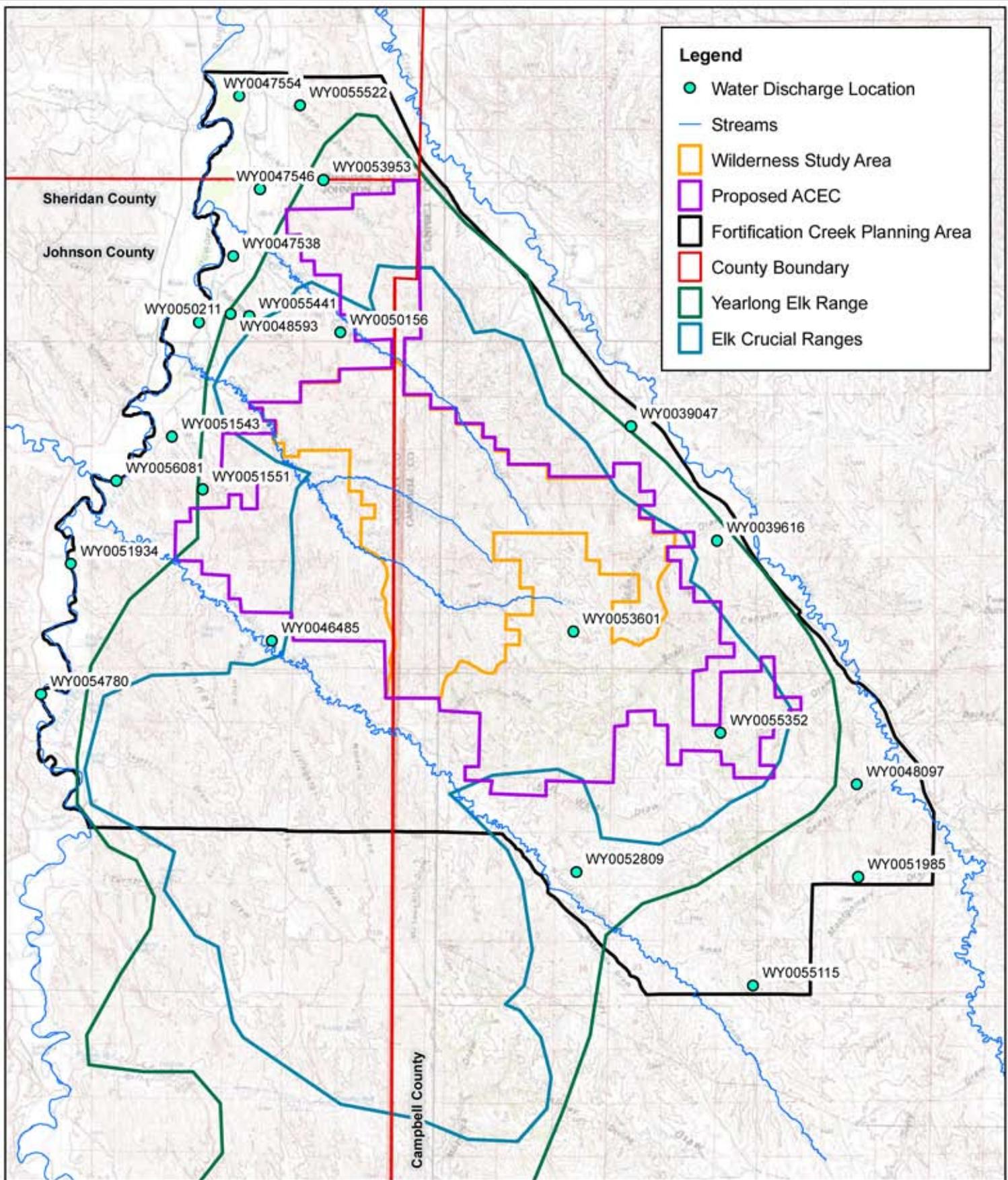
Assumptions used in analyzing impacts to the water resources include the following:

- The BLM estimated water production within the FCPA to be greater than 79 million barrels per year (BLM 2003a). Based on this modeling and a complete FCPA buildout, it was estimated that approximately 70 percent (55.3 million barrels per year) of produced CBNG water would be directly discharged into existing ephemeral drainages, and 25 percent (19.75 million barrels per year) of produced CBNG water will be retained through development of water impoundments. The remaining 5 percent (3.95 million barrels per year) of produced CBNG water may be lost through evaporation or infiltration.
- Groundwater discharge data compiled by the WDEQ and BLM in 2008 identified 23 current CBNG permit holders within the FCPA. Of these, 18 CBNG permit holders have reported the number of existing groundwater extraction wells permitted and their associated flow rates. Table 4-11 presents a summary of this data. The data indicates 75 percent [35.51 million gallons per day (mgd)] of produced groundwater is permitted for discharge into drainage channels. In addition, approximately 25 percent (12.052 mgd) of the data indicates produced groundwater is permitted for impoundment by either on-channel reservoirs or in full-containment structures. Figure 4-1 shows discharge locations within the FCPA held by permit holders in 2008. Any additional discharge flows within the currently permitted outfall locations may exceed the naturally occurring, 2-year peak flow for the receiving channels' specific reach.

Table 4-11 Fortification Creek Planning Area CBNG 2008 Groundwater Extraction Wells and Flow Rates¹			
Permit Number	Number of Groundwater Wells	Groundwater Well Flow Rate (mgd)	Drainage Channel Discharge Point (discharge type)²
WY0039616	180	4.16	(2 OCR/1A)
WY0046485	111	2.01	(2 OCR/1A)
WY0047538	32	0.1	(2 OCR/1A)
WY0047546	24	0.52	(2 OCR/1B)
WY0047554	36	0.52	(2 OCR/1B/1A)
WY0048097	33	1.01	(2 OCR)
WY0048593	48	0.32	(1A/1B)
WY0050156	58	0.13	(2 OCR)
WY0050211	33	0.32	(1A/1B)
WY0051985	624	16.16	(2 DD)
WY0052809	122	1.55	(2 OCR/2 DD)
WY0053601	26	0.55	(1B)
WY0053953	10	0.25	(2 OCR)
WY0054780	184	13.9	(2 DD)
WY0055115	22	0.934	(2 OCR)
WY0055352	45	0.878	(2 OCR)
WY0055441	7	0.35	(2 OCR)
WY0056081	212	3.9	(2 DD)

¹ Extraction Well and Flow Rate table summarized from WDEQ and BLM 2008 permit holder data.

² Discharge Types defined as: 2 OCR = Option 2 on-channel reservoirs; 2 DD = Option 2 discharge; 1B = Option 1B full containment-class 4; 1A = Option 1A full containment-class 3.



**Resource Management Plan
 Amendment/Environmental Assessment
 Fortification Creek Planning Area**

**Figure 4-1
 Water Discharge
 in the
 Fortification Creek Planning Area**



Campbell, Johnson, and Sheridan Counties, Wyoming

Map Reference:		
Date: 07/2/08	GIS: dsc	Project ID: 7945

Environmental consequences and alternative comparisons associated with CBNG development within the FCPA are based on an analysis of the most current data available and the best professional judgment of the preparers. The following terms and definitions will be used to describe the anticipated impacts to water resources for each of the alternatives, these include:

- *Negligible* – The effect on water resources is barely detectable; less than 1 percent of the resource is affected. This could include a 1 percent increase in discharge rates, drawdown, or exceedance of a water quality parameter.
- *Minor* – The effect on water resources is slight but detectable; there would be a small change in the resource. This could include impacts on 1 to 10 percent of the resource. This could include a 10 percent increase in discharge rates, drawdown, or exceedance of a water quality parameter.
- *Moderate* – The effect on water resources is readily apparent; there would be a measurable change in the resource. This could include impacts between 10 and 30 percent of the resources. This could include a 10 to 30 percent increase in discharge rates, drawdown, or exceedance of a water quality parameter.
- *Major* – The effect on water resources is large; there would be a highly noticeable, long-term, or permanent measurable change in the resource. This could include impacts to more than 30 percent of the resource. This could include a 30 percent or greater increase in discharge rates, drawdown, or exceedance of a water quality parameter.

4.3.5.2. Alternative Analysis

Impacts to water resources may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the anticipated impacts under each alternative resulting from the management of the water resource, as well as those expected to result from the management actions proposed for Wildlife and Special Status Species, Fluid Minerals, and Soils.

Alternative I (No Action Alternative)

Water Resources Management

Alternative I water resources management would include requirements for WYPDES permits for the discharge of CBNG produced water with water quality but not quantity requirements. CBNG discharge is currently permitted at approximately 48 mgd for 1,807 wells, 75 percent of which (36 mgd) is permitted for discharge. Current discharge is estimated at 1.8 mgd (16.2 million barrels per year [mby]) and current storage is estimated at 0.6 mgd (4 mby).

Under this alternative there is the potential for approximately 726 new wells in the FCPA. It is anticipated that 75 percent of those wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and Wild Horse Creek. With an average discharge of approximately 0.026 mgd per well (Table 4-11), an increase of 726 wells would result in an additional 14 mgd (93 mby) of produced water directly discharged into FCPA channels. This increase would have a major impact on stream channels. Intermittent streams would become perennial and could support non-native fish species. Vegetation would change significantly in and adjacent to streams; wetlands would be generated. Additionally, and perhaps most important, the increase in water discharge to streams would change the morphology of the stream channels and increase

sediment transport downstream. This impact cannot be specified at this time because the results would depend on stream-specific factors including slope, depth, and soil composition. Changes to water chemistry, while possible, may be mitigated because of WYPDES discharge limits.

Twenty-five percent, or 4.8 mgd (31 mby), of produced CBNG water would be discharged to surface impoundments. This increase of discharged water in surface impoundments would impact soils and vegetation in the surrounding area, resulting in wetlands and invasive weeds.

Drawdown from 726 new wells would have a major impact on aquifers in the FCPA. Free-flowing wells in the Fort Union Formation would likely lose their water. Free-flowing wells in the Wasatch Formation could lose water; however, this would depend on their connection to CBNG coal seams and cannot be quantified at this time. Results of groundwater modeling for the PRB O&G FEIS (BLM 2003a) indicated that drawdown of 200 to 400 feet would be generally expected. Drawdown cannot be estimated at this time because specific information on CBNG drawdown in wells in the FCPA is not available. Drawdown would be mitigated by recharge; however, recharge would lag drawdown by an average of four years and the rate cannot be estimated at this time.

Additionally, water resources management under the No Action Alternative would result in minor adverse impacts to the water resources because of increased sediment loading within drainage channels through degradation of existing drainage networks from roadways and other ancillary facility development. Additionally, existing surface and groundwater chemistry could be altered to unacceptable/unusable levels and perennial water sources within the elk ranges could be eliminated.

Wildlife and Special Status Species Resources Management

Under this alternative, wildlife resources management, including specific elk management actions, would not have any impact on water resources. TLs in elk crucial winter range would provide only a temporary benefit. Because there are no restrictions on water management facility locations and no requirements for water sources for elk, there are no adverse or beneficial impacts.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact other resource values in the FCPA.

Management actions specific to Alternative I include an unrestricted development pace and no elk-related restrictions on ancillary and water management facilities. Under Alternative I, there would be approximately 73 miles of overhead power lines within the FCPA and an increase of approximately 179 miles of roads. The buffer width of these roads follows information presented in Table 4-1 and it is assumed that all overhead power lines would be included within this buffer. These actions would result in minor temporary impacts to water resources because installation of underground utilities, roads, and ancillary facilities would temporarily disturb drainage channel profiles and increase channel sedimentation. Development would alter the existing vegetative cover along existing drainage channels, increase erosion and sediment

loading within drainage channels, alter existing surface and groundwater chemistry and potentially eliminate perennial water sources within the elk ranges.

Additional adverse impacts to water resources from fluid minerals management are discussed under the Water Resources Management section above.

Other Resources Management

Approximately 33,694 acres (34 percent) of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Under this alternative, surface disturbance would be restricted on slopes greater than 25 percent, or on highly erodible soils. Standard lease terms, stipulations, and notices apply, and there may be exceptions to this restriction.

Soil resource management under the No Action Alternative would result in minor initial adverse impacts to the watershed resource because projected development of CBNG facilities will temporarily remove the existing vegetative cover on approximately 3,593 acres (3.6 percent) of the FCPA allowing for increased wind and water erosion, soil compaction, as well as increasing the potential for sediment migration into drainage courses.

Soil resource management actions associated with Alternative I would result in minor adverse long-term impacts to the watershed resource because projected CBNG well pad and ancillary facilities development on approximately 1,001 acres (1 percent) of the FCPA will result in permanent alteration of the soil profile through compaction, changes to the soil/groundwater chemistry at produced water storage facilities, and increased soil loss through airborne dust, wind, and water erosion.

Alternative II

Water Resources Management

Alternative II water resources management would include requirements for WYPDES permits for the discharge of CBNG produced water with water quality but not quantity requirements. CBNG discharge is currently permitted at approximately 48 million gallons per day (mgd) for 1,807 wells, 75 percent of which (36 mgd) is permitted for discharge. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby).

Under this alternative there is the potential for approximately 468 new wells in the FCPA. It is anticipated that 75 percent of those wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and Wild Horse Creek. With an average discharge of approximately 0.026 mgd per well (see Table 4-11), an increase of 468 wells would result in an additional 9.2 mgd (60.5 mby) of produced water directly discharged into FCPA channels. This increase would have a major impact on stream channels. Intermittent streams would become perennial and could support non-native fish species. Vegetation would change significantly in and adjacent to streams; wetlands would be generated. Additionally, and perhaps most importantly, the increase in water discharge to streams would change the morphology of the stream channels and increase sediment transport downstream. This impact cannot be determined at this time because the results would depend on stream-specific factors including slope, depth, and soil composition. Changes to water chemistry, while possible may be mitigated because of WYPDES discharge limits. Downstream monitoring of CBNG discharge will enable future impact assessment and an adaptive management approach, if necessary.

Twenty-five percent, or 3.1 mgd (20.2mby), of produced CBNG water would be discharged to surface impoundments. This increase of discharged water in surface impoundments would impact soils and vegetation in the surrounding area, resulting in wetlands and invasive weeds.

Drawdown from 468 new wells could have a major impact on aquifers in the FCPA. Free-flowing wells in the Fort Union Formation would likely lose their water. Free-flowing wells in the Wasatch Formation could lose water; however, this would depend on their connection to CBNG coal seams and cannot be quantified at this time. Results of groundwater modeling for the PRB O&G FEIS (BLM 2003a) indicated that drawdown of 200 to 400 feet would be generally expected. Drawdown cannot be estimated at this time because specific information on CBNG drawdown in wells in the FCPA is not available. Drawdown would be mitigated by recharge; however, recharge would lag drawdown by an average of four years and the rate cannot be estimated at this time.

Additionally, water resource management under this alternative would result in minor adverse impacts to water resources because of increased sediment loading within drainage channels through degradation of existing drainage networks from roadways and other ancillary facility development. Additionally, existing surface and groundwater chemistry could be altered to unacceptable/unusable levels and perennial water sources within the elk ranges could be eliminated.

Wildlife and Special Status Species Resources Management

Alternative II Wildlife and Special Status Species Resources management would result in minor beneficial impacts to watershed resources because the acreage of disturbance in and around special status habitats would be minimized, livestock grazing would be deferred up to two years allowing time for vegetative cover establishment, and produced water management facilities would be constructed outside the yearlong range thus minimizing potential decreases on the carrying capacity.

Fluid Minerals Management

Management actions specific to Alternative II include a phased development approach, year-round water sources provided by CBNG projects, and restrictions on ancillary and water management facilities in the elk yearlong range. Under Alternative II, overhead power lines would be allowed, but there would be no net increase in roads. The restriction on roads would result in limited impacts and would be mitigated by restoration of an equivalent number of road miles. Construction of ancillary facilities, along with power lines and roads, would temporarily disturb drainage channel profiles and potentially increase channel sedimentation. Development would alter the existing vegetative cover along existing drainage channels, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry, and potentially eliminate perennial water sources within the elk ranges.

Additional adverse impacts to water resources from fluid minerals management are discussed under the Water Resources Management section above.

Other Resources Management

Under Alternative II there would be no surface-disturbing activities on slopes greater than 25 percent, soils with a severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. There would be no exceptions to these restrictions.

Soils management under this alternative would result in minor adverse initial impacts to the FCPA water resources because although CBNG facilities would temporarily remove the existing vegetative cover on approximately 2,168 acres (2.2 percent) of the FCPA allowing for a temporary increase of wind and water erosion and increasing the potential for sediment migration into perennial drainage channels, disturbance would be restricted to slopes less than 25 percent reducing potential erosion into streams.

Soils management under this alternative would result in minor adverse long-term impacts to the FCPA water resources because, although CBNG facilities would be sited within less severe soil types and on slopes less than 25 percent that are typically associated with ephemeral and perennial drainageways within the FCPA. Impacts to the watershed resource would be realized because CBNG facilities would remove the existing vegetative cover on approximately 571 acres (0.6 percent) within the FCPA allowing for increased degradation of the existing drainage channels through airborne dust, wind and water soil loss, and their close proximity to the drainage network.

Alternative III

Water Resources Management

Alternative III water resources management would include requirements for WYPDES permits for the discharge of CBNG produced water with water quality but not quantity requirements. CBNG discharge is currently permitted at approximately 48 mgd for 1,807 wells, 75 percent of which (36 mgd) is permitted for discharge. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby). No additional discharge will be authorized from Federal projects directly into ephemeral and intermittent channels.

With an average discharge of approximately 0.026 mgd per well (see Table 4-11), an increase of 574 wells would result in an additional 15.1 mgd (98.9 mby) of produced water discharged to surface impoundments. This increase of discharged water in surface impoundments would impact soils and vegetation in the surrounding area, resulting in wetlands and invasive weeds.

Drawdown from 574 new wells could have a major impact on aquifers in the FCPA and a moderate impact overall. Free-flowing wells in the Fort Union Formation would likely lose their water. Free-flowing wells in the Wasatch Formation could lose water; however, this would depend on their connection to CBNG coal seams and cannot be quantified at this time. Results of groundwater modeling for the PRB O&G FEIS (BLM 2003a) indicated that drawdown of 200 to 400 feet would be generally expected. Drawdown cannot be estimated at this time because specific information on CBNG drawdown in wells in the FCPA is not available. Drawdown would be mitigated by recharge; however, recharge would lag drawdown by an average of four years and the rate cannot be estimated at this time.

Additionally, water resources management under Alternative III would result in minor adverse impacts to the water resources because of increased sediment loading within drainage channels through degradation of existing drainage networks from roadways and other ancillary facility development. Development would alter the existing vegetative cover within and adjacent to impoundments, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry, and potentially eliminate perennial water sources within the elk ranges.

Wildlife and Special Status Species Resources Management

Alternative III Wildlife and Special Status Species Resources management would result in minor beneficial impacts to watershed resources because the acreage of disturbance in and around special status habitats would be minimized, livestock grazing would be deferred up to one year allowing time for vegetative cover establishment, and produced water management facilities would be constructed outside critical habitat areas thus minimizing potential decreases on the carrying capacity.

Fluid Minerals Management

Management actions specific to Alternative III include a phased development approach, permanent summer water sources provided by CBNG projects, and restrictions on ancillary and water management facilities in the crucial elk winter and calving ranges. Under Alternative III, overhead power lines would be allowed on BLM surface land. The buffer width of these roads follows the Table 4-1 data and it is assumed that all power lines would be included within this buffer. There would be up to a 20 percent decrease in elk security habitat with approximately 522 acres of associated disturbance from an increase in roads. The increased roads would result in minor adverse impacts because of additional erosion potential. Construction of ancillary facilities, along with power lines and roads would temporarily disturb drainage channel profiles and potentially increase channel sedimentation. Development would alter the existing vegetative cover along existing drainage channels and within and adjacent to impoundments, increase erosion and sediment loading within drainage channels, alter existing surface and groundwater chemistry; and potentially eliminate perennial water sources within the elk ranges.

Additional adverse impacts to water resources from fluid minerals management are discussed under the Water Resources Management section above.

Other Resources ManagementSoil Resources

Under Alternative III, BLM management actions would restrict surface disturbance on slopes greater than 25 percent, soils with severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. There would be exceptions to these restrictions.

Approximately 34 percent of the soil resources within the FCPA are located on slopes that are greater than 25 percent. Soils associated with steep landforms are highly susceptible to wind and water erosion. Soil resource management under Alternative III would result in minor adverse initial impacts to water resources because development of CBNG facilities would remove the existing vegetative cover on approximately 2,541 acres (2.5 percent) of the FCPA allowing for increased wind and water erosion as well as increasing the potential for sediment migration into drainage channels.

Additionally, management actions associated with Alternative III soil resources management would result in negligible long-term impacts to the water resource on approximately 641 acres (0.6 percent) of the FCPA because CBNG well pads and ancillary facilities will permanently alter the soil profile through compaction, which minimizes infiltration rates, change the soil/groundwater chemistry from produced water storage, and increase soil loss into the drainage network through airborne dust, wind, and water erosion.

Summary

The summary of impacts to water resources is shown in Table 4-12.

Table 4-12 Summary of Impacts to Water Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Water Resources Management	Major (-) Discharge to ephemeral channels. 14 mgd produced water Drawdown from 726 wells.	Major (-) Discharge to ephemeral channels. 9.2 mgd produced water Drawdown from 468 wells.	Moderate (-) Drawdown from 574 wells
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Water facilities outside yearlong range	Minor (+) Water facilities outside crucial ranges
Fluid Minerals Management	Minor (-) 179 miles of new road	Minor (-) 90 miles of new road	Minor (-) 90 miles of new road
Other Resource Management Soil Resources	Minor (-) 3,593 acres (3.6%) soil disturbance	Minor (-) 2,168 acres (2.2%) soil disturbance	Minor (-) 2,541 acres (2.5%) soil disturbance

4.3.5.3. Cumulative Impacts

Cumulative impacts to water resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). The FCPA is in Upper Powder River subbasin, which was predicted to produce 1.2 million acre-feet of water from CBNG development (BLM 2003a). CBNG development in the FCPA is expected to produce between 12 mgd (26,883 acre-feet) and 19 mgd (42,564 acre-feet) of water assuming 2 years of produced water. Produced water from any alternative in the FCPA is approximately 3 percent of the total produced water predicted for the FCPA.

Groundwater in the FCPA will be subjected to drawdown, which is predicted to recover within 25 feet of pre-operational conditions within 25 years. Full recovery would likely take 10s to hundreds of years (BLM 2003a). Seventy-five percent of the produced water estimate for the FCPA is permitted for discharge to drainages. Cumulative impacts from this discharge could result in changes to water chemistry and increased sediment loading to the Powder River and Wild Horse Creek.

4.3.6. Vegetation Resources

Management goals for vegetation resources within the FCPA are (1) maintain or improve the diversity of plant communities to support livestock needs, wildlife habitat, watershed protection, and acceptable visual resources; and (2) reduce the spread of noxious weeds. Most management actions related to these goals are common to all alternatives and include:

- Management actions affecting vegetation will be designed to meet overall resource management objectives and will be consistent with policy to protect or improve biodiversity and water quality.
- In cooperation with county weed and pest districts, cooperative integrated weed control programs are being implemented on public land in conjunction with control work on adjoining deeded and state lands.
- Weed educational material will be reviewed during pre-construction onsite meetings with operators, subcontractors, and landowners and will be attached to approved Applications for Permit to Drill (APDs) and PODs (PRB O&G ROD, p. A-32 [BLM 2003c]).
- The operator will be responsible for prevention and control of noxious weeds and weeds of concern on all areas of surface disturbance associated with the project (well locations, roads, water management facilities, etc.) Use of pesticides will comply with the applicable Federal and state laws. Pesticides will be used only in accordance with their registered uses and within limitations imposed by the Secretary of the Interior. Prior to the use of pesticides on public land, the holder will obtain from the BLM Authorized Officer written approval of a plan showing the type and quantity of material to be used, pest(s) to be controlled, method of application, location of container storage and disposal, and any other information deemed necessary by the BLM Authorized Officer for such use.
- Authorized livestock grazing use will not be increased.
- 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.
- Operators in areas with identified weed infestations or suitable Ute ladies'- tresses orchid habitat will be required to submit an integrated pest management plan prior to APD approval. Mitigation will be determined on a site-specific basis and may include measures such as spraying herbicides prior to entering areas and washing vehicles before leaving infested areas. Infestation areas of noxious weeds have been identified throughout the county Weed and Pest Districts and information is available at the Buffalo BLM office.

A distinction would be made between alternatives in regard to how livestock management would be conducted within oil and gas projects. The following alternative analysis considers adverse and beneficial impacts as well as direct and indirect impacts to vegetation resources.

4.3.6.1. Evaluation Criteria

The degree of both beneficial and adverse estimated impacts to vegetation resources is described using the following categories. These categories are defined in both quantitative terms (surface disturbance area), when such analyses are possible, and in more qualitative terms (visibility, duration, and in the context of Wyoming Standards for Healthy Public Rangelands) when there are no quantitative parameters available for analysis.

- *None* – No physical disruption of the resource. Effects are unlikely to be detectable. No impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995).
- *Negligible* – Physical disruption to less than 5 percent of the resource. Effects may be detectable but of short duration (would last no more than one growing season) and not of concern to the general public. Unlikely to impair the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995).
- *Minor* – Physical disruption to less than 5 percent of the resource. Effects would be detectable but temporary (would last no more than 2 years) and unlikely to be of concern to the general public. Likely to cause some impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995).
- *Moderate* – Physical disruption to 6 to 15 percent of the resource. Effects would be readily visible and maybe of concern to the general public. Effects may increase over time or be long-term to permanent. May cause substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995).
- *Major* – Physical disruption to more than 15 percent of the resource. Effects would be highly visible and of concern to the general public. Effects likely to increase over time and be long term or permanent. Likely to cause substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangelands (BLM 1995).

4.3.6.2. Alternative Analysis

Direct adverse impacts to upland vegetation are considered to include disruption or removal of rooted vegetation resulting in a reduction in areas of native vegetation; reduction of total numbers of plant species (species richness) within an area; and/or reduction or loss of total area, diversity, structure, or function of wildlife habitat. Impacts to vegetation resources may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses.

A number of indirect impacts to vegetation resources are also a potential result of proposed management actions. Potential indirect impacts include disruption or reduction of pollinator populations; loss of habitat suitable for colonization due to surface disturbance; introduction of noxious weeds by various vectors or conditions that enhance the spread of weeds; and general loss of habitat due to surface occupancy, surface compaction, or trampling. Upgradient physical disruption can result in sedimentation into occupied habitat and/or potential habitat. Failed reclamation or mitigation may also cause indirect impacts to these resources. Most indirect impacts are assumed to result from direct impacts in proportion to the relative amount of surface disturbance.

The estimated extent of ground-disturbing activities associated with fluid minerals management to each vegetation type, by alternative, shown on Table 4-13, is as follows:

- The linear extent of associated roads was calculated based on location and length estimated in Section 4.3.7, Fish and Wildlife Resources. Because both would result in direct impacts to vegetation resources, this number includes existing roads that would be used for each alternative as well as anticipated new roads. These were overlaid on vegetation type boundaries and the proportion of the total road lengths (existing and new roads) was estimated for each vegetation type.

- The estimated buffer width of these roads follows Table 4-1. It was assumed that all pipelines and overhead power lines would be included within this buffer.
- The proportion of the total road disturbance area within each vegetation type was applied to the total estimated disturbance area for all other associated structures and facilities, as shown in Table 4-13. These include well pads, overhead electric, compressor, metering, and water facilities)

Table 4-13 Estimated Area of Direct Surface Disturbance to Vegetation Resources				
Vegetation Class	Total Area (acres) Percentage of FCPA	Estimated Impacts		
		Alternative I	Alternative II	Alternative III
Agricultural	99.7 (0.1%)	7.2 (7.2%)	6.8 (6.8%)	7.0 (7.0%)
Woodland	1,737.2 (1.7%)	36.3 (2.1%)	20.7 (1.2%)	27.7 (1.6%)
Herbaceous Rangeland	66,848.7 (66.4%)	2,910.8 (4.4%)	2,053.0 (3.1%)	2,473.6 (3.7%)
Rock-Bare Soil	1,514.5 (1.5%)	37.3 (2.5%)	29.5 (1.9%)	32.7 (2.2%)
Shrubland	30,451.5 (30.3%)	1,531.6 (5.0%)	1,049.5 (3.4%)	1,284.6 (4.2%)
Total Vegetation Resources	100,652 (100%)	4,523.2 (4.5%)	3,159.5 (3.1%)	3,825.6 (3.8%)

Note: Water not included in acreage.

Disturbance estimates are based on all roads as “improved roads” with a width of 48 feet.

The following sections describe the impacts under each alternative resulting from the management of vegetation resources (including noxious weed management), as well as those anticipated to result from the management actions proposed for wildlife, special status species, fluid mineral management, and other resource management, including soil resources and special designations.

Alternative I (No Action Alternative)

Vegetation Resources Management

Alternative I, the No Action Alternative, would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including direction to design all vegetation management to meet these objectives. A number of management actions specifically address undertaking actions that would result in some control of existing noxious weed populations and limit the spread of noxious weeds. As is currently practiced, livestock management would be allowed within oil and gas projects. Several allotments have been assessed and determined to meet Wyoming Standards for Healthy Public Rangelands (BLM 1995); however, the condition of other allotments is not known. Management actions under Alternative I, including weed control and revegetation, are expected to result in

beneficial impacts. Weed control actions would result in some control of existing weed populations and limit the further spread of noxious weeds. Revegetation would be planned and implemented to prevent noxious weed proliferation and spread. Overall the results of these actions would be considered minor in terms of visibility and duration of impacts, because weed populations continue to decrease in size, incipient populations are not allowed to spread, and native vegetation cover within the FCPA increases as a result.

Wildlife and Special Status Species Resources Management

Under this alternative TLs for crucial elk habitat limit surface-disturbing activities during parts of the year. Prohibiting impacts to vegetation in elk crucial winter range between November 15 and April 30 will result in better plant growth and less erosion during this time; however, the benefits are temporary. Existing management of wildlife resources, including specific elk management actions, does not impact vegetation resources.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not negatively affect resource values in the FCPA. Current management actions for CBNG development under Alternative I include restrictions and limitations for wildlife values. Under Alternative I, no overhead power lines are allowed on BLM lands but all power lines on other lands would be along road corridors. These restrictions are reflected in the estimated surface disturbance impacts.

Development of CBNG under Alternative I would result in an estimated 4,523 acres of vegetation disturbance (4.5 percent of the total area) (Table 4-13). This would affect approximately 7 percent of agricultural lands. All other vegetation types would experience less than 5 percent surface disturbance. It should be noted that while revegetation may take approximately two years to reestablish some vegetation cover, vegetative structure, function, and diversity will likely take decades to reestablish to pre-disturbance conditions.

CBNG development results in produced water from well development, which is handled in either impoundments or discharge to channels. Development of impoundments can lead to localized water leakage, which would result in changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges (*Carex* sp.), foxtail barley (*Hordeum jubatum*), and, in places, cattails (*Typha* sp.). Salt cedar (*Tamarix* sp.), a noxious weed species, has a toehold in the FCPA, and expansion of mesic habitats could allow for further invasion by this species. Under Alternative I, an estimated 218 acres will be disturbed as a result of water impoundments.

The discharge to channels, although treated if necessary as required by WDEQ, would likely have an adverse impact on aquatic habitats, including vegetation. Under this alternative there is the potential for approximately 726 new wells in the FCPA. It is anticipated that 75 percent of those wells would discharge produced water directly into drainage channels. These drainage channels could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and Wild Horse Creek. With an average discharge of approximately 0.026 mgd per well (Table 4-11), an increase of 726 wells would result in an additional 14 mgd (93 mby) of produced water directly discharged into FCPA channels. Increased flows and sedimentation could result in conversion of reaches of ephemeral drainages that currently support

upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall the impacts to vegetation resources from these conversions would be minor in extent and negative. Although they would result in an increase in wetland and riparian habitat, both limited in the FCPA, these vegetation types are temporary and dependent on continued CBNG discharge for their existence.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure (erosive), and erosive soils. This would result in indirect minor beneficial impacts to any vegetation that occurs in these areas because erosion would be minimized on approximately 33,694 acres; however vegetation is sparse in these areas.

Special Designations

Special designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area. Under Alternative I, the WSA (approximately 12,185 acres) would continue to be managed to maintain wilderness characteristics and no development would be allowed. No Area of Critical Environmental Concern (ACEC) or Wildlife Habitat Management Areas (WHMAs) would be designated. Therefore, it is expected that with no area of special designation in addition to the WSA, impacts to vegetation resources would be considered negligibly beneficial.

Alternative II

Vegetation Resources Management

Under Alternative II, current management goals and objectives summarized above would be continued. Most of the specific management actions are common to all alternatives, including direction to design all vegetation management to meet these objectives. A number of management actions specifically address undertaking efforts that would result in some control of existing noxious weed populations and limit the spread of noxious weeds. Several allotments have been assessed and determined to meet Wyoming Standards for Healthy Public Rangelands (BLM 1995); however, the condition of other allotments is not known. Management actions under Alternative II, including weed control and revegetation, are expected to result in beneficial impacts. Weed control through several actions would result in a potential reduction of noxious weeds through mitigation and prevention. Revegetation would be planned and implemented to prevent noxious weeds. Reclamation in problematic areas may be enhanced by the requirement to fence seeded areas for at least two years. Overall the results of these actions would be considered moderate in terms of visibility and duration of impacts, as weed populations continue to decrease in size, incipient populations are not allowed to spread, and native vegetation cover within the FCPA increases as a result.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values such as no net loss of elk security habitat. Such actions indirectly benefit vegetation resources, because they limit surface disturbance. Prohibiting impacts to vegetation in elk crucial winter range between November 15 and April 30, and in elk calving

areas from May 1 through June 30, will result in better plant growth and less erosion during this time; however, the benefits are temporary. Rest from livestock grazing in interim reclamation areas could be expected to result in more complete revegetation, contributing to minor beneficial impacts to vegetation.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not negatively impact resource values in the FCPA. Continuing current management actions for CBNG development under Alternative II include restrictions and limitations for wildlife values. Alternative II also specifies that there will be no net increase in road density from existing conditions. However, new roads can be built if others are reclaimed. Overhead power lines could be constructed along road corridors. These restrictions are reflected in the estimated surface disturbance impacts.

Development of CBNG under Alternative II would result in an estimated 3,160 acres of surface disturbance (3.1 percent of the total area) (Table 4-13) to vegetation, less than under Alternative I. This would affect approximately 6.8 percent of agricultural lands. All other vegetation types would experience less than 5 percent surface disturbance. This would result in minor adverse impacts to vegetation resources. It should be noted that while revegetation may take approximately two years to reestablish some vegetation cover, vegetative structure, function, and diversity will likely take decades to reestablish to pre-disturbance conditions.

CBNG development results in produced water from well development, which is handled in either impoundments or a discharge to channels. Development of impoundments can lead to localized water leakage, which in turn would result in changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar, a noxious weed, has a toehold in the FCPA, and expansion of mesic habitats could allow for further invasion by this species. Under Alternative II, an estimated 140 acres will be disturbed as a result of water impoundments.

Under this alternative there is the potential for approximately 468 new wells in the FCPA. It is anticipated that 75 percent of those wells would discharge produced water directly into drainage channels. This could include the Powder River, Mickleberry Creek, Deer Creek, Bull Creek, Fortification Creek, and Wild Horse Creek. With an average discharge of approximately 0.026 mgd per well (Table 4-11), an increase of 468 wells would result in an additional 9.2 mgd (60.5 mby) of produced water directly discharged into FCPA channels. Increased flows could result in conversion of reaches of ephemeral drainages that currently support upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall the impacts to vegetation resources from these conversions would be minor in extent and negative. Although they would result in an increase in wetland and riparian habitat, these vegetation types are temporary and dependent on continued CBNG discharge for their existence.

Other Resources Management

Soil Resources

Under this alternative, no surface disturbance would be allowed on slopes greater than 25 percent, badlands, rock outcrop, areas susceptible to mass failure, and erosive soil. There would be no exceptions to this restriction. This limitation of activities would indirectly result in minor beneficial impacts to any vegetation that occurs in these areas because erosion would be minimized on approximately 33,694 acres; however, much of this area is not vegetated.

Special Designations

Special area designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area as well as potentially including protective or otherwise beneficial management prescriptions. As under all alternatives, the WSA (approximately 12,185 acres) would continue to be managed to maintain wilderness characteristics. Under Alternative II, an ACEC (approximately 52,069 acres) may be designated for elk calving and crucial winter range. A WHMA for elk yearlong winter range (approximately 78,251 acres) would also be designated. It is expected these actions would result in minor beneficial impacts to vegetation resources because surface disturbance and erosion may be reduced.

Alternative III

Vegetation Resources Management

Under Alternative III, current management goals and objectives summarized above would be continued. Most of the specific management actions are common to all alternatives, including direction to design all vegetation management to meet these objectives. A number of management actions specifically address undertaking efforts that would result in some control of existing noxious weed populations and limit the spread of noxious weeds. Management actions under Alternative III, including weed control and revegetation, are expected to result in general beneficial impacts. Weed control through several actions would result in a potential reduction of noxious weeds through mitigation, prevention, and revegetation, would be planned and implemented to prevent noxious weeds. Under this alternative, livestock management on disturbed areas will be evaluated and may be modified to include such efforts as adjusting stocking rates/timing, fencing, and rest the first year following reclamation and deferment of grazing the second year. This action would result in minor beneficial impacts to vegetation resources because additional time would be allowed for revegetation of disturbed areas. Several allotments have been assessed and determined to meet standards Wyoming Standards for Healthy Public Rangelands (BLM 1995). But the condition of other allotments is not known. Overall the results of these actions could be considered moderate in terms of the visibility and time period of these impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative III include restrictions and limitations for wildlife values such as a 20 percent threshold for security habitat loss. Such actions indirectly benefit vegetation resources, because they result in limitations to surface disturbance. Prohibiting impacts to vegetation in elk calving areas from May 1 through June 30 would result in better plant growth and less erosion; however, the restrictions are temporary. Potential rest from livestock grazing in interim reclamation areas could be expected to result in more complete revegetation, contributing to minor beneficial impacts to vegetation. While

revegetation may take approximately two years, vegetative structure, function, and diversity will likely take decades.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not negatively impact resource values in the FCPA. Continuing current management actions for CBNG development under Alternative III include restrictions and limitations for wildlife values. Development of CBNG under Alternative III would allow up to a 20 percent increase in road density from current conditions. These conditions and restrictions are reflected in the estimated surface disturbance impacts.

Alternative III would result in less surface disturbance than Alternative I, but more than under Alternative II. It is estimated that approximately 3,826 acres of surface disturbance (3.8 percent of the total area) (Table 4-13) would result to vegetation resources. This would affect approximately 7 percent of agricultural lands. All other vegetation types would experience less than 5 percent surface disturbance. This would result in minor adverse impacts to vegetation resources. It should be noted that while revegetation may take approximately two years to reestablish some vegetation cover, vegetative structure, function, and diversity will likely take decades to reestablish to pre-disturbance conditions.

CBNG development results in produced water from well development, which is handled in impoundments. Development of impoundments can lead to localized water leakage that would result in changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar, a noxious weed, has a toehold in the FCPA, and expansion of mesic habitats could allow for further invasion by this species. Under Alternative III, an estimated 172 acres will be disturbed as a result of water impoundments.

Alternative III would include requirements for WYPDES permits for the discharge of CBNG produced water with water quality but not quantity requirements. CBNG discharge is currently permitted at approximately 48 mgd for 1,807 wells. Current discharge is estimated at 1.8 mgd (16.2 mby) and current storage is estimated at 0.6 mgd (4 mby).

Under this alternative there is the potential for approximately 574 new wells in the FCPA. Overall the impacts to vegetation resources from these conversions would be minor in extent and negative in that they would result in an increase in area of wetland and riparian habitat.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure, and erosive soil. This would result in indirect minor beneficial impacts to any vegetation that occurs in these areas because erosion would be minimized on approximately 33,694 acres.

Special Designations

Special area designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area as well as potentially including protective or otherwise beneficial management prescriptions. As under all alternatives, the WSA (approximately 12,185 acres) would continue to be managed to maintain wilderness characteristics. Under Alternative III, an ACEC would be designated for resources including the Fortification Creek elk herd, erosive soil, and scenic values. This 33,757-acre area represents 33 percent of the vegetation resources in the FCPA. In addition, a WHMA for elk crucial winter range and elk calving range (approximately 52,069 acres) would also be designated. It is expected these actions would result in minor beneficial impacts to vegetation resources because more area would be protected from erosion.

Summary

Table 4-14 summarizes estimated impacts to vegetation resources, by alternative.

Table 4-14 Summary of Impacts to Vegetation Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Vegetation Resources Management	Minor (+) Reduction in noxious weeds.	Moderate (+) Fence problem reclamation areas.	Moderate (+) Manage livestock to protect reclamation.
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Two-year rest	Minor (+) One-year rest
Fluid Minerals Management	Minor (-) 3,593-acre (3.6%) disturbance	Minor (-) 2,183-acres (2.2%) disturbance	Minor (-) 2,514-acre (2.5%) disturbance
Other Resource Management			
Soil Resources	Minor (+) Exceptions apply	Minor (+) No exceptions	Minor (+) Exceptions apply
Special Designations	Negligible (+) WSA protections	Minor (+) WHMA 78,251 acres	Minor (+) WHMA 52,069 acres

4.3.6.3. Cumulative Impacts

Cumulative impacts to vegetation resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Total acreage affected by CBNG development would not be disturbed simultaneously because development would occur over approximately 10 years. Disturbed areas would be revegetated or would be in the process of being revegetated while new disturbance was occurring (BLM 2003a). The BLM estimated that 2,300 acres per day were being colonized by weeds in the western U.S. (BLM 1995b). From 1999 to 2002, the

area of infestation of Canada thistle almost doubled in Campbell County, and Scotch thistle and salt-cedar tripled in distribution in Johnson County (BLM 2003a). Water quality, quantity, and long-term production can be reduced by spotted knapweed and diffuse knapweed invading watersheds. In western Montana, surface runoff was increased by 56 percent and sediment yield was 192 percent higher in spotted knapweed sites, compared to those sites dominated by native bunch grass (Wyoming State Weed Team 2003). CBNG development in the FCPA will result in an increase in noxious weeds in areas of surface disturbance (potentially 3,593 acres), which could spread to areas outside the FCPA. Similarly, noxious weeds outside of the FCPA from current and future CBNG development could colonize disturbed land inside the FCPA.

4.3.7. Fish and Wildlife Resources

Fish and Wildlife Resources include animals, typically vertebrates, that are not threatened, endangered, or of special concern. Such species are discussed in the next section (Section 4.3.8), below. The goals of fish and wildlife management in the FCPA are to maintain biological diversity; support Wyoming Game and Fish Department (WGFD) population objective levels to the extent practical and to the extent consistent with BLM multiple use; maintain and improve forage production and quality of rangelands, fisheries, and wildlife habitat; provide habitat for threatened and endangered and special status species to the extent possible; and provide habitat for elk and other big game species. The management objectives related to this goal are to support big game and fisheries management levels identified in the WGFD's 2007–2011 strategic plan (WGFD 2006a), and protect the isolated elk herd in the FCPA while allowing CBNG development.

There are no management actions common to all alternatives. The following alternative analysis considers the impacts of the various management actions on fish and wildlife

4.3.7.1. Evaluation Criteria

The boundary of the FCPA was used as the impact analysis area. This is the boundary specified for the RMPA/EA. The WGFD had developed boundaries for the elk yearlong range (defined by the core use area for the herd) and elk crucial range (the crucial winter range and calving range, combined). The boundaries for both the elk yearlong range and elk crucial range extend south beyond the limits of the FCPA. For purposes of analysis, the yearlong and crucial ranges within the boundaries of the FCPA will be the analysis area for the elk. To avoid confusion, it should be noted that in other documents (BLM 2007a, WGFD 2007a), the term *Fortification Creek Area* is used to refer to the entire elk yearlong range.

The WGFD has identified a herd management objective of 150 elk for the yearlong range (WGFD 2007a). The 2007 pre-hunt population estimate was 270 animals in the yearlong range. Anticipated changes in elk population numbers are difficult, if not impossible, to predict. In addition to elk numbers, useful and measurable metrics include effective habitat and security habitat. BLM has indicated that loss of habitat, effective habitat, or security habitat would serve to evaluate management actions, and these are the metrics used in the present analysis.

The discussion below describes the factors that define habitat loss for wildlife, with specific references to elk, and to the Fortification Creek elk herd where data were available.

Direct Habitat Loss

Direct habitat loss occurs when required life-sustaining conditions are lost (i.e., through removal of vegetation or draining a pond). Removal of vegetation affects wildlife by reducing the extent

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

Effective Habitat Loss

While some species are more tolerant of human activity than others, virtually all species have some threshold of disturbance above which they will abandon or avoid an area. The result is a de facto loss of habitat, because avoided areas meet no survival needs. The amount of habitat actually available to wildlife is called effective habitat, and reductions in the amount of effective habitat can greatly exceed any direct habitat loss. Also important is security habitat, defined as a place to escape from disturbance. Security habitat is typically defined in patches of a minimum size.

Effective loss of habitat can occur as a result of habitat modification, habitat fragmentation, disturbance, and interference with movement. These impacts to habitat reduce the ability of the habitat to provide the basic needs of the wildlife in question.

Habitat modification, or changes in habitat, are generally less obvious than losses of habitat but can be significant, especially if small impacts accumulate across large areas. Invasion of weeds leading to a reduction in native plant vigor or cover is a notable habitat modification in the FCPA. Habitat modification can also be beneficial and is an important tool in wildlife management. Examples include use of prescribed fires to stimulate new growth on senescent (older) woody vegetation, thinning of overly dense shrubs to enhance forage production, construction of protective fencing along riparian areas, and creation of alternative watering features for elk and other wildlife to allow for a potentially greater dispersion across the landscape.

Habitat fragmentation is increasingly recognized as an important impact on wildlife. Impacts of habitat fragmentation relate to the loss of large habitat blocks and the increased percentage of “edge” on smaller blocks as compared to larger blocks. Roads can cause habitat fragmentation, and hence loss of effective habitat, because many species exhibit a decline in use of areas adjacent to roads. Habitat-interior birds may avoid habitat within 497 feet of roads (Forman and Alexander 1998, Forman 2000, Ingelfinger 2001) and sagebrush obligate birds experienced a 39 to 60 percent reduction in density near roads in a natural gas oil field (Ingelfinger and Anderson 2004). In one study, use by mule deer was reduced within 0.125 mile of a road (Knight et al. 2000). A study in central Wyoming reported that mineral drilling activities displaced mule deer by more than 0.5 miles (Hiatt and Baker 1981). Small mammal studies in sagebrush-steppe landscapes indicate that species richness decreased with increasing isolation of habitat patches (Hanser and Huntly 2006). The authors suggest that these sagebrush-obligate species are at risk of extirpation as sagebrush becomes ever more fragmented. Another cause of habitat fragmentation is the replacement of native vegetation by weeds. The presence of cheatgrass further added to the decrease in species richness in that study.

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

Habitat loss or modification, habitat fragmentation, and disturbance impacts can also affect wildlife by altering important daily or seasonal movement patterns. These patterns may be altered through shifts to avoid human activity or to avoid crossing open areas that provide inadequate cover. Conversely, some species and populations adapt to disturbance. This effect, called habituation, is very difficult to predict with a species such as elk. Some populations appear to habituate, such as in Yellowstone National Park, and yet others do not and continue to be stressed and move away from human disturbance, as appears to be the case for the Fortification Creek herd. Elk habituate in areas where activity is predictable and non-lethal. Hunted populations show less tendency to habituate, which appears to be the case in Fortification Creek herd.

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

Direct Mortality

Direct mortality can result from collisions with vehicles, electrocution of raptors on utility lines, increased likelihood of illegal hunting, or inadvertent trampling of nests, as well as other events. The most likely cause of direct mortality in the FCPA is vehicle collisions. Amphibians, reptiles, prairie dogs, and other small mammals, because of their slow rate of mobility, are particularly vulnerable to this while crossing roads to access hibernation, breeding, and foraging sites.

Road and Elk Model Analysis

For the purposes of analyzing the impact of CBNG development scenarios on elk habitat, a modeling effort, similar to that used by BLM (2007c), was conducted for that portion of the elk yearlong range and the elk crucial range within the FCPA. The elk ranges are defined in WGFD Fortification elk study progress report (2007b). The analysis was limited to lands with Federal mineral estate, except when actions led to impacts on elk or other wildlife elsewhere (as in the discussion of water management).

The analysis evaluated the acreage of effective and security habitat available to elk under the three alternatives. Effective habitat was modeled as all areas within the elk ranges that were either 0.5 miles from roads or at less than 0.5 miles where visibility of the road was obscured by topography at a lesser distance. The model does not account for vegetation, because a previous study found that vegetation did not explain observed elk use in relation to roads (BLM 2007d). Rather than calculate the buffering around individual wells, especially because their exact location is difficult to predict, it was assumed that by calculating the loss of effective habitat around roads that access the wells, the loss of effective habitat around wells was generally accommodated because elk are avoiding human activity more than the physical road or well, and

more surface area and activity occurs on the roads than at the wells. The visibility model employed a 98-foot digital elevation model to account for topography (U.S. Geological Survey [USGS] National Elevation Database). Because no development will occur in the WSA, it was assumed that no roads occurred or were used in the WSA. The model was run for the entire yearlong elk range and subsequently clipped to the FCPA. This ensures that roads immediately outside the FCPA but within 0.5 miles would show the loss of effective habitat. The same algorithm was used for the elk crucial range.

Security habitat, the number of patches and total acreage, was also analyzed. A security patch was defined as a block of contiguous effective habitat with a size of 250 acres or more. This is a common minimum patch size that has been employed in other elk studies (Christensen Lyon, and Lonner 1991, Leege 1984, cited in BLM 2007a).

Alternative I was analyzed using a planimetric road layer designed to avoid slopes greater than 25 percent and accommodate an 80-acre well spacing. Alternative II was analyzed with the existing road layer, which did not avoid slopes greater than 25 percent. This represents no net increase in roads, however, proposed roads and wells must avoid slopes greater than 25 percent. Alternative III was analyzed by eliminating a 0.5-mile buffer around the WSA, and then using an algorithm that employed the 80-acre spacing road layer. The algorithm took the longest road, then the next longest road, etc., until the road density increase was actualized. If the last road added was too long (and surpassed the target), it was clipped back to the appropriate length not to exceed the 20 percent decrease in security habitat loss. This process was conducted separately for the yearlong elk range and the crucial elk range. The methodology is further described in Appendix D.

Loss of habitat is measurable. However, it is not possible to translate this information directly to changes in elk population estimates. In fact, it is difficult to predict exactly what the elk herd will do in response to the various development scenarios (O'Brien 2008). With that in mind, the analysis of available habitat is the best measure that can be applied to estimate impacts to the elk herd.

4.3.7.2. Alternative Analysis

Impact intensity defines the degree or extent of impacts. For this analysis, the categories are defined as follows:

- *Minor* – The effect is slight but detectable; there would be a small change. Resource indicator thresholds are potentially exceeded, but on a short-term or highly localized basis. This would be characterized as less than 15 percent alteration in resource indicators.
- *Moderate* – The effect is readily apparent; there would be a measurable change that could result in long-term or permanent change to a resource. Some resource indicator thresholds are exceeded. This would be characterized by a 15 to 20 percent alteration.
- *Major* – The effect is large; there would be a highly noticeable, long-term, or permanent measurable change. Resource indicator thresholds are clearly exceeded. An alteration of more than 20 percent in resource indicators would qualify as a major impact.

The occurrence, abundance, and distribution of wildlife are most strongly affected by habitat availability and accessibility. These habitat characteristics may be severely altered as a result of increased human activity and resource development. Negative impacts are a typical result of management actions associated with fluid minerals development. Other management actions can

be beneficial or harmful, such as soil and water resources management, and others, depending on how and what actions are implemented.

Wildlife also can benefit from resource management activities aimed at specific wildlife or other environmental concerns, such as protective measures for special status species, TLs, no surface occupancy (NSOs), disturbance-free buffer zones, and other actions aimed at preserving or enhancing fish and wildlife resources.

Impacts to fish and wildlife resources associated with Alternatives I through III are summarized in the following subsections. These impacts can be either direct or indirect and can result from any activity involving increased levels of human activity and removal or modification of habitat.

Alternative I (No Action Alternative)

Fish and Wildlife Management

Alternative I, the No Action Alternative, would allow CBNG development at an unrestricted pace. Surface disturbance would not be allowed in elk crucial winter range between November 15 and April 30. Well metering and visitation, and water management facility locations, would not be restricted. No water sources would be required for elk, although proposed stock tanks would be required to be wildlife friendly. Compressor locations would not be restricted in elk areas. No elk security habitat or road density standards would be implemented. Because these management actions are also Fluid Minerals management actions, they are further described below along with their impacts to wildlife.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects on the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. There are additional restrictions that relate to special status species. They are also listed as management actions common to all alternatives for management of special status species, and will be addressed under Special Status Species Management.

Management actions specific to Alternative I include an unrestricted development pace; no restrictions on location of compressors and water management facilities; and restriction (when deemed necessary) of surface disturbance and disruptive activities in elk crucial winter range between November 15 and April 30. Further actions include no restriction on well metering and visitation, no requirement of water sources for elk, all proposed stock tanks would be wildlife friendly, no elk security habitat or road density standards implemented, and overhead power lines would be prohibited on BLM surface land.

Fluid minerals development has many aspects that are detrimental to wildlife populations. Often, it is the roads and associated disturbances that humans bring that impact wildlife in these otherwise isolated areas. One example is the increase in shooting of prairie dogs (Reeve and Vosburgh 2006) and other species that can occur when roads open up an otherwise inaccessible area.

Unrestricted development pace has a major adverse impact on wildlife, especially the Fortification Creek elk herd. Unrestricted development, including roads, wells, and ancillary facilities, would result in habitat fragmentation and loss. Because roads, wells, and facilities could be placed anywhere in the FCPA without regard for timing or coordination among operators, the elk would be forced into smaller areas. In the FCPA this would be the WSA, which is not large enough to support an elk population of 120 because the majority of the elk crucial ranges are outside of the WSA.

Roads cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat because of habitat fragmentation, disturbance, and interference with movement patterns. Direct mortality is also an occurrence on roads. These impacts were evaluated for elk in particular. The comparison of road length, road density, effective habitat, and security habitat under the three alternatives is shown in Table 4-15 below.

In the elk yearlong range, road density would increase from 2.3 miles/square mile (mile²) under present conditions to 3.5 miles/mile² under Alternative I. The 17,931 acres of effective habitat under existing conditions would decrease by 6,526 acres, representing a loss of 36 percent of the existing effective habitat. Whereas current conditions show four security patches with a total of 11,516 acres, Alternative I would cause the loss of three of the security patches (75 percent loss from existing conditions) and a loss of 4,884 acres of security habitat, or 42 percent of that currently available. The only security habitat would be inside the WSA. Elk yearlong security areas are shown on Figure 4-2.

Table 4-15 Comparison of Linear Road Miles and Road Density, Effective Elk Habitat, and Elk Security Habitat Under the Three Alternatives				
Alternative	Linear Road Miles and Road Density (miles/mile²)	Effective Habitat (acres)	Number of Security Patches	Security Area Total (acres)
Elk Yearlong Range in FCPA				
Alternative I 80-acre spacing (8 wells/section)	428 miles 3.5 miles/mile ²	11,405	1	6,632
Alternative II Existing Conditions	282 miles 2.3 miles/mile ²	17,931	4	11,516
Alternative III 20 Percent Change from Current	348 miles 2.8 miles/mile ²	12,932	3	9,388
Elk Crucial Ranges (includes calving range and crucial winter range) in FCPA				
Alternative I 80-acre spacing (8 wells/section)	245 miles 3.0 miles/mile ²	9,505	1	6,632

Alternative	Linear Road Miles and Road Density (miles/mile²)	Effective Habitat (acres)	Number of Security Patches	Security Area Total (acres)
Alternative II Existing Conditions	153 miles 1.9 miles/mile ²	13,774	2	9,818
Alternative III 20 Percent Change from Existing	195 miles 2.4 miles/mile ²	10,552	2	8,625

Notes:
 Limited to specified elk ranges within FCPA and includes all lands.
 Model assumes no roads in WSA. Conducts model before clipping to the FCPA.
 Uses 0.5-mile buffer on roads, or less than 0.5 miles if road not visible at lesser distance (see text for explanation). Alternative III calculates a 20 percent increase in road density from existing conditions (see text for explanation).

For elk crucial range, road density would increase from 1.9 miles/mile² under present conditions to 3.0 miles/mile² under Alternative I. The 13,774 acres of effective habitat under existing conditions would decrease by 4,269 acres, representing a loss of 31 percent of the existing effective habitat. Whereas current conditions show two security patches with a total of 9,818 acres, Alternative I would cause the loss of one of the security patches (representing a 50 percent loss from existing) and a loss of 3,186 acres of security habitat, or 32 percent of that currently available. The only security habitat would be inside the WSA. Elk crucial range security areas are shown on Figure 4-3. These three measures across the yearlong and crucial ranges indicate habitat impacts of 31 to 75 percent. The theoretical road density increase is shown on Figure 4-4. Road density was modeled, consequently, road locations are theoretical and Figure 4-4 does not indicate where all roads will go.

If adequate security is not available within the FCPA and/or the WSA, it possible that some elk will flee the area and may or may not return as has been observed with the collared elk where individuals have not returned (O'Brien 2008). Individuals that leave likely will move downriver to Montana. Although some individuals may flee, it is suspected that most of the elk would remain in the FCPA, causing overcrowding in the WSA (BLM 2007a).

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as salt cedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low- or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelagic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.).

Legend

-  Fortification Creek Planning Area
-  Wilderness Study Area

Security Patches

Alternative I

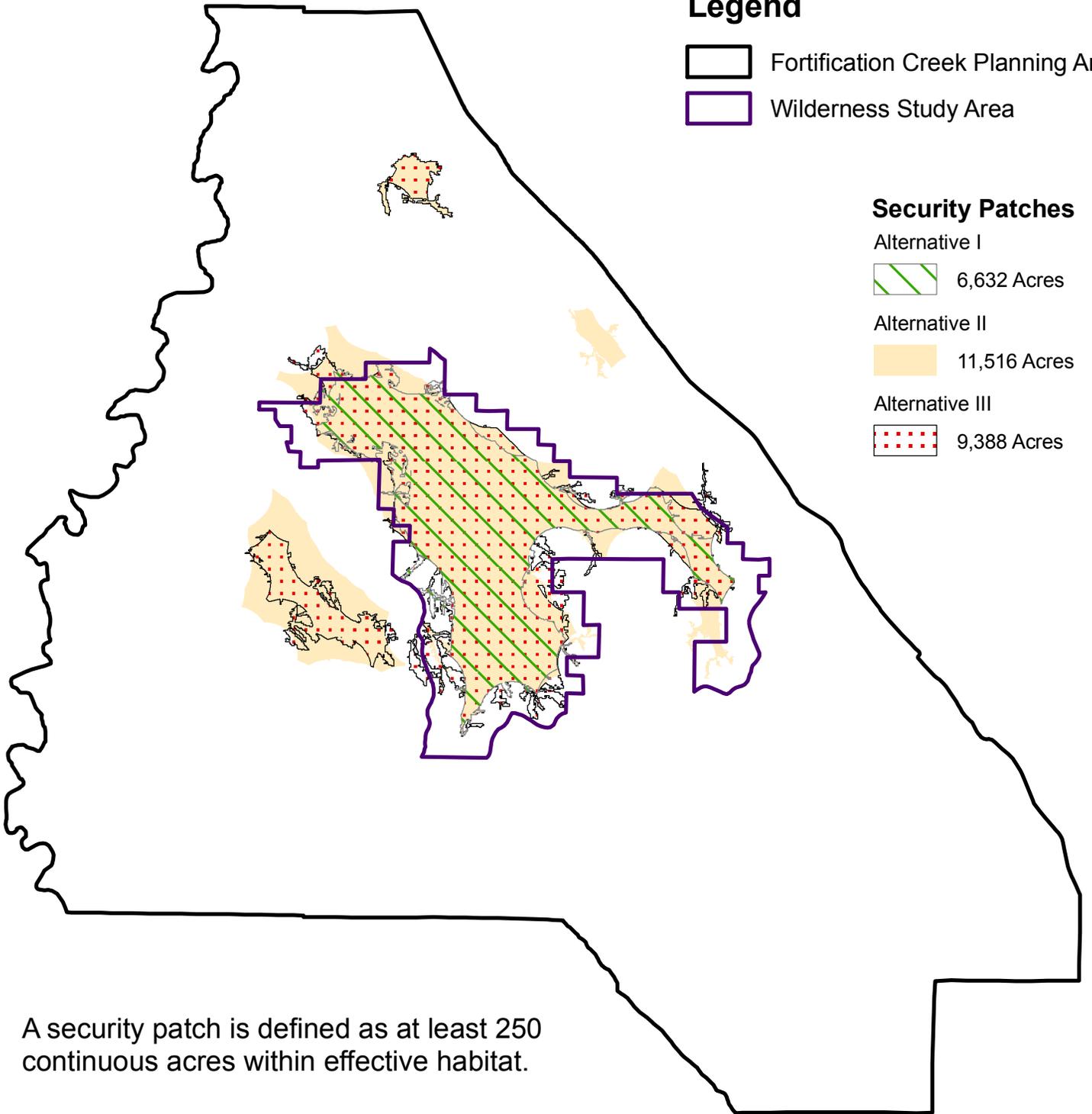
-  6,632 Acres

Alternative II

-  11,516 Acres

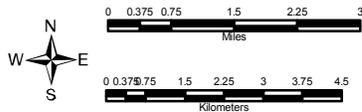
Alternative III

-  9,388 Acres



A security patch is defined as at least 250 continuous acres within effective habitat.

Effective habitat is defined as lands that are more than 0.5 mile from a road or areas less than 0.5 mile from roads where topography obscures the road.



Resource Management Plan Amendment/Environmental Assessment Fortification Creek Planning Area

**Figure 4-2
Elk Yearlong Range
Security Patches**

Map Reference:

Date:
07/2/08

GIS:
mc/ljr

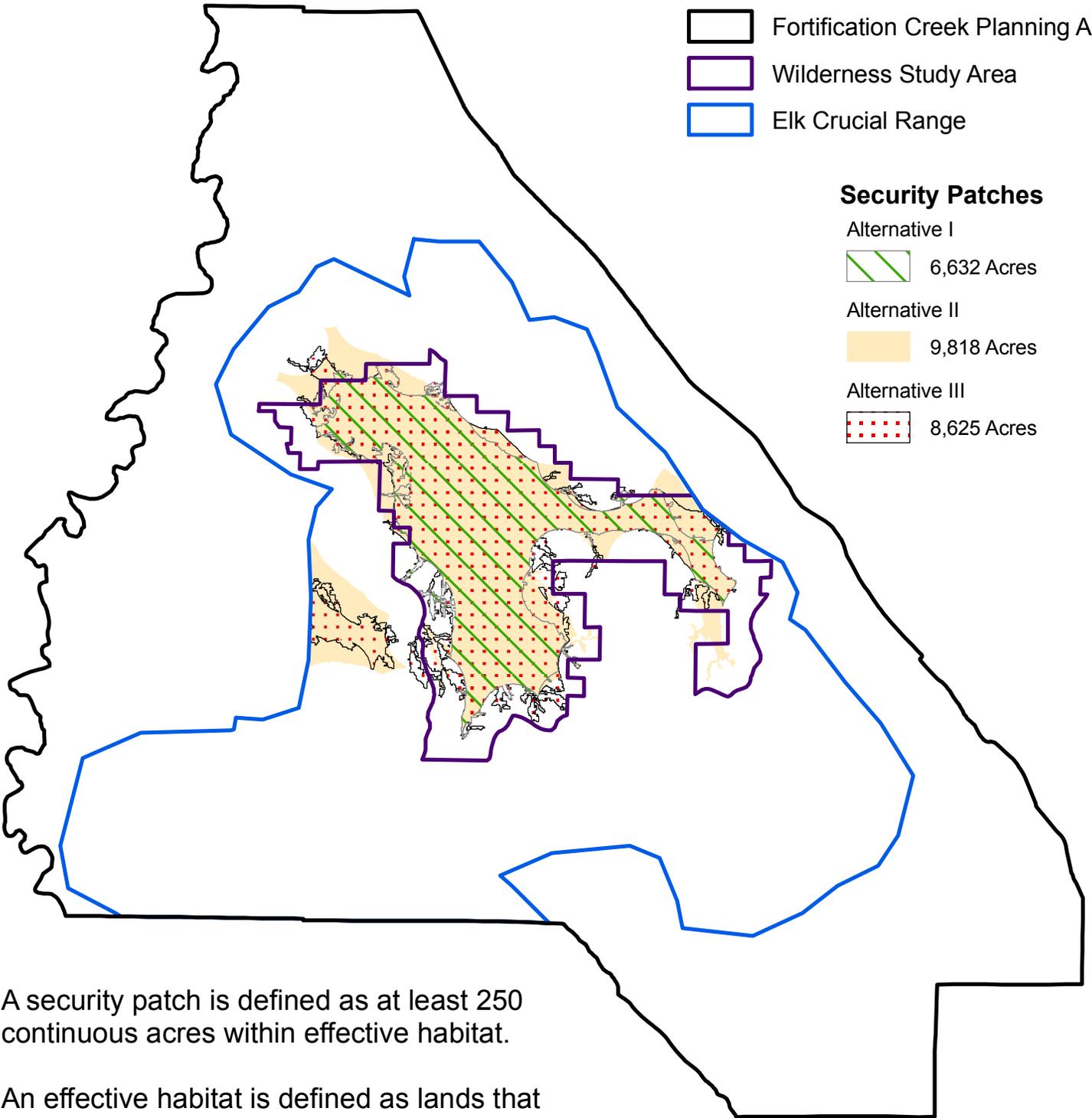
Project ID:
7945

Legend

-  Fortification Creek Planning Area
-  Wilderness Study Area
-  Elk Crucial Range

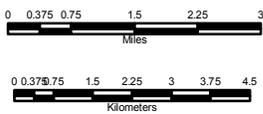
Security Patches

- Alternative I
 6,632 Acres
- Alternative II
 9,818 Acres
- Alternative III
 8,625 Acres



A security patch is defined as at least 250 continuous acres within effective habitat.

An effective habitat is defined as lands that are more than 0.5 mile from a road or areas less than 0.5 mile from roads where the topography obscures the road.



Resource Management Plan Amendment/Environmental Assessment Fortification Creek Planning Area

Figure 4-3 Elk Crucial Range Security Patches

Map Reference:

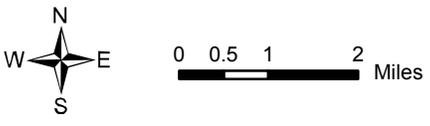
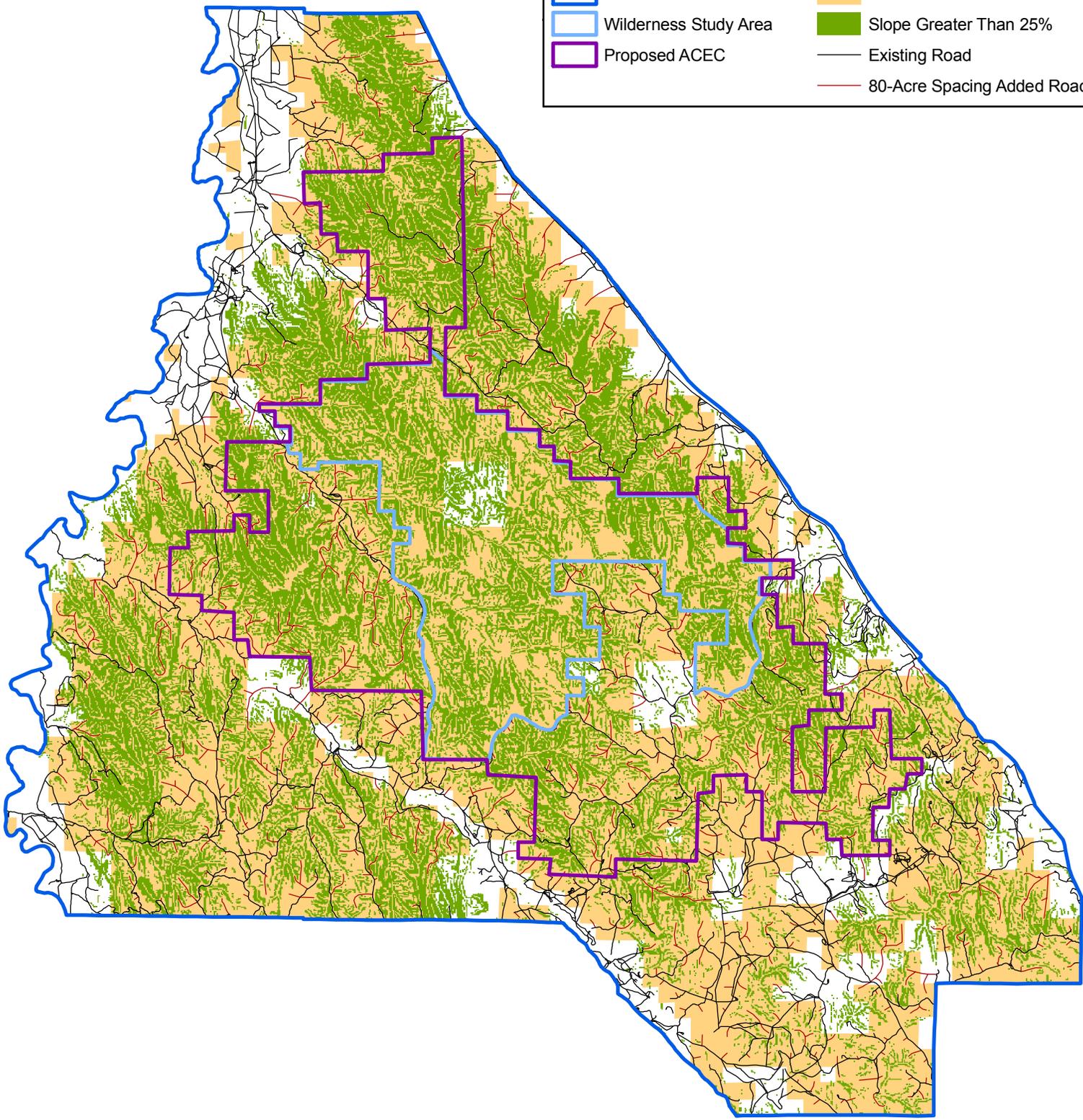
Date:
07/2/08

GIS:
mc/jjr

Project ID:
7945

Legend

- Fortification Creek Area
- Wilderness Study Area
- Proposed ACEC
- Federal Minerals
- Slope Greater Than 25%
- Existing Road
- 80-Acre Spacing Added Road



**Resource Management Plan
Amendment/Environmental
Assessment Fortification Creek
Planning Area**

**Figure 4-4
Theoretical 80 Acre
Spacing Road Network**

Map Reference:		
Date: 07/2/08	GIS: dsc	Project ID: 7945



Habitat-interior birds avoid use within 300 to 450 feet from forested roads, and up to 1.2 miles away from grassland roads (Forman 2000, Forman and Alexander 1998). The size of an undisturbed habitat block also affects the number of bird species present. In Georgia Piedmont forests, contiguous forest areas larger than 25 acres are needed to maintain high levels of avian diversity (McIntyre 1995). Although these studies were not conducted in sagebrush/juniper woodlands, it is not unreasonable to assume that the same concept applies. Similarly, small mammal species richness is sensitive to fragmentation in sagebrush shrublands (Hanser and Huntly 2006).

Under Alternative I, overhead power lines would be prohibited on BLM surface land. The prohibition on overhead power lines would avoid electrocutions and collision fatalities to raptors. However, these impacts would be transferred to adjacent non-Federal lands where power lines would not be prohibited. Generators are used as a temporary power source and typically run for a period of two years. The presence of generators would require fuel truck visits, on the order of one to two trips per week, and the sound of generators would be heard around the clock. Even limited to 55 decibels, this noise level would be readily heard by elk and other wildlife. These combined impacts would cause additional disturbance to wildlife, and to elk, due to truck visitations and attendant exhaust fumes, increased noise, and the potential for fuel spills. There are other means of onsite power generation that provide less disturbance impact (natural gas microturbines, wind or solar, burial of electric lines), but gas generators are, to date, the most commonly employed source.

The sum of impacts from fluid minerals development under Alternative I is a major negative impact. This is a significant impact because of the following:

- For elk yearlong range:
 - 36 percent of the existing effective habitat is lost (more than 20 percent); three security patches (66 percent loss from existing) are lost (more than 20 percent);
 - 4,601 acres of security habitat, or 41 percent of that currently available, is lost (more than 20 percent); and
 - Unrestricted development pace would restrict elk to the WSA, which would provide habitat for 46 to 64 elk for the 20-year duration (BLM 2007a).
- For elk crucial ranges:
 - 31 percent of the existing effective habitat (4,269 acres) would be lost (major because greater than 20 percent) ;
 - One security patch would be lost (50 percent) (major because greater than 20 percent); and
 - 32 percent (3,186 acres) of security habitat is lost (major because greater than 20 percent).

Other Resources Management

Soil Resources

Alternative I would allow for the potential control or exclusion of surface-disturbing activities on slopes greater than 25 percent, or soils with a severe erosion hazard. No surface disturbance activity would be allowed on badlands, rock outcrop, or soils susceptible to mass failure.

Standard lease terms and conditions would apply. Activities on 25 percent slopes would very likely to lead to increased erosion, which causes habitat modification in the form of a loss of vegetation. It is anticipated that very few exceptions would be allowed to the restriction of activities on slopes of 25 percent or greater. Increased erosion and habitat modification would have beneficial impacts on wildlife in the FCPA.

The avoidance of slopes would protect the broken country favored by this elk herd (WGFD 2007a), and would place much of the development on bottomlands. Soil resources management under Alternative I is a major positive impact because approximately 33,694 acres would be protected by the 25 percent slope restrictions. The bottomland riparian areas would be impacted by both roads (discussed above) and impoundments. On-channel impoundments for CBNG produced water are located in the drainage bottoms. Overall there are few suitable locations for impoundments within the FCPA because of the highly incised drainages and rough topography that dominates the landscape. With limited available acreage of level locations within the FCPA, off-channel impoundments would not be commonly proposed. These impacts are discussed under Water Resources Management.

Water Resources

Under Alternative I, the location of water management facilities is not restricted and discharge to drainages is permissible with no subsequent monitoring or mitigation of downstream effects and no water resources are required for elk but proposed stock tanks would be required to be wildlife friendly.

Many different techniques are potentially employed for discharge of produced water. Two commonly employed methods are impoundments and pipelines to transport waters to the Powder River. Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be employed on flat terraces. The placement of impoundments inside the elk yearlong range may cause elk and deer to come to water. This may cause them to leave their security habitat, and experience higher levels of stress, and an increased exposure to potential poaching. There would also be disturbance associated with added human activity. In addition to impoundments on Federal minerals lands, a large proportion of impoundments would likely be placed on private lands along the Powder River with water piped in from projects on Federal lands. Already an 80-foot-wide disturbance through elk crucial range has been constructed on private land to conduct piped water from Fortification Creek to the Powder River through the Kinney Divide. These actions related to CBNG development on FCPA will likely continue and impact habitat and wildlife on adjacent lands. Non-game wildlife such as bats, small carnivores, birds, and amphibians would likely benefit from access to additional water sources. Canada geese and other waterfowl are known to frequent these newly developed water sources.

Development of impoundments lead to water leakage, which causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar has a toehold in the FCPA, and expansion of mesic habitats allows for further invasion by this species. Typically the area of disturbance to construct an impoundment is as much as twice the size of the containment area.

Under Alternative I, an estimated 218 acres will be disturbed as a result of water impoundments. The discharge to channels, although treated if needed as required by WDEQ, would likely have a negative impact on aquatic habitats of native species because of increased sedimentation and

increased flows, and result in a negative impact on downstream native fish and amphibians adapted to more seasonally fluctuating conditions. To date, 53 mgd of produced waters have been permitted for discharge. With no monitoring requirement, there would be no opportunity to evaluate this issue and use adaptive management if necessary.

No water resources required for elk would likely mean that the increased level of disturbance would not be offset by easy access to water. However, some stock tanks would likely be added and would have to be available to wildlife, including elk. The requirement that proposed stock tanks be wildlife friendly would mean that small animals that entered the stock tank would have a means of getting out and avoiding drowning.

Actions from water management would result in a moderately adverse impact on elk and other wildlife and their habitat and a minor negative impact to downstream aquatic resources.

Special Designations

Alternative I specifies that, although an ACEC was proposed in the PRB O&G FEIS (BLM 2003a), it was not designated and current status would be maintained. In addition, no WHMA would be designated. This would result in no impact to elk or other wildlife resources.

Alternative II

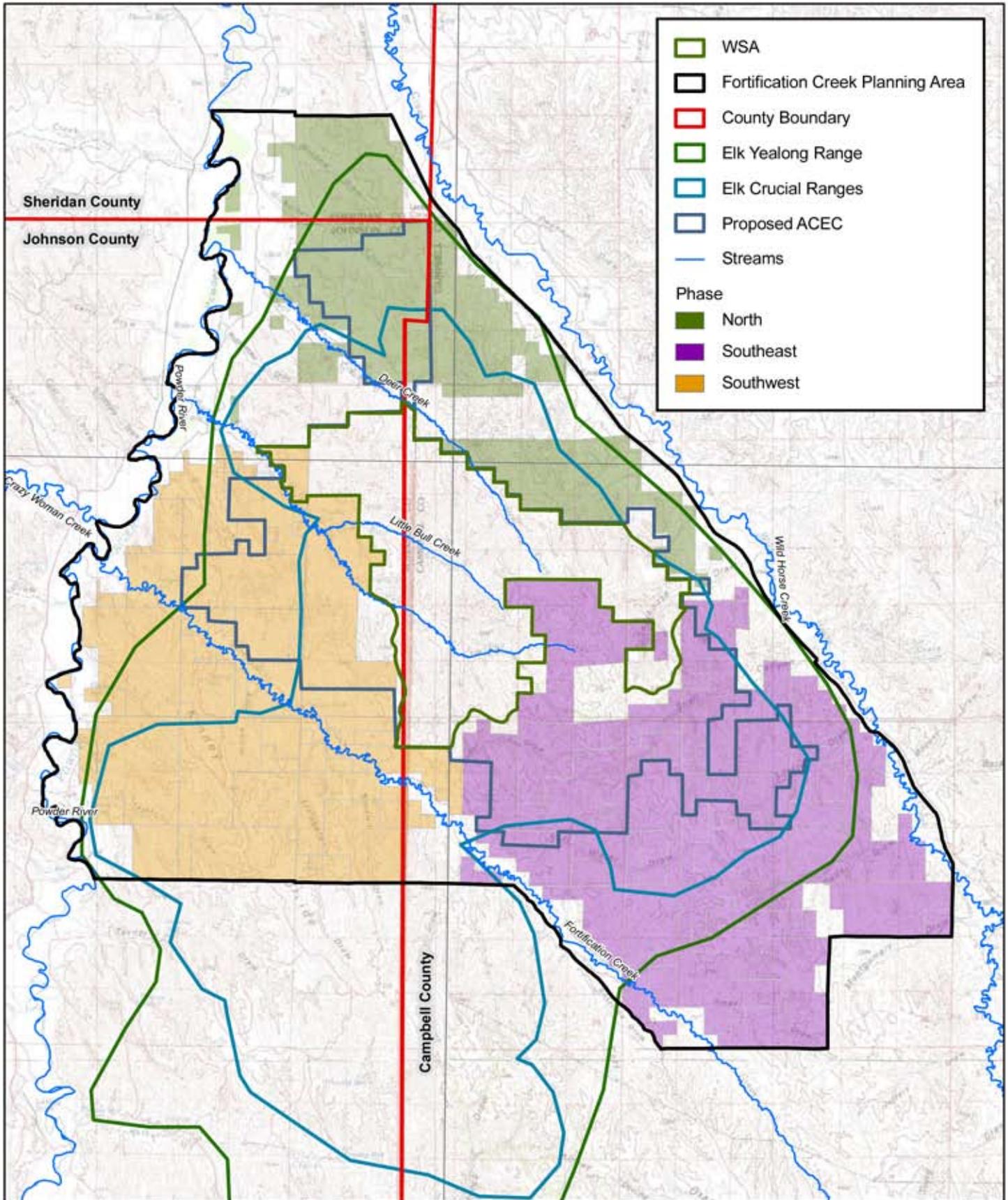
Fish and Wildlife Management

Alternative II would incorporate a number of management actions including a tri-phased development plan with livestock rest up to two years after reclamation; surface disturbance and disruptive activity TLs (as in Alternative I) and restriction to weekly visitation for well metering, POD monitoring, and maintenance activities in elk crucial winter range from November 15 through April 30 and calving areas from May 1 through June 30. Water management facilities would be located outside elk yearlong range; permanent year-round frost-free water sources would be provided by CBNG projects; secondary compressors would be located outside yearlong ranges; and there would be no net change from BLM base data for elk security areas and road density. Because these management actions are also fluid minerals management actions, they are further described below along with their impacts on wildlife.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects on the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. There are additional restrictions that relate to special status species. They are also listed as management actions common to all alternatives for management of special status species, and will be addressed under Special Status Species Management.

Alternative II would incorporate a number of management actions including a tri-phased development approach. This approach would restrict development to three geographical areas as shown in Figure 4-5. The tri-phased development approach would allow continued CBNG



	WSA
	Fortification Creek Planning Area
	County Boundary
	Elk Yealong Range
	Elk Crucial Ranges
	Proposed ACEC
	Streams
Phase	
	North
	Southeast
	Southwest

0 0.3 0.6 1.2 1.8 2.4

 0 0.305 0.61 1.22 1.83 2.44

 Kilometers

 Scale 1:155,000

**Resource Management Plan
 Amendment/Environmental Assessment
 Fortification Creek Planning Area**

**Figure 4-5
 Phased Development**

Map Reference:		
Date: 07/2/08	GIS: myc	Project ID: 7945

development, while allowing the elk herd to move to areas without construction activities. The tri-phased development approach would have a moderately beneficial impact on wildlife because it would limit construction to one third of the FCPA during any given development phase. This means that wide-ranging animals, such as the elk, have the potential for locating secure areas away from the activity, and ensure that effective and security habitat are likely available within the overall range. Animals with small home ranges, such as rodents, would be displaced in the immediate area. Up to two years of livestock rest would provide time for revegetation efforts, and for vegetation at the edges of the new water reservoirs, to take hold. This would benefit all wildlife.

Along with the tri-phased development would be livestock rest up to two years after interim reclamation; surface disturbance TLs (as in Alternative I) and restriction to weekly visitation for well metering, POD monitoring, and maintenance activities in elk crucial winter range from November 15 through April 30 and calving areas from May 1 through June 30. Additionally, water management facilities would be located outside elk yearlong range; permanent year-round frost-free water sources would be provided by CBNG projects; secondary compressors would be located outside yearlong ranges; and there would be no net change from BLM base data for elk security areas and road density. Overhead power lines with these networks would be planned in advance to maximize use of existing corridors and to minimize excessive cross-country power line construction.

Under Alternative II, overhead power lines would be allowed, and provisions would be made for power line network planning to be conducted planning-area wide in order to maximize use of existing corridors and roads and minimize cross-country power line construction. Power poles located within 0.5 miles of sage-grouse and/or sharp-tailed grouse leks (if buffer requirement cannot be met) would be fitted with raptor perch preventors, thus minimizing the potential for raptor predation on grouse. Generators are used in all three alternatives due to a backlog in the overhead line construction schedule. Generators, with their attendant fuel truck visits, on the order of one to two trips per week, and the around-the-clock noise, cause additional disturbance to wildlife, and to elk, because of truck visitations and exhaust fumes, increased noise, and the potential for fuel spills.

The tri-phased development approach (Figure 4-5) would be beneficial for the elk herd because it would limit disturbance to one-third of the FCPA during any given development phase. This means that wide-ranging animals, such as the elk, have the potential for locating secure areas away from the activity, and ensures that effective and security habitat are likely available within the overall range. Animals with small home ranges, such as rodents, would be displaced in the immediate area. Up to two years of livestock rest would provide time for revegetation efforts, and for vegetation at the edges of the new water reservoirs to take hold. This would benefit all wildlife. Timing limitations and restrictions on visitation during critical periods for the elk will benefit the herd in terms of body condition and reproductive potential, and the lesser disturbance would benefit all wildlife in general as well. The requirement for water management facilities to be located outside the yearlong range may cause some elk to move out of secure areas in order to obtain water; however, the creation of sources specifically for wildlife will benefit elk and other wildlife.

Location of secondary compressors outside the yearlong range will limit sound disturbance and human disturbance to areas not frequented by elk. No net change in elk security areas and road density will be beneficial, and should result in no habitat impacts to the herd. The allowance for

overhead power lines, with thoughtful planning and careful location of these lines, would not impact the elk. The limitations on power lines to minimize raptor collisions and the avoidance of water bodies to minimize waterfowl collisions will reduce potential negative impacts on these two avian groups. Fluid minerals development has many aspects that are detrimental to wildlife populations. Often, it is the roads and associated disturbances that humans bring that affect wildlife in these otherwise isolated areas. One example is the increase in shooting of prairie dogs (Reeve and Vosburgh 2006) and other species that can occur when roads open up an otherwise inaccessible area.

Roads cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, disturbance, and interference with movement patterns. Direct mortality is also an occurrence on roads. These impacts were evaluated for elk in particular. The comparison of road length, road density, effective habitat, and security habitat under the three alternatives is shown in Table 4-15.

In the elk yearlong range, road density is 2.3 miles/mile² under present conditions. There are 17,931 acres of effective habitat and four security patches with a total of 11,516 acres (Table 4-15). For elk crucial range, road density is 1.9 miles/mile² with 13,774 acres of effective habitat. Current conditions show two security patches with a total of 9,818 acres. Present conditions, as defined for Alternative II, represent no loss of effective habitat, security habitat, or security patches. These existing conditions, because they represent the least loss of effective and security habitat because new roads are not added, are the most protective for the elk and other wildlife. There would be no change in elk effective or security habitat.

The combined management actions related to CBNG development under Alternative II, present conditions, result in an anticipated minor negative impact on elk and other wildlife.

Other Resources Management

Soil Resources

As part of Alternative II no surface-disturbing activities would be allowed on soils with a severe erosion hazard, badlands, rock outcrop, slopes susceptible to mass failure, or slopes more than 25 percent. No exceptions would be allowed, and standard lease terms would apply.

The 25 percent slope restriction would reduce the amount of CBNG development along with the restriction on the increase in road density. Together these actions would result in a decrease of 258 potential wells (36 percent) from Alternative I, producing moderately beneficial impacts to wildlife, because habitat would be preserved especially in areas around the WSA.

Under this alternative, there would be protection of erosive soils and a reduced localized loss of vegetation, as well as a potential for additional stream sedimentation. The avoidance of slopes would protect the broken county favored by this elk herd (WGFD 2007a). It is anticipated that this action would be protective of habitat and have a major positive impact on wildlife.

Water Resources

Under Alternative II, reservoirs and water management facilities would be located outside the elk yearlong range; discharge to channels would be permissible with subsequent monitoring and mitigation of downstream effects; and permanent year-round frost-free water sources would be provided by CBNG projects. With reservoirs located outside the yearlong range, where they do

not occur, elk would be less likely to attempt to access them, with the result that there would not be a notable impact on the elk.

Many different techniques are potentially employed for discharge of produced water. Two commonly employed methods are impoundments and pipelines to transport waters to the Powder River. Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be employed on flat terraces. In addition to impoundments on Federal minerals lands, a large proportion of impoundments would likely be placed on private lands along the Powder River with water piped in from projects on Federal lands. Already an 80-foot-wide disturbance through elk crucial range has been constructed on private land to conduct piped water from Fortification Creek to the Powder River through the Kinney Divide. These actions associated with CBNG development in the FCPA will likely continue and impact habitat and wildlife on adjacent lands. Non-game wildlife such as bats, small carnivores, birds, and amphibians would likely benefit from access to additional water sources. Canada geese and other waterfowl are known to frequent these newly developed water sources.

Development of impoundments leads to water leakage, which causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar has a toehold in the FCPA, and expansion of mesic habitats allows for further invasion by this species. Generally, the area of disturbance is twice the size of the impoundment. Under Alternative II, an estimated 182 acres will be disturbed as a result of water impoundments.

The discharge to channels, although treated if necessary as required by WDEQ, would likely have a negative impact on aquatic habitats of native species due to increased sedimentation and increased flows, and result in a negative impact on downstream native fish and amphibians adapted to more seasonally fluctuating conditions. To date, 53 million gpd of produced waters have been permitted for discharge. With monitoring required, there is the opportunity to evaluate this issue and use adaptive management if necessary.

Required permanent year-round frost-free water resources for elk would provide easy access to water for elk and other wildlife. The requirement that proposed stock tanks be wildlife friendly would mean that small animals that entered the stock tank would have a means of getting out and avoiding drowning.

In summary, elk would benefit from the permanent year-round frost-free water sources to be provided, non-game wildlife and waterfowl in the limited area outside the yearlong elk range would benefit from the presence of reservoirs, and fish and amphibians would likely experience, at least at times and in some locations, increased sedimentation in waterways. The net result is anticipated to be a minor negative impact on fish and wildlife.

Special Designations

Alternative II specifies the evaluation and establishment, if warranted, of an ACEC within the elk calving and crucial winter ranges, with management prescriptions would be the same as those in the FCPA and the designation of a WHMA that includes the elk yearlong range. Although ACECs and WHMAs are typically managed with a resource in mind, to the benefit of that resource, the management would be the same as those in the FCPA with the only difference

being a formal name. This action, if implemented, would have a negligible beneficial impact on wildlife.

Alternative III

Fish and Wildlife Management

Alternative III would incorporate a tri-phased development approach with livestock rest up to one year after interim reclamation; surface disturbance and disruptive activity TLs (as in Alternative I) would be implemented in elk crucial winter range from November 15 through April 30 and well metering and POD visitation activities would be prohibited in elk crucial winter range from November 15 through April 30 and elk calving areas from May 1 through June 30. Additionally, all water management facilities would be located outside elk crucial winter range and elk calving areas; permanent summer water sources are required to be provided by CBNG projects; secondary compressors are required to be located outside elk crucial winter range and elk calving areas; and an allowance would be made of up to a 20 percent change from BLM base data for elk security areas. Because these management actions are also fluid minerals management actions, they are further described below along with their impacts to wildlife.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. There are additional restrictions that relate to special status species. They are also listed as management actions common to all alternatives for management of special status species, and will be addressed under Special Status Species Management.

Alternative III would incorporate tri-phased development with livestock rest up to one year after interim reclamation; well metering and POD visitation activities would be prohibited in elk crucial winter range from November 15 through April 30 and elk calving areas from May 1 through June 30. All water management facilities are required to be located outside elk crucial winter range and elk calving areas; permanent summer water sources are required to be provided by CBNG projects; secondary compressors are required to be located outside elk crucial winter range and elk calving areas; and an allowance would be made for a 20 percent change from BLM base data for elk security areas.

Power line networks would be planned in advance to maximize use of existing corridors and to minimize excessive cross-country power line construction. Like Alternatives I and II, Alternative III would also require operators to locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds and, if that is not practical, power poles would be fitted with raptor perch preventors. Operators would construct power lines to minimize the potential for raptor collisions, with potential modification to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize collision fatalities for waterfowl.

The tri-phased development approach would be beneficial for the elk herd because it would limit construction to one third of the FCPA during any given development phase. This means that wide-ranging animals, such as the elk, would have the potential for locating secure areas away from the activity, and ensure that effective and security habitat are likely available within the overall range. Animals with small home ranges, such as rodents, would be displaced in the immediate area. A year of livestock rest would provide some time for revegetation efforts, and for vegetation at the edges of the new water reservoirs to take hold. However, in the arid climate of Wyoming, one year does not allow for much vegetation development and two years are typically needed. Consequently, there is not much benefit to wildlife. Timing limitations and restrictions on visitation during critical periods for the elk will benefit the herd in terms of body condition and reproductive potential, and the lesser disturbance would benefit all wildlife in general as well. The requirement of water management facilities to be located outside the crucial winter range and elk calving areas would reduce impacts in those areas, while still allowing for their installation within the elk yearlong range. Thus, if elk were attracted to them, they would be able to remain within their general use areas. The creation of summer water sources specifically for wildlife will benefit elk and other wildlife and may offset the need to visit water management facilities. Location of secondary compressors outside the crucial winter range and elk calving areas will limit sound disturbance and human disturbance to areas not as critical to elk, albeit within their yearlong range.

Fluid minerals development has many aspects that are detrimental to wildlife populations. Often, it is the roads and associated disturbances that humans bring that affect wildlife in these otherwise isolated areas. One example is the increase in the shooting of prairie dogs (Reeve and Vosburgh 2006) and other species that can occur when roads open up an otherwise inaccessible area.

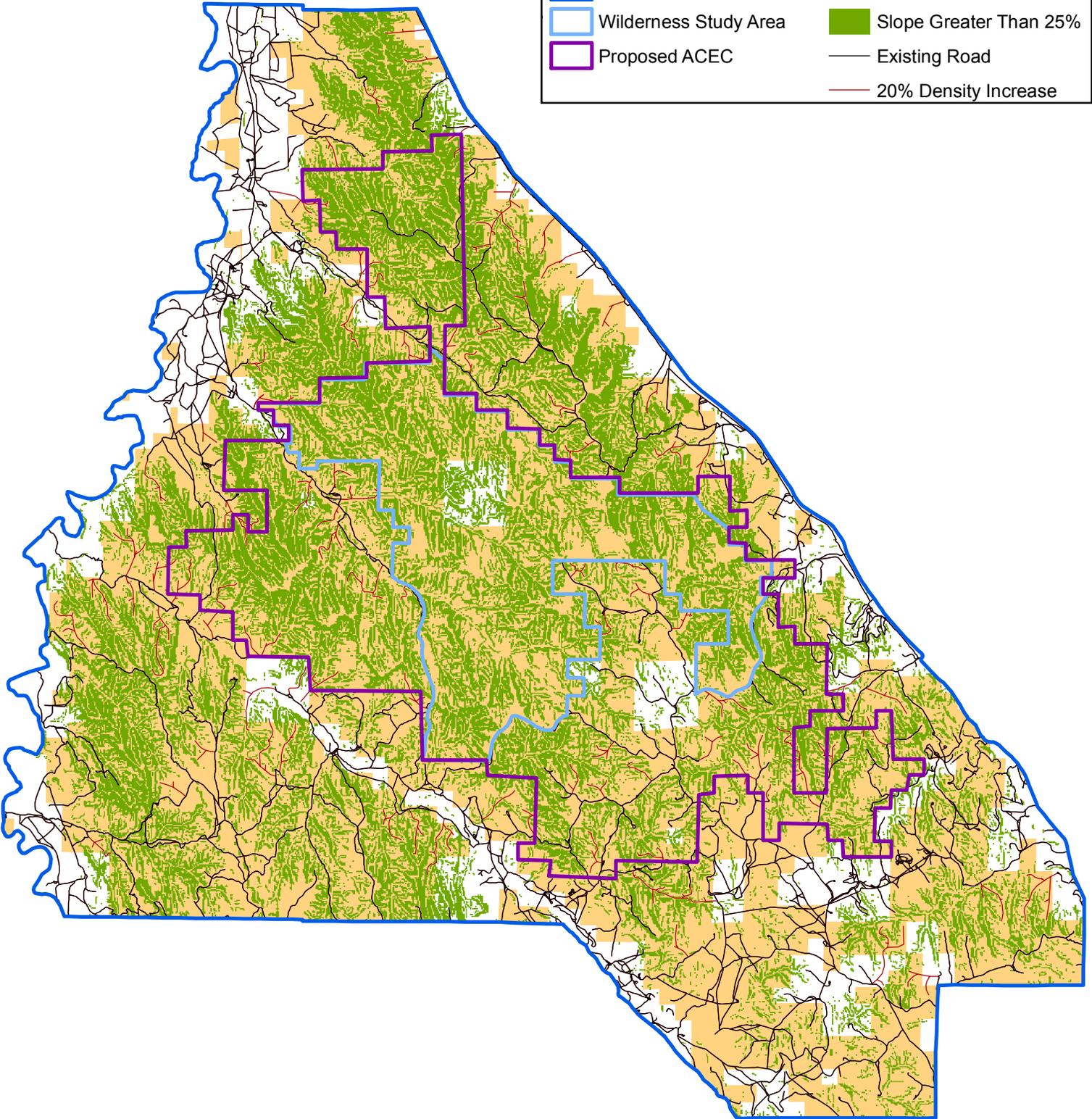
Roads cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, disturbance, and interference with movement patterns. Direct mortality is also an occurrence on roads. These impacts were evaluated for elk in particular. The comparison of road length, road density, effective habitat, and security habitat under the three alternatives is shown in Table 4-15.

In the elk yearlong range, road density would increase from 2.3 miles/mile² under present conditions to 2.8 miles/mile² range under Alternative III as shown in Figure 4-6. Road density was modeled, consequently, road locations are theoretical and Figure 4-6 does not indicate where all roads will go. The 17,931 acres of effective habitat under existing conditions would decrease by 4,999 acres, representing a loss of 28 percent of the existing effective habitat. Whereas current conditions show four security patches with a total of 11,516 acres, Alternative III would cause the loss of two of the security patches (50 percent loss from existing) and a loss of 2,128 acres of security habitat, or 18 percent of that currently available.

For elk crucial range, road density would increase from 1.9 miles/mile² under present conditions to 2.4 miles/mile² under Alternative III. The 13,774 acres of effective habitat under existing conditions would decrease by 3,222 acres, representing a loss of 23 percent of the existing effective habitat. Current conditions show two security patches with a total of 9,818 acres. Alternative III would maintain both security patches but cause a loss of 1,193 acres of security

Legend

- Fortification Creek Area
- Wilderness Study Area
- Proposed ACEC
- Federal Minerals
- Slope Greater Than 25%
- Existing Road
- 20% Density Increase



**Resource Management Plan
Amendment/Environmental
Assessment Fortification Creek
Planning Area**

**Figure 4-6
Theoretical 20%
Density Increase Road Network**

Map Reference:

Date: 07/2/08	GIS: dsc	Project ID: 7945
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habitat, or 12 percent of that currently available. These three measures across the yearlong and crucial ranges indicate impacts to security habitat of 12 to 18 percent.

If adequate security is not available within the FCPA and/or the WSA, it is possible that some elk will flee the area and may or may not return as has been observed with collared elk where individuals have not returned (O'Brien 2008). Individuals that leave will likely move downriver to Montana. Although it is possible that some individuals may flee, it is suspected that most of the elk would remain in the FCPA, causing overcrowding in the WSA (BLM 2007a).

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may adversely affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as salt cedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low, or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelagic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.).

Habitat-interior birds avoid use within 300 to 450 feet from forested roads, and up to 1.2 miles away from grassland roads (Forman 2000, Forman and Alexander 1998). The size of an undisturbed habitat block also affects the number of bird species present. In Georgia Piedmont forests, contiguous forest areas larger than 25 acres are needed to maintain high levels of avian diversity (McIntyre 1995). Although these studies were not conducted in sagebrush/juniper woodlands, it is not unreasonable to assume that the same concept applies. Similarly, small mammal species richness is sensitive to fragmentation in sagebrush shrublands (Hanser and Huntly 2006).

Activities on 25 percent slopes are very likely to lead to increased erosion, which causes habitat modification in the form of a loss of vegetation. It is anticipated that very few exceptions would be allowed to the restriction of activities on slopes of 25 percent or greater. The avoidance of slopes will protect the broken country favored by this elk herd (WGFD 2007a), and would place much of the development on bottomlands that provide high forage value particularly during the winter. These bottomland riparian areas will be impacted by both roads (discussed above) and impoundments. On-channel impoundments for CBNG produced water are located in the drainage bottoms. Overall there are few suitable locations for impoundments within the FCPA because of the highly incised drainages and rough topography that dominate the landscape. With limited available acreage of level locations within the FCPA, off-channel impoundments would not be commonly proposed. These impacts are discussed under Water Resources Management.

Under Alternative III, overhead power lines would be allowed, and provisions would be made for power line network planning to be conducted planning-area wide in order to maximize use of existing corridors and roads and minimize cross-country power line construction. Power poles located within 0.5 miles of sage-grouse and/or sharp-tailed grouse leks (if buffer requirement cannot be met) will be fitted with raptor perch preventors, thus minimizing the potential for raptor predation on grouse. Generators are used in all three alternatives due to a backlog in the overhead line construction schedule. Generators, with their attendant fuel truck visits, on the order of one to two trips per week, and the round-the-clock noise of generators, cause additional

disturbance to wildlife, and to elk, because of truck visitations and exhaust fumes, increased noise, and the potential for fuel spills.

Combined with the other management actions related to CBNG development under Alternative III, the sum of impacts from fluid minerals development under Alternative III results in a moderately negative impact on elk and other wildlife because of the following:

- In elk yearlong range:
 - 28 percent (4,999 acres) of the existing effective habitat is lost;
 - Two security patches (50 percent loss from existing) are lost; and
 - 18 percent (2,128 acres) of security habitat is lost (moderate because less than 20 percent).
- For elk crucial range:
 - 23 percent (3,222 acres) of the existing effective habitat is lost;
 - No security patches are lost; and
 - 12 percent (1,193 acres) of security habitat is lost (moderate because less than 20 percent).

Other Resources Management

Soil Resources

Alternative III would require that surface disturbances on slopes greater than 25 percent be restricted or excluded; no surface-disturbing activities on badlands, rock outcrop, or slopes susceptible to mass failure; surface-disturbing activities may be restricted or excluded on soils with a severe erosion hazard; standard lease terms would apply; and exceptions may apply. The 25 percent slope restriction reduced the amount of CBNG development along with the restriction on road density. Together these actions would result in a decrease of 152 potential wells (21 percent) from Alternative I, resulting in major beneficial impacts to wildlife, because habitat is preserved especially in areas around the WSA.

Exceptions to the slope restriction are expected to be rare; however, activities on 25 percent slopes are very likely to lead to increased erosion, which causes habitat modification in the form of a loss of vegetation. Increased erosion and habitat modification would have negligible adverse impacts on wildlife in the FCPA.

The avoidance of slopes will protect the broken country favored by this elk herd (WGFD 2007a), and resulting a major positive impact on fish and wildlife. Much of the development will be located on bottomlands. These bottomland riparian areas will be affected by both roads (discussed above) and impoundments. On-channel impoundments for CBNG produced water are located in the drainage bottoms. Overall there are few suitable locations for impoundments within the FCPA because of the highly incised drainages and rough topography that dominates the landscape. With limited available acreage of level locations within the FCPA, off-channel impoundments would not be commonly proposed. These impacts are discussed under Water Resources Management.

Water Resources

Under Alternative III, reservoirs and water management facilities would be located outside the elk crucial ranges; no additional discharge to ephemeral or intermittent channels would be allowed; and permanent summer water sources would be provided by CBNG projects. With reservoirs located outside the crucial range, elk would be able to access them because they would be located in areas where the elk do occur. At the same time, the disturbance factor associated with their development would be removed from crucial ranges. Non-game wildlife such as bats, small carnivores, birds, and amphibians would likely benefit from access to additional water sources. Canada geese and other waterfowl are known to frequent these newly developed water sources and would make use of them. The elimination of additional discharge to channels would have a positive impact on water quality, thus positively affecting native fish and amphibians by not altering the hydrology and water quality from sedimentation. This action removes the potential for negative impacts to water quality downstream as well. This action could have a positive impact on downstream fish and amphibians. The installation of permanent summer water sources would benefit elk and other wildlife.

In summary, elk would benefit from the availability of water from water management facilities and summer water sources; non-game wildlife and waterfowl in the area outside the crucial elk range would benefit from the presence of reservoirs and native fish and amphibians onsite and downstream would benefit by not having changes in water quality and quantity. The net result is anticipated to be a moderately positive impact on fish and wildlife.

Special Designations

Alternative III specifies the designation of an ACEC of 33,757 acres based on the proposed boundaries, and management prescriptions would be identified. A WHMA that includes elk crucial winter range and calving areas would be designated.

An ACEC for the elk herd was proposed in the PRB O&G FEIS (BLM 2003a), and the management action stated above serves to follow through on that action. The establishment of an ACEC and WHMA would be a negligible benefit to the elk herd because management would not change from prescribed conditions. This action would have negligible beneficial impacts on the elk.

Summary

The summary of impacts to Fish and Wildlife Resources is shown in Table 4-16.

Table 4-16 Summary of Impacts to Fish and Wildlife Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Fish and Wildlife Management	See Fluid Minerals Management		
Fluid Minerals Management	Major (-) 4,601 acres (41%) of yearlong security habitat is lost	Minor (-) no loss of security habitat in yearlong or crucial range	Moderate (-) 2,128 acres (18%) of yearlong security habitat is lost

Table 4-16 Summary of Impacts to Fish and Wildlife Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
	4,269 acres (31%) of crucial range security habitat is lost		1,193 acres (12%) of crucial range security habitat is lost
Other Resources Management			
Soil Resources Management	Major (+) 33,694 acres protected	Major (+) 33,694 acres protected	Major (+) 33,694 acres protected
Water Resources Management	Moderate (-) Discharge of 14 mgd produced water	Minor (-) Discharge of 9.2 mgd produced water	Moderate (+) No discharge
Special Designations	No Impact	Negligible (+) No change in management	Negligible (+) No change in management

4.3.7.3. Cumulative Impacts

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

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

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

4.3.8. Special Status Species Management

There are four goals of special status species management in the FCPA: (1) Maintain biological diversity of plant and animal species; (2) support the WGFD's 2007–2011 strategic plan (WGFD 2006a) to the extent practical and consistent with BLM multiple-use management requirements;

(3) maintain, and where possible, improve forage production and quality of rangelands, fisheries, and wildlife habitat; and (4) provide habitat for threatened and endangered and special status plant and animal species on all public lands in compliance with the Endangered Species Act (ESA) and approved recovery plans to the extent possible. The management objective is to protect special status species while allowing CBNG development.

Some management actions common to all alternatives are also listed under Fluid Minerals Management, where they are addressed. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. Restrictions common to all alternatives are listed for bald eagle, black-footed ferret, mountain plover, Ute ladies'-tresses orchids, greater sage-grouse, plains sharp-tailed grouse, and raptors. However, these restrictions relate to small areas containing few individuals, as described below.

Bald eagle habitat is restricted to the Powder River and Wild Horse Creek and there are no known nests within the FCPA (Figure 3-5). A roost has been identified in the northwestern corner of the FCPA. The black-footed ferret is not present (BLM 2005b). Mountain plovers are very unlikely because of the lack of suitable habitat and there are no mountain plover observations in the FCPA. Ute ladies'-tresses orchids are unlikely to occur because of lack of perennial water; the Wyoming Natural Diversity Database (WYNDD) habitat model does not predict suitable habitat for the orchid within the FCPA. However, it should be noted that the WYNDD model was based on vegetation characteristics at four sites and general soils data, which may define suitable orchid habitat too narrowly. There is only one sage-grouse lek, in the southeastern corner of the FCPA, and there are two sharp-tailed grouse leks (Figure 3-7). Raptors are present throughout the FCPA; data collected by the BLM show active and inactive raptor nests from 2004 through 2007 for the FCPA (Figure 3-5).

Management restrictions apply to one sage-grouse lek by reducing noise levels to 49 decibels at the lek, restricting surface-disturbing activity within 0.25 miles of the lek, and precluding new surface-disturbing activity an additional 1.75 miles from the lek buffer (or 2 miles from the lek itself) between March 1 through June 15. Clearance surveys are required in sagebrush habitat prior to surface-disturbing activities to identify new leks and verify occupancy of known leks. Management actions apply to sharp-tailed grouse, by restricting surface-disturbing activity within 250 yards of leks and restricting surface-disturbing activities for an additional 0.5 miles from the lek buffer (or 0.67 miles from the lek itself) from April 1 through May 31. For raptors, the restrictions preclude new surface-disturbing activities within 0.5 mile of nests during the period from February 1 through July 31. These management actions and the realities of actual occurrence of the subject species apply to all three alternatives and will not be repeated.

Potential impacts to special status species fall into one or more of the categories that include habitat loss or modification, habitat fragmentation, disturbance, interference with movement patterns, and direct mortality. These impacts can reduce numbers of one or more species, potentially to the point of local extirpation; disrupt community composition and function through changes in the distribution, relative abundance, and habitat use by various species (e.g., reduced prey abundance affects predator abundance); and make populations and communities overly vulnerable to other perturbations. For example, increases in roads can cause habitat fragmentation. This can result in habitat specialist species being more vulnerable to disturbance by reducing patch size, increasing the amount of edge, and increasing accessibility to predators or (in the case of songbirds) nest parasitism by brown-headed cowbirds. The sage thrasher,

Brewer's sparrow, and sage sparrow are three species that might suffer from fragmentation of sagebrush habitat by the addition of roads.

Impacts associated with changes in management, human use, and resource development can have direct and indirect impacts on these species. For wide-ranging or migratory species such as migratory songbirds, onsite impacts can also affect community composition and function in the southern portion of the species' range where they overwinter, and project impacts can combine with non-project impacts to cause cumulative impacts.

The special status species listed in Chapter 3 are those with special or protective designations by state or Federal Agencies. In addition, this analysis may also make reference to species or groups that do not have any special status, but are included with protective measures listed in Table 2-2 under Special Status Species. These include sharp-tailed grouse and raptors (other than the ferruginous hawk, which is state-listed but does not appear to occur in the FCPA).

4.3.8.1. Alternative Analysis

Impact intensity defines the degree or extent of impacts. For this analysis, the categories are defined as follows:

- *Minor* – The effect is slight but detectable; there would be a small change. Resource indicator thresholds are potentially exceeded, but on a short-term or highly localized basis. This would be characterized as less than 15 percent alteration in resource indicators.
- *Moderate* – The effect is readily apparent; there would be a measurable change that could result in long-term or permanent change to a resource. Some resource indicator thresholds are exceeded. This would be characterized by a 15 to 20 percent alteration.
- *Major* – The effect is large; there would be a highly noticeable, long-term, or permanent measurable change. Resource indicator thresholds are clearly exceeded. An alteration of more than 20 percent in resource indicators would qualify as a major impact.

The occurrence, abundance, and distribution of wildlife are most strongly affected by habitat availability and accessibility. These habitat characteristics may be severely altered as a result of increased human activity and resource development. Negative impacts are a typical result of management actions associated with fluid minerals development. Other management actions can be beneficial or harmful, such as soil resource management, water resources management, visual resource management, and others, depending on how and what actions are implemented.

Special status species also can benefit from resource management activities aimed at specific species or other environmental concerns, such as protective measures, TLs, NSOs, disturbance-free buffer zones, and other actions aimed at preserving or enhancing these resources.

Impacts to special status species associated with Alternatives I through III are summarized in the following subsections. These impacts can be either direct or indirect and can result from any activity involving increased levels of human activity and removal or modification of habitat.

The following alternatives analysis considers both short-term and long-term impacts to special status wildlife resources. For the purpose of this analysis, short-term or temporary impacts are those that most often are associated with a period of initial habitat loss or modification and intensive human activity. Short-term impacts are those that last five to 10 years or less. In the context of future management and development scenarios for the FCPA, short-term impacts are mostly associated with fluid minerals development, during which activity in specific POD areas

may last for several weeks or months but then is reduced in severity as that POD enters the production phase.

Long-term impacts are those that last longer than 10 years, and most of these would extend throughout or potentially beyond the period of the management action or development activity. Examples include impacts associated with the continued presence of elevated levels of human activity throughout the life of CBNG development (10 years or longer) and the protracted period needed for final reclamation of disturbed areas. Permanent impacts are those with a likely duration of more than 50 years, such as may occur at developed cultural sites.

For purposes of expediency, the analysis addresses generalized impacts for all special status species as a group. Occasionally specific mention is made of one or more species when particular potential impacts are noteworthy. Special status species that could potentially occur in the FCPA were listed in Chapter 3, and include all species that are Federally listed, state listed, Forest Service listed, or BLM listed. Discussions with WGFD and BLM staff indicated that many of those species are uncommon or unlikely, or not known to occur on the FCPA because of lack of suitable habitat. The focus for this analysis is on those species that are known to occur, or are representative of a group or guild, and/or are monitored (and thus data exist). These focus species groups are:

- Bald eagle (*Haliaeetus leucocephalus*), and raptors in general;
- Greater sage-grouse (*Centrocercus urophasianus*);
- Sage thrasher (*Oreoscoptes montanus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*), as a guild of sagebrush-obligates;
- Myotis bats, representing the long-legged myotis (*Myotis volans*), western small-footed myotis (*Myotis ciliolabrum*), and little brown myotis (*Myotis lucifugus*); and
- Native fishes.

Alternative I (No Action Alternative)

Special Status Species Management

Unique to Alternative I is that overhead power lines would be prohibited on BLM surface. The impacts of this action are discussed under Fluid Minerals Management, below, and will not be addressed here.

All of the restrictions for special status species will benefit these species. However, as discussed above, the benefits are relatively limited because of the small number of individuals of the special status species present, and the localized extent of the restrictions. The sage-grouse at the single lek will benefit from the restriction on surface-disturbing activity and noise level limitations, as will sharp-tailed grouse at their two leks (Figure 3-7). Nesting raptors will benefit from restrictions within the 0.5 mile of their nests (Figure 3-5). Timing limitations initially apply to nearly all nests. After occupancy surveys are conducted, operators may request exceptions for nests that are not active; the same procedure will apply for grouse leks. Other special status species such as migratory birds nesting within timing limitation areas will also benefit. The impact of these management actions is positive to a minor degree.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. The potential avoidance of impoundments in sagebrush will benefit sage-grouse (to the small degree that they are present) and sage-obligate songbirds. Installation of wildlife escape ramps could potentially benefit special status species if they were to land in the tank. The installation of noise mufflers will benefit all special status species by reducing noise disturbance.

Management actions specific to Alternative I include an unrestricted development pace; no restrictions on location of compressors and water management facilities; and restriction (when deemed necessary) of surface disturbance and disruptive activity in elk crucial winter range between November 15 and April 30. Further actions include no restriction on well metering and visitation, no requirement of water sources for elk, and all proposed stock tanks would be wildlife friendly; no elk security habitat or road density standards would be implemented; and overhead power lines would be prohibited on BLM surfaces lands.

Roads are directly associated with development and cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, disturbance, and interference with movement patterns. An example of disturbance relates to raptors. The proximity to roads is a major factor in reduced availability of nesting sites for raptors. A typical buffer distance for nesting raptors and human activity is 0.5 mile. Distances less than that can lead to reduced productivity and possibly nest abandonment. Direct mortality is also an occurrence on roads. A comparison of road length, road density, effective elk habitat, and elk security habitat under the three alternatives is shown in Table 4-15. The presence and amount of this effective habitat and security habitat, by being distant from roads and other human disturbance activities, are important for all special status species. In particular, there will be benefits to sage-obligate bird species because these habitat-interior species are more successful away from disturbance impacts that create edges, as do roads. Alternative I maintains the least amount of this interior habitat, resulting in 11,405 acres of effective habitat and 6,632 acres of security habitat.

Sediment from roads may carry seeds of invasive plant species such as salt cedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low, or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelagic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.). Alternative I has the largest number of roads of the three alternatives. This would result in the largest negative impact to special status fishes.

Habitat-interior birds avoid use within 300 to 450 feet from forested roads, and up to 1.2 miles away from roads in grasslands (Forman 2000, Forman and Alexander 1998). Increases in habitat loss from oil and gas development in Wyoming and the associated disturbance and habitat fragmentation have a negative impact on birds. For sagebrush-obligate birds, bird densities were 50 percent lower within 100 meters of roads constructed for natural gas development in Wyoming than at greater distances (Ingelfinger 2001). The size of an undisturbed block also affects the number of bird species present. In Georgia Piedmont forests, contiguous forest areas larger than 25 acres are needed to maintain high levels of avian diversity (McIntyre 1995). Although these studies were not conducted in sagebrush/juniper woodlands, it is not unreasonable to assume that the same concept applies. Similarly, small mammal species richness is sensitive to fragmentation in sagebrush shrublands (Hanser and Huntly 2006). The extent of effective elk habitat, number of security patches, and amount of security habitat are all measures that are important to these disturbance-sensitive birds. And all three measures are reduced the most under Alternative I compared to Alternatives II and III.

There would be long-term disturbance and habitat alteration impacts to special status species from compressors and impoundments. Impoundments may also provide foraging habitat for some special status species such as bald eagles and bats. Timing restrictions in elk crucial ranges would limit disturbance in those areas. Because special status species distributions are independent of elk distribution, this would benefit those individuals living within crucial ranges, particularly those breeding during the elk calving period. No restrictions on well metering and visitation would be a disturbance impact because most operators continue to visit each well multiple times per week despite using remote metering technologies.

Under Alternative I, new overhead power lines would be prohibited on BLM surface. Power line impacts would likely be transferred to adjacent non-Federal lands. Generators are used as a temporary power source due to the shortage of available power and they typically run for a period of two years. The presence of generators would require fuel truck visits, on the order of one to two trips per week, and the sound of generators would be heard around the clock. Even limited to 55 decibels, this noise level would be readily heard by various species including bald eagles and raptors, sage-grouse, sage-obligate birds, and bats. These impacts combined would cause additional short-term disturbance to special status species from the truck visits and attendant exhaust fumes, increased noise, and the potential for fuel spills.

The sum of impacts from fluid minerals development under Alternative I is a major negative impact.

Fish and Wildlife Management

Alternative I would allow CBNG development at an unrestricted pace. Surface disturbance and disruptive activities would not be allowed in elk crucial winter range between November 15 and April 30, and in elk calving areas from May 1 through June 30, when necessary. Well metering and visitation, and water management facility locations would not be restricted. No water sources would be required for elk or other wildlife, although proposed stock tanks would be required to be wildlife friendly. Compressor locations would not be restricted. No elk security habitat or road density standards would be implemented. To avoid repetition, these management actions are addressed under Fluid Minerals Management, above. No other specific actions would be identified and no impacts would be anticipated.

Other Resources Management

Soil Resources

Alternative I would allow for the potential control or exclusion of surface-disturbing activities on slopes greater than 25 percent, or soils with severe erosion hazards. No surface disturbance activity would be allowed on badlands, rock outcrop, and soils susceptible to mass failure. Standard lease terms and conditions would apply. Activities on 25 percent slopes would lead to increased erosion, which causes habitat modification in the form of a loss of vegetation and added siltation of streams. It is anticipated that very few exceptions would be allowed to the restriction of activities on slopes of 25 percent or greater.

The avoidance of slopes would place much of the development on bottomlands. These bottomland riparian areas would be impacted both by roads (discussed above under Fluid Minerals Management) and impoundments (discussed below under Water Resources Management). The impact of soil resource management on special status species is anticipated to be negative to a minor degree.

Water Resources

Under Alternative I, the location of water management facilities is not restricted; discharge to drainages is permissible with no subsequent monitoring or mitigation of downstream effects; no water resources are required for elk; and proposed stock tanks would be required to be wildlife friendly.

Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be employed on flat terraces. In addition to impoundments on Federal minerals lands, impoundments would likely also be placed on non-Federal lands along the Powder River with water piped in from projects on Federal lands. These actions related to CBNG development on the FCPA will likely continue and affect habitat on adjacent lands. There would also be disturbance associated with added human activity.

Development of impoundments leads to water leakage, which causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar has a toehold in the FCPA, and expansion of mesic habitats allows for further invasion by this species. Another concern is that impoundments can provide habitat for mosquitoes associated with the West Nile virus (Oedekoven 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse an average of 25 percent within four populations including the PRB (Naugle et al. 2004).

Generally, the area of disturbance is twice the size of the impoundment. Under Alternative I, an estimated 218 acres of native habitat will be disturbed as a result of water impoundments. The loss of native sagebrush would cause the loss of habitat for sage-obligate species, and the loss of grassland and sagebrush would negatively impact raptors. The very slow pace and low success rate of revegetation, with the attendant increase in weeds, would lead to habitat loss for special status species. The creation of impoundments may benefit bats, because they are extremely water dependent and need to drink every night when they come out to forage. Bats would also benefit from mosquitoes and other insects that hatch in water, although the added sodium in the water may present a problem (Adams 2003, Adams et al. 2003).

The discharge to channels, although treated if necessary as required by WDEQ, would likely have a negative impact on aquatic habitats of native species due to increased flows, and result in a negative impact on downstream (Powder River) native fish adapted to seasonally fluctuating conditions. To date, 53 mgd of produced waters have been permitted for discharge. With no monitoring requirement, there would be no opportunity to evaluate this issue and use adaptive management.

Fortification Creek is primarily an ephemeral stream and does not provide fish habitat. Native fish do occur in the Powder River. Sustained high flows, due to CBNG produced water, could potentially inundate the shallow water habitats that the native fish in the Powder River use for breeding and rearing habitats. The native fish in the Powder River have evolved with the variable flows of the Powder River system, so they thrive under those conditions. This would have a negative impact on special status fish species that are adapted to ephemeral flows or lower flows, and the potential would exist for expansion of non-native fish species that may out-compete native species.

Some stock tanks would likely be added and would be wildlife friendly to prevent drowning of small animals. These would benefit bats as well as other special status species.

Actions from water management would result in a potential positive effect for bats, although this would be reduced due to the increased amount of associated human disturbance. It would result in a negative impact to special status species, such as raptors, sage-grouse, and sage-obligate species, that require expanses of sagebrush and other native habitat, and a negative impact for downstream aquatic resources due to changes in hydrology, with a sum of moderately negative.

Alternative II

Special Status Species Management

Shared with Alternative III is the provision for planning of the area wide power line network to be conducted in advance and to maximize use of existing corridors and roads to minimize cross-country power line construction. The impacts of these actions are discussed under Fluid Minerals Management, below, and will not be addressed here.

Also, in common with Alternative III are three additional actions not listed or discussed elsewhere. They are that: (1) operators will locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds; power poles within that area would be raptor-proof; (2) operators will construct power lines to minimize the potential for raptor collisions, with potential modifications to include burying the lines, avoiding areas of high avian use, and increasing the visibility of individual conductors; and (3) the operator will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl collisions.

All of the restrictions for special status species common to all alternatives will benefit these species. However, as discussed in detail under Alternative I, these management actions have limited reach in terms of species, individuals, and surface area. The further restrictive actions outlined in Alternative II will benefit the single sage-grouse lek on the FCPA by restricting activity within 0.5 mile, and will benefit raptors by reducing mortalities due to collisions and electrocutions. The impact of special status species management on special status species is beneficial to a minor degree.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. The potential avoidance of impoundments in sagebrush will benefit sage-grouse (to the small degree that they are present) and sage-obligate songbirds. Installation of wildlife escape ramps could potentially benefit special status species if they were to land in the tank. The installation of noise mufflers will benefit all special status species by reducing noise disturbance.

Alternative II would incorporate a tri-phased development with livestock rest up to two years after interim reclamation; TLs (as in Alternative I) and restriction to weekly visitation for well metering, POD monitoring, and maintenance activities in elk crucial winter range for elk crucial winter habitat from November 15 through April 30 and calving areas from May 1 through June 30; a requirements that all water management facilities are to be located outside elk yearlong range; a requirement of permanent year-round frost-free water sources to be provided by CBNG projects; a requirement that secondary compressors be located outside of yearlong ranges; an allowance of no net change from BLM base data for elk security areas and road density; and an allowance for overhead power lines with these networks to be planned in advance to maximize use of existing corridors and to minimize excessive cross-country power line construction.

In addition, there would be a requirement to bury power lines from drop points, and, as mentioned, for power line networks to be planned in advance to maximize use of existing corridors and to minimize excessive cross-country power line construction. Like Alternative III, Alternative II would also require operators to locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds; and if not practical, power poles would be fitted with raptor perch preventers. Operators would construct power lines to minimize the potential for raptor collisions, with potential modification to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize collision fatalities for waterfowl.

The tri-phased development approach would benefit broader-ranging species that can move relatively long distances to escape disturbance, such as bald eagles and raptors, but may not benefit smaller or site-dependent species, such as sage-grouse and sage-obligate songbirds. Although raptors may be able to search for alternative nest sites away from development, many species prefer to use the same nest site from year to year. The allowance of two years livestock rest would benefit habitat restoration for special status species. The restriction to weekly visitation would reduce disturbance in the elk crucial range. And the allowance of no net change in road density would avoid further loss of effective habitat.

Roads are directly associated with development and cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, disturbance, and interference with movement patterns. An example of disturbance relates to

raptors. The proximity to roads is a major factor in reduced availability of nesting sites for raptors. A typical buffer distance for nesting raptors from human activity is 0.5 mile. Distances less than that figure can lead to reduced productivity and possibly nest abandonment. Direct mortality is also an occurrence on roads. A comparison of road length, road density, effective elk habitat, and elk security habitat under the three alternatives is shown in Table 4-15. The presence and amount of this effective habitat and security habitat, by being distant from roads and other human disturbance activities, are important for all special status species. In particular, there will be of benefits to sage-obligate bird species because these habitat-interior species are more successful away from disturbance impacts that create edges, as do roads. Alternative II maintains the greatest amount of this interior habitat, with 17,931 acres of effective habitat and 11,516 acres of security habitat in the elk yearlong range (Table 4-15).

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as salt cedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low, or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelagic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.). Alternative II has the least amount of roads of the three alternatives. This would result in the least negative impact to special status fishes of the three alternatives.

Under Alternative II, overhead power lines would be allowed, and provisions would be made for power line network planning to be conducted planning area-wide in order to maximize use of existing corridors and roads and minimize excessive cross-country power line constructions. This management action would result in the potential for some electrocutions and collision fatalities to raptors.

The combined management actions related to CBNG development under Alternative II result in an anticipated minor negative impact to special status species.

Fish and Wildlife Management

Alternative II would incorporate a tri-phased development with livestock rest up to two years after interim reclamation; TLs (as in Alternative I) and restriction to weekly visitation for well metering, POD monitoring, and maintenance activities in elk crucial winter range from November 15 through April 30 and calving areas from May 1 through June 30; that all water management facilities be located outside elk yearlong range; a requirement that permanent year-round frost-free water sources be provided by CBNG projects; a requirement that secondary compressors be located outside yearlong ranges; and no net change from BLM base data for elk security areas and road density. To avoid repetition, these management actions are addressed under Fluid Minerals Management. No other specific actions would be identified and no impacts would be anticipated.

Other Resources Management

Soil Resources

Alternative II would require no surface-disturbing activities on soils with a severe erosion hazard, badlands, rock outcrop, slopes susceptible to mass failure, or slopes more than 25 percent. No exceptions would be allowed, and standard lease terms would apply. Under this alternative, there would be protection of erosive soils and a resultant reduced localized loss of vegetation and potential for additional stream sedimentation. It is anticipated that this action would be protective of habitat. The avoidance of slopes would place much of the development on bottomlands. These bottomland riparian areas will be impacted both by roads (discussed above under Fluid Minerals Management) and impoundments (discussed below under Water Resources Management). Soil resources management would have a minor negative impact on special status species.

Water Resources

Under Alternative II, reservoirs and water management facilities would be located outside the elk yearlong range; discharge to channels would be permissible with subsequent monitoring and mitigation of downstream effects; and permanent year-round frost-free water sources would be provided by CBNG projects.

Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be employed on flat terraces. In addition to impoundments on Federal minerals lands, impoundments would likely also be placed on private lands along the Powder River with water piped in from projects on Federal lands. These actions related to CBNG development on the FCPA will likely continue and affect habitat and wildlife on adjacent lands. There would also be disturbance associated with added human activity.

Development of impoundments leads to water leakage that causes changes in vegetation from existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar has a toehold in the FCPA, and expansion of mesic habitats allows for further invasion by this species. Another concern is that impoundments can provide habitat for mosquitoes associated with the West Nile virus (Oedekoven 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse an average of 25 percent within four populations including the PRB (Naugle et al. 2004).

Generally, the area of disturbance is twice the size of the impoundment. Under Alternative II, an estimated 140 acres would be disturbed as a result of water impoundments. The very slow pace and low success rate of revegetation, with the attendant increase in weeds, would lead to habitat loss for special status species. The creation of impoundments may benefit bats because of their extreme dependence on water, as well as other special status species by providing drinking water. The high sodium content of these waters may, however, present a problem to bats, because they are sensitive to water chemistry (Adams 2003, Adams et al. 2003).

The discharge to channels, although treated if necessary as required by WDEQ, would likely have a negative impact on aquatic habitats of native species due to increased sedimentation and increased flows, and result in a negative impact on downstream native fish adapted to natural flow regimes experienced in an arid prairie environment. To date, 53 million gallons per day of

produced waters have been permitted for discharge. With monitoring required, there is the opportunity to evaluate this issue and take remedial action if necessary.

Fortification Creek is primarily an ephemeral stream and does not provide fish habitat. Native fish do occur in the Powder River. Sustained high flows, due to CBNG produced water, could potentially inundate the shallow water habitats that the native fish in the Powder River use for breeding and rearing habitats. The native fish in the Powder River have evolved with the variable flows of the Powder River system, so they thrive under those conditions. Sustained higher flows due to CBNG produced waters could have a negative impact on special status fish species that are adapted to variable flow regimes. Sustained higher flows favor the expansion of non-native fish species, which prefer the moderated flows and out-compete native fish.

Required permanent year-round frost-free water resources for elk would provide easy access to water for special status species. The requirement that proposed stock tanks be wildlife-friendly would benefit all special status species.

In summary, all special status species benefit from water sources, sagebrush-obligates and raptors that use grasslands lose 180 acres of native habitat, and the high flows have a negative impact on special status fish downstream. The net result is anticipated to be a minor negative impact on fish and wildlife.

4.3.8.2. Alternative III

Special Status Species Management

Like Alternative II, there is a provision for planning the area wide power line network in advance and maximizing use of existing corridors and roads to minimize cross-country power line construction. The impacts of these actions are discussed under Fluid Minerals Management, below, and will not be addressed here.

Also shared with Alternative II are three additional actions not listed or discussed elsewhere (except under Alternative II). They are that (1) operators will locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds; power poles within that area would be raptor-proof; (2) operator will construct power lines to minimize the potential for raptor collisions, with potential modifications to include burying the lines, avoiding areas of high avian use, and increasing the visibility of individual conductors; and (3) the operator will limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize the potential for waterfowl collisions.

All of the restrictions for special status species that are common to all alternatives will benefit wildlife. However, as discussed in detail under Alternative I, these management actions have limited reach in terms of species, individuals, and surface area. The further restrictive actions outlined in Alternatives II and III will benefit the single sage-grouse lek and two sharp-tailed grouse leks on the FCPA by restricting activity within the 0.5 mile buffer, and will benefit raptors by reducing mortalities due to collisions. The impact is beneficial to a minor degree.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, COAs, and BMPs for exploration, development, production, and interim reclamation to ensure that activities would not impact resource values in the FCPA. A

number of wildlife-protective restrictions on management actions for CBNG development are common to all alternatives. These include avoiding placement of impoundments in sagebrush, where possible; fencing of impoundments; installing wildlife escape ramps in stock tanks; installing noise mufflers on compressors; and limiting noise levels to 55 decibels. The potential avoidance of impoundments in sagebrush will benefit sage-grouse (to the small degree that they are present) and sage-obligate songbirds. Installation of wildlife escape ramps could potentially benefit special status species if they were to land in the tank. The installation of noise mufflers will benefit all special status species by reducing noise disturbance.

Alternative III would incorporate a tri-phased development approach with livestock rest for up to one year after interim reclamation; prohibition of well metering and POD visitation activities in elk crucial winter range from November 15 through April 30 and elk calving areas from May 1 through June 30; all water management facilities would be located outside elk crucial winter range and elk calving areas; requirement for permanent summer water sources to be provided by CBNG projects; requirement that secondary compressors be located outside elk crucial winter range and elk calving areas; and allowance of up to 20 percent change from BLM base data for elk security areas.

Power line networks would be planned in advance to maximize use of existing corridors and to minimize excessive cross-country power line construction. In common with Alternatives I and II, Alternative III would also require operators to locate aboveground power lines, where practical, at least 0.5 miles from sage-grouse breeding or nesting grounds; and if not practical, power poles would be fitted with raptor perch preventors. Operators would construct power lines to minimize the potential for raptor collisions, with potential modifications to include burying the lines, avoiding areas of high avian use, and increasing the visibility of the individual conductors. Operators would limit the construction of aboveground power lines near streams, water bodies, and wetlands to minimize collision fatalities for waterfowl.

The tri-phased development approach would benefit broader-ranging species that can move relatively long distances to escape disturbance, such as bald eagles and raptors, but may not benefit smaller or site-dependent species, such as sage-grouse and sage-obligate songbirds. Although raptors may be able to search for alternative nest sites away from development, many species prefer to use the same nest site from year to year. One-year allowance of livestock rest provides less time for habitat restoration than Alternative II. Timing limitations and restrictions on visitation during critical periods for the elk will benefit special status species in general because of fewer disturbances. Although development is not as restrictive, visitation and monitoring are more restricted, as compared with Alternative II. These actions under Alternative III are thus variable in their protectiveness. The creation of water sources specifically for wildlife would benefit bats.

Roads are directly associated with development and cause direct habitat loss. However, the larger impact comes from the reduction in effective habitat due to habitat fragmentation, disturbance, and interference with movement patterns. An example of disturbance relates to raptors. The proximity to roads is a major factor in reduced availability of nesting sites for raptors. A typical buffer distance for nesting raptors from human activity is 0.5 mile. Direct mortality is also an occurrence on roads. A comparison of road length, road density, effective elk habitat, and elk security habitat under the three alternatives is shown in Table 4-15. The presence and amount of this effective habitat and security habitat, by being distant from roads and other human disturbance activities, is important for all special status species. In particular,

there would be benefits to sage-obligate bird species because these habitat-interior species are more successful away from disturbance impacts that create edges, as do roads. Alternative III maintains a moderate amount of this interior habitat, compared with Alternatives I and II, with 12,932 acres of effective habitat and 9,388 acres of security habitat for the elk yearlong range (Table 4-15).

Although the Powder River is a naturally turbid river, increased sedimentation into channels from road building may affect aquatic habitat conditions. Sediment from roads may carry seeds of invasive plant species such as salt cedar and Russian-olive and exacerbate an already serious problem. Sediment from roads may be especially damaging during low-flow periods when the river is relatively clear, and when larval fish inhabit shallow, low, or zero-velocity habitats. Increasing sediment to larval fish habitats can smother eggs directly or reduce primary food sources by covering epipelagic benthos. Channel morphology may also be affected, particularly on the descending limb of the hydrograph following high-flow events when deposition occurs (reducing complexity, filling pools, altering deposition features, etc.). Alternative III has a moderate amount of roads, compared with Alternatives I and II, with 281 miles of additional roads in the elk yearlong range (Table 4-15).

Combined with the other management actions related to CBNG development under Alternative III, this alternative results in a moderately negative impact to special status species.

Fish and Wildlife Management

Alternative III would incorporate a tri-phased development with livestock rest up to one year after interim reclamation; prohibition of well metering and POD visitation activities in elk crucial winter range from November 15 through April 30 and elk calving areas from May 1 through June 30; all water management facilities to be located outside elk crucial winter range and elk calving areas; requirement of permanent summer water sources to be provided by CBNG projects; requirement that secondary compressors be located outside elk crucial winter range and elk calving areas; and allowance of 20 percent change from BLM base data for elk security areas. To avoid repetition, these management actions are addressed under Fluid Minerals Management. No other specific actions would be identified and no impacts would be anticipated.

Other Resources Management

Soil Resources

Alternative III would require that surface disturbances on slopes greater than 25 percent be restricted or excluded; there would be no surface-disturbing activities on badlands, rock outcrop, or slopes susceptible to mass failure; surface-disturbing activities may be restricted or excluded on soils with a severe erosion hazard; standard lease terms would apply; and exceptions may apply.

Activities on 25 percent slopes would lead to increased erosion, which causes habitat modification in the form of a loss of vegetation. It is anticipated that very few exceptions would be allowed to the restriction of activities on slopes of 25 percent or greater.

The avoidance of slopes would place much of the development on bottomlands. These bottomland riparian areas would be impacted both by roads (discussed above under Fluid Minerals Management) and impoundments (discussed below under Water Resources

Management). The impact of soil resource management on special status species is anticipated to be negative to a minor degree.

Water Resources

Under Alternative III, reservoirs and water management facilities would be located outside the elk crucial ranges; no additional discharge to ephemeral or intermittent channels would be allowed; and permanent summer water sources would be provided by CBNG projects.

The location of reservoirs outside the elk crucial range, assuming that this action only shifts activity and disturbance rather than outright reducing it, would not affect special status species because their location is independent of elk crucial range. Because impoundments would be developed however, results in impacts.

Impoundments would be developed in bottomlands along the Powder River and Fortification Creek, and alongside tributaries. Off-channel impoundments would be developed on flat terraces. In addition to impoundments on Federal minerals lands, a large proportion of impoundments would likely be placed on private lands along the Powder River with water piped in from projects on Federal lands. There are likely to be more impoundments in Alternative III due to the requirement of no additional discharge into stream channels.

These actions related to CBNG development on the FCPA will likely continue and impact habitat and special status species on adjacent lands. There would also be disturbance associated with added human activity. The creation of impoundments may benefit bats because of their extreme dependence on water, although the high sodium content of these waters may present a problem to the species, because they are sensitive to water chemistry (Adams 2003, Adams et al. 2003). Added water may benefit other special status species by providing drinking water, although this is somewhat offset by the additional disturbance.

Development of impoundments leads to water leakage, which causes changes in vegetation from the existing range grasses, sagebrush, and juniper to more mesic species such as sedges, foxtail barley, and, in places, cattails. Salt cedar has a toehold in the FCPA, and expansion of mesic habitats would allow further invasion by this species. In addition, Alternative III has a higher potential for West Nile virus if reservoirs are not constructed properly. CBNG impoundments can provide habitat for mosquitoes associated with West Nile virus (Oedekoven 2004). West Nile virus represents a significant new stressor, which in 2003 reduced late summer survival of sage-grouse by an average of 25 percent within four populations including the PRB (Naugle et al. 2004).

Typically, the disturbance to construct the impoundment is twice the size of the impoundment's containment area. Under Alternative III, due to the non-allowance of discharge to streams, there is likely to be a greater number of impoundments than in Alternative I or II.

The elimination of additional discharge to channels would have a positive impact on water quality, thus positively affecting special status fish by not altering the hydrology (increased flows) and water quality (sedimentation). This action removes the potential for negative impacts to water quality downstream as well. This action, or lack thereof, could have a positive impact on downstream fish.

However, it is anticipated that alternative methods will be employed for removal of produced water. These may include piping of waters to private lands along the Powder River or its tributaries. Native fish occur in the Powder River. Sustained high flows, from the CBNG

produced water, could potentially inundate the shallow water habitats that the native fish in the Powder River use for breeding and rearing habitats. The native fish in the Powder River have evolved with the variable flows of the Powder River system, so they thrive under those conditions. This alternative would have a negative impact on special status fish species that are adapted to natural flow regimes experienced in an arid prairie environment. Sustained high flows have the potential for expansion of non-native fish species.

The installation of permanent summer water sources would benefit special status species by providing a water source.

In summary, some special status species would likely benefit from water sources whereas others would experience losses due to increased presence of West Nile virus, sagebrush-obligates and raptors that use grasslands would lose native habitat due to impoundments, and the waters discharged to the Powder River by means other than discharge would have a negative impact on special status fish species. The net result is anticipated to be a minor negative impact on fish and wildlife.

Summary

The summary of impacts to special status species is shown in Table 4-17.

Table 4-17 Summary of Impacts to Special Status Species Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Special Species Management	Minor (+) Special status stipulations	Minor (+) Special status stipulations	Minor (+) Special status stipulations
Fish and Wildlife Management	No Impact	No Impact	No Impact
Fluid Minerals Management	Major (-) Loss of security habitat	Minor (-) No loss of security habitat	Moderate (-) Loss of some security habitat
Other Resources Management			
Soil Resources Management	Minor (-) Development in bottomlands	Minor (-) Development in bottomlands	Minor (-) Development in bottomlands
Water Resources Management	Moderate (-) Discharge of 14 mgd produced water	Minor (-) Discharge of 9.2 mgd produced water	Minor (-) No additional discharge but more water in impoundments

4.3.8.3. Cumulative Impacts

Cumulative impacts to special status species were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). As additional development occurs both within and outside the FCPA, cumulative impacts could include increased disturbance to nesting raptors, degradation or destruction of nesting habitats, increased raptor collisions with power lines, increased electrocutions of raptors and increased vehicular collisions with carrion-feeding raptors (BLM 2003a). These impacts would affect raptor populations throughout the PRB.

There is only one sage-grouse lek in the FCPA, but sage-grouse leks are present around the FCPA. Continued CBNG development in and around the FCPA will continue to impact sage-grouse through human activity, noise, and loss of habitat.

4.3.9. Cultural Resources

The goal of cultural resources management in the FCPA is to avoid or mitigate significant impacts to historic properties. The management actions related to this goal include: (1) requiring archaeological inventory for all Federal undertakings, regardless of surface ownership; (2) identifying historic properties; (3) designing projects to avoid or mitigate impacts to historic properties prior to approval; and (4) mitigating impacts to historic properties inadvertently discovered during or after construction.

As described in Chapter 3, site density in the FCPA is the same as the rest of the PRB, and there are no known or anticipated unique sites in the FCPA that would require special management. Current management actions that are a required in order to comply with Section 106 of the National Historic Preservation Act (NHPA) should result in the identification and avoidance or mitigation of all historic properties that may be impacted. There are no foreseeable differences among the alternatives because the management (identification with avoidance or mitigation) must remain the same for each alternative.

4.3.9.1. Evaluation Criteria

Assumptions used in analyzing impacts to cultural resources include the following:

- Archaeological inventories will be conducted for all projects in the FCPA;
- Historic properties will be identified and will either be avoided or mitigated prior to project approval;
- Archaeological sites that are not eligible for listing on the NRHP need not be avoided or mitigated;
- Historic properties inadvertently discovered and impacted during or after construction will be mitigated; and
- The cultural resource types encountered in the FCPA are assumed to be consistent with those encountered in the rest of the PRB.

The following definitions and assumptions will be used for impacts to historic properties:

- *Negligible* – All historic properties that are located prior to project approval will be avoided or mitigated. No historic properties will be discovered during construction.

- *Minor* – All historic properties that are located prior to project approval will be avoided or mitigated. Between one and 10 historic properties could be discovered during construction and will be mitigated.
- *Moderate* – All historic properties that are located prior to project approval will be avoided or mitigated. More than 10 historic properties would be discovered during construction and mitigated. There will be unanticipated impacts to between one and five historic properties that cannot be mitigated.
- *Major* – All historic properties that are located prior to project approval will be avoided or mitigated. More than 10 historic properties will be discovered during construction and mitigated. There will be unanticipated impacts to more than five historic properties that cannot be mitigated.

4.3.9.2. Alternative Analysis

As described in Chapter 3, site density in the FCPA is the same as the rest of the PRB, and there are no known or anticipated site types in the FCPA that require special management. Current management actions that are a required in order to comply with Section 106 of the NHPA should result in the identification and avoidance or mitigation of all historic properties that may be affected. Unanticipated impacts to historic properties that were not located during the inventory can be mitigated. There are no foreseeable differences among the alternatives since the management (identification with avoidance or mitigation) must remain the same for each alternative.

Summary

The summary of impacts to Cultural Resources is shown in Table 4-18.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Cultural Resources Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	Minor (-) 3,593-acre (3.3%) disturbance	Minor (-) 2,168-acre (2.2%) disturbance	Minor (-) 2,541-acre (2.5%) disturbance
Fluid Minerals Management	Minor (-) Sites inventoried and mitigated.	Minor (-) Sites inventoried and mitigated.	Minor (-) Sites inventoried and mitigated.
Other Resource Management Soil Resources	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided

4.3.9.3. Cumulative Impacts

CBNG development on private mineral estate within and around the FCPA may result in cumulative impacts, including, increased surface disturbance when additional well pads, pipelines, compressor stations, roads and/or other facilities are built. Almost all private mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of FCPA. Currently there are approximately 217 producing gas wells on private mineral estate in the FCPA and many leases are not fully developed in other parts of the FCPA. There are no requirements for survey and mitigation of cultural sites on private surface. Also some sites may be missed on federal development areas despite cultural surveys.

Cumulative impacts to cultural resources were evaluated for the entire PRB, including the FCPA in the PRB O&G FEIS (BLM 2003a). Results of this analysis indicate that 178 historic properties would be directly affected in the PRB. Continued development in and around the FCPA will result increased erosion from roads and other facilities, increased vibration from traffic on roads, and overall increased access into the area. Even though significant sites are not expected in the FCPA, this type of disturbance would result in destabilization and increased vandalism at some sites.

4.3.10. Geologic Resources

The primary goal for geologic resources in the FCPA is to maintain or enhance opportunities for mineral exploration and development while maintaining other resource values. Because this goal pertains to CBNG development in the FCPA, impacts to geologic resources are the same as those described in Section 4.4.5, Fluid Minerals Management.

4.3.11. Paleontological Resources

The primary goal for paleontological resources in the FCPA is protect the scientific value of significant fossils. The management actions related to this goal include:

- Paleontological inventories will be targeted to specific areas or will be issue driven as needed;
- Large, conspicuous, and/or scientifically significant fossils or localities found during development will be reported to the BLM;
- Evaluation of discoveries during construction will be conducted by a BLM-approved professional paleontologist within five working days; and
- Adverse impacts to paleontological resources will be mitigated as necessary.

4.3.11.1. Evaluation Criteria

Assumptions used in analyzing impacts to paleontological resources include the following:

- The potential for significant vertebrate fossil discovery is low in the FCPA.

The following definitions will be used for impacts to paleontological resources:

- *Negligible* – The effect on paleontological resources is barely detectable. All significant fossils are discovered and avoided or mitigated before project approval.

- *Minor* – Significant fossils are discovered and avoided or mitigated before project approval. Between one and five significant fossils are discovered during construction and adequately mitigated.
- *Moderate* – Significant fossils are discovered and avoided or mitigated before project approval. More than five significant fossils are discovered during construction and adequately mitigated. Between one and two significant fossils are disturbed by construction and adequate mitigation is unattainable.
- *Major* – Significant fossils are discovered and avoided or mitigated before project approval. More than 10 significant fossils are discovered during construction and adequately mitigated. More than three significant fossils are disturbed by construction and adequate mitigation is unattainable.

4.3.11.2. Alternative Analysis

Current management actions that are required prior to project approval should result in the identification and avoidance or mitigation of all significant fossils that may be impacted. Unanticipated impacts to significant fossils that were not located during the inventory can be mitigated. There are no foreseeable differences among the alternatives since the management (identification with avoidance or mitigation) must remain the same for each alternative. The summary of impacts to Paleontological Resources is shown in Table 4-19.

Table 4-19 Summary of Impacts to Paleontological Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Paleontological Resources Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	Minor (-) 3,593-acre (3.6%) disturbance	Minor (-) 2,168-acre (2.2%) disturbance	Minor (-) 2,541-acre (2.5%) disturbance
Fluid Minerals Management	Minor (-) Fossils inventoried and mitigated.	Minor (-) Fossils inventoried and mitigated.	Minor (-) Fossils inventoried and mitigated.
Other Resource Management Soil Resources	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided	Minor (+) Erosive soils avoided

4.3.11.3. Cumulative Impacts

CBNG development on non-Federal mineral estate within and around the FCPA may result in cumulative impacts, including increased surface disturbance when additional well pads, pipelines, compressor stations, roads, and/or other facilities are built. Almost all non-Federal mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of FCPA. Currently there are approximately 217 producing gas

wells on non-Federal mineral estate in the FCPA. Many leases are not fully developed in other parts of the FCPA.

CBNG development on non-Federal mineral estate within and around the FCPA may result in cumulative impacts, including increased erosion and fossil collecting associated with ground disturbance when additional well pads, pipelines, compressor stations, roads, and/or other facilities are built. Continued development in and around the FCPA will result increased erosion from roads and other facilities, increased vibration from traffic on roads, and overall increased access into the area. Even though significant fossils are not expected in the FCPA, this type of disturbance would result in destabilization and increased vandalism at some sites. Additionally, because the paleontological resources in the FCPA are not unique or significant, impacts to overall scientific knowledge would be extremely small.

4.3.12. Visual Resources

The goal for visual resource management under Alternatives I, II, and III is to maintain or improve scenic values and visual quality, and establish visual resource management priorities in conjunction with other resource values (BLM 2003a).

To achieve the goal for Alternatives I, II, and III, the following objective was established:

- Protect, maintain, improve, or restore visual resource values by managing all public lands in accordance with the Visual Resource Management (VRM) system.

4.3.12.1. Evaluation Criteria

Assumptions used in analyzing impacts to visual resources include the following:

- Facilities or structures such as power lines, oil wells, and storage tanks are required to be screened, painted, and designed to blend with the surrounding landscape except where safety indicates otherwise.
- The WSA is the visual reference point for the analysis.
- Any facilities or structures proposed in or near WSAs will be designed so as not to impair wilderness suitability.
- The FCPA is designated and managed as VRM Class III.
- The WSA is managed under interim guidance for non-impairment, (i.e., VRM Class I).
- The operator will complete the following measures where practical: use existing well pads where feasible, use vegetative and topographic screening when siting well locations, and avoid highwall cuts.
- The operator 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.
- The operator will use buried power lines to each well, where feasible, to reduce the linear element in the landscape.

The following definitions will be used for impacts to visual resources:

- Viewpoint sensitivity for the viewers in the FCPA includes high-sensitivity viewpoints from locations within the WSA boundary and moderate- to low-sensitivity viewpoints from county

roads in the FCPA. Sensitivity is assigned to these levels because the expectation for scenic views from within the WSA boundary is much higher than motorists traveling general use roadways not currently designated as scenic highways. Additionally, duration of view is longer for viewpoints within the WSA boundary.

- *Negligible* – The effect on visual resources is barely detectable. Less than 1 percent of the resource would be affected. This could include surface disturbance that would be visible in the seldom seen distance zone (beyond 5 miles) from WSA viewpoints;
- *Minor* – The effect on visual resources is slight but detectable; there would be a small change in the resource. This could include surface disturbance that would be visible in the background distance zone (beyond 3 miles) from WSA viewpoints;
- *Moderate* – The effect on visual resources is readily apparent; there would be a measurable change in the resource. This could include surface disturbance that would be visible in the foreground to middle ground distance zone (between 0.5 and 3 miles away from the WSA viewpoint).
- *Major* – The effect on visual resources is large; there would be a highly noticeable, long-term, or permanent measurable change in the resource. This could include surface disturbance that would be visible within the proximate distance zone (less than 0.5 mile away from the WSA viewpoint). This intensity level equates to a significant impact for this resource if the transmission poles were greater than 70 feet tall and would occupy the entire view perspective. The development of gas wells and associated road and pipeline networks, impoundments, water treatment facilities, compressors, and other facilities would not be considered a highly noticeable change to visual resources found on VRM Class III lands unless the management activity would remain completely visible and dominant from any portion of the WSA.

4.3.12.2. Alternative Analysis

Alternative I – No Action

Visual Resource Management

Current management actions for the FCPA under Alternative I include the following:

- VRM Class III standards apply to the entire resource area unless otherwise stated;
- Actions in the FCPA must meet VRM Class III standards; and
- Overhead power lines are prohibited on BLM surface within FCPA.

Under Alternative I, overhead power is estimated to encompass 73 miles of poles and conductors; no overhead power lines are allowed on BLM lands. Approximately 726 wells would be drilled to extract CBNG. The FCPA is classified as VRM Class III with a special provision prohibiting overhead power lines on the Federal surface, and all power lines associated with Federal actions must be in road corridors. According to BLM classification, overhead power lines typically would be permitted in VRM Class III areas. However, management for the FCPA specifies, “power lines will be buried” on BLM surface (BLM 2003a). This management continues to result in moderately negative impacts to visual resources because power lines would be installed on non-BLM surface lands.

Wildlife and Special Status Species Resource Management

Under this alternative, there are TLs for elk habitat; however, these restrictions are temporary and therefore do not impact visual resources. There are no restrictions on the location of water management facilities resulting in minor adverse impacts, because water management facilities will be visible throughout the FCPA.

Fluid Minerals Management

Fluid minerals management actions include the proposed road and pipeline networks needed to support the proposed gas wells. The road networks (approximately 179 miles) would cause moderately adverse visual impacts because the cut and fill slopes have greater visibility than a buried pipeline corridor. Additionally, road (and associated pipeline) network scars would remain visible for a long time, even when revegetated. The linear lines would detract from the overall naturally appearing landscape currently found upon VRM Class III lands in the FCPA. Because development pace is not constrained under this alternative more than 300 additional water treatment and other ancillary facilities would be constructed in the FCPA. Along with roads and wells there would be approximately 3,593 acres of disturbance that would impact visual resources. This additional infrastructure would also be visible to dispersed recreational viewpoints. Alternative I would have a moderately adverse impact to visual resources because the greatest amount of road and pipeline networks and ancillary facilities of this alternative would be balanced with the possibly reduced visibility of overhead power because of its prohibition on BLM surface land within the FCPA.

Other Resource ManagementSoil Resources

Where restrictions are placed on the location of gas wells and road networks because of sensitivity to soil erosion the VRM impacts would be reduced especially from the WSA. Under Alternative I, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, on badlands, rock outcrop, slopes susceptible to mass failure, and soils with a severe erosion hazard. This management action would have a beneficial impact on VRM because few wells, power lines, and other infrastructure would be constructed on high viewpoints. Impacts to visual resources would be minor and beneficial.

Alternative II**Visual Resource Management**

WSAs and designated wilderness would be classified as VRM Class I. Overhead power on BLM surface would be constructed along road corridors. Overhead power is estimated to encompass 47 miles of poles and conductors. The number of wells is estimated at 468. This option allows for gas extraction with fewer overhead power lines and well pads compared to Alternatives I and III. Assuming the overhead power lines would be built beyond the proximate distance zone from WSA viewpoints, this option would have moderately adverse impacts to visual resources.

Wildlife and Special Status Species Resource Management

Under this alternative, there are TLs for elk habitat; however, these restrictions are temporary and therefore do not impact visual resources. Water management facilities and secondary compressors would be located outside the elk yearlong range. Additionally, there would be no net increase in road density. These actions would result in minor beneficial impacts to VRM

around the WSA because facilities would be located on the periphery of the FCPA. However, visual impacts would increase at the edges of the FCPA where ancillary facilities would be located. Overall impacts would be minor and beneficial.

Fluid Minerals Management

Alternative II has the least number of wells and the fewest miles of overhead power compared to Alternatives I and III. Approximately 468 wells would be developed with 47 miles of overhead power lines. An area wide power line network would be planned in advance, which would maximize use of existing corridors and roads to minimize excessive cross-country power line construction. In addition to the visual impacts to VRM Class III from overhead power, the road network (and associated buried power lines) would result in visual impacts because the cut and fill slopes have greater visibility than the surrounding landscape. Under this alternative, there would be no net increase in roads, but new roads would be built as others were reclaimed. Additionally, road (and associated pipeline) network scars would remain visible for a long time, even when revegetated. The linear lines would detract from an overall natural appearing landscape currently found upon VRM Class III lands in the FCPA.

Under Alternative II, there would be approximately 220 ancillary facilities to support CBNG development with approximately 160 acres of new disturbance. Water treatment facilities will be located outside the elk yearlong range where they would be most visible to the public. The additional infrastructure would also be visible to dispersed recreational viewpoints. Compared to Alternative I, Alternative II would have the least impact to visual resources because of the least amount of road, pipeline, and ancillary facilities; however, impacts would be moderate and adverse.

Other Resource Management

Soil Resources

Where restrictions are placed on the location of gas wells and road networks because of sensitivity to soil erosion, the VRM impacts would be reduced. Under Alternative II, surface-disturbing activities would be restricted or excluded on slopes greater than 25 percent, on badlands, rock outcrop, slopes susceptible to mass failure, and soils with a severe erosion hazard. This management action would have a beneficial impact on VRM, especially in the WSA because few wells, power lines, and other infrastructure would be constructed on high viewpoints. However, CBNG facilities would be located outside the elk yearlong range in areas where they would be more visible to the public. Impacts to visual resources would be negligible and adverse.

Alternative III

Visual Resource Management

WSAs and designated wilderness would be classified as VRM Class I. Overhead power lines would be allowed in road corridors. It is estimated that 574 new wells would be installed under this option with 57 miles of overhead power lines needed to supply electrical needs. This option would have greater visual impact than Alternative II because of the additional infrastructure that would be visible to dispersed recreational viewpoints. Assuming the overhead power lines would be built beyond the proximate distance zone from WSA viewpoints, this option would have moderately adverse impacts to visual resources.

Fish and Wildlife Resource Management

Under this alternative, there are TLs for elk habitat; however, these restrictions are temporary and therefore do not impact visual resources. Water management facilities and secondary compressors would be located outside crucial winter range and elk calving areas, which would make them more visible to the public from public roads, but less visible from the WSA. These actions would result in minor beneficial impacts to visual resources.

Fluid Mineral Management

Approximately 574 wells would be developed with 57 miles of overhead power lines. An area wide power line network would be planned in advance, which would maximize use of existing corridors and roads to minimize excessive cross-country power line construction. The road networks would cause more visual impacts because the cut and fill slopes have greater visibility than a buried pipeline corridor. Additionally, road (and associated pipeline) network scars would remain visible for a long time, even when revegetated. The linear lines would detract from an overall natural appearing landscape found upon VRM Class III lands in the FCPA. Under Alternative III, there would be approximately 270 ancillary facilities (approximately 192 acres of disturbance) to support CBNG development that would be located outside the elk crucial winter and calving ranges. These facilities would be more visible to the public from county roads and dispersed recreational viewpoints. Compared to Alternative I, Alternative III would have a moderately adverse impact to visual resources because of the second largest quantity of roads, pipelines, and facilities.

Other Resource Management

Soil Resources

Where restrictions are placed on the location of gas wells and road networks because of sensitivity to soil erosion the VRM impacts would be reduced. Under Alternative III, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, on badlands, rock outcrop, slopes susceptible to mass failure, and soils with a severe erosion hazard. This management action would have a minor beneficial impact on VRM, especially in the WSA because few wells, power lines, and other infrastructure would be constructed on high viewpoints. However, CBNG facilities would be concentrated in areas on the edges of the FCPA where they would be visible from county roads. Overall, impacts to VRM are minor and adverse.

Summary

The summary of impacts to visual resources is shown in Table 4-20.

Table 4-20 Summary of Impacts to Visual Resources Management			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Visual Resources Management	Moderate (-) 73 miles of power lines on non-BLM	Moderate (-) 47 miles of power lines on all surfaces	Moderate (-) 57 miles of power lines on all surfaces

Table 4-20 Summary of Impacts to Visual Resources Management			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
	surface		
Wildlife and Special Status Species Resources Management	Minor (-) CBNG facilities dispersed	Minor (+) Facilities outside yearlong range	Minor (+) Facilities outside crucial ranges
Fluid Minerals Management	Moderate (-) 73 miles of overhead power lines 179 miles new roads	Moderate (-) 47 miles of overhead power lines no net increase in roads	Moderate (-) 57 miles of overhead power lines 90 miles new roads
Other Resource Management Soil Resources	Minor (+) Erosive soils avoided	Negligible (-) CBNG facilities visible to public	Minor (-) CBNG facilities visible to public

4.3.12.3. Cumulative Impacts

Cumulative impacts to visual resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). CBNG development on Federal, state, and private lands in and around the FCPA would increase the industrial character of the area. As described in the PRB O&G FEIS, approximately 39,367 CBNG wells would be drilled in the PRB (BLM 2003a). Associated facilities would include water facilities, aboveground power lines, roads, generators, and other ancillary facilities. This development would result in an overall increase in the industrial character of the area including a decrease in air and visual quality as the number of CBNG wells and facilities increase especially near roads.

Almost all non-Federal mineral estate has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of the FCPA. Currently, there are approximately 217 producing gas wells on non-Federal mineral estate in the FCPA. This development has already affected visual resources especially in the southeastern portion of the FCPA.

4.3.13. Fuels and Fire

The primary goals for fuels and fire management in the FCPA are to restore the natural role of fire in the ecosystem; cost-effectively protect life, property, and resource values from wildfire; and to use prescribed fire to achieve multiple-use management goals. The management actions related to these goals include the following:

- Unwanted wildland fires will be suppressed. The use of some types of suppression equipment will be restricted in some areas, and fire and suppression damage will be rehabilitated.
- Wildfires will be managed in all areas of the resource area. Priority will be given to suppressing fires in or threatening higher value resources (the WSA) and keeping fires from

spreading onto private, state, or other Federal lands. Protecting human life will be the highest priority.

- Heavy equipment (dozers) will be restricted from being used for wildfire suppression in the WSA and areas of known cultural values.
- Aerial retardant use will be restricted to keep retardant out of water sources. Specific restrictions on retardant use apply to the WSA.
- Helispot construction is prohibited in the WSA.
- Firelines that are constructed by heavy equipment or on steep slopes will be rehabilitated to prevent or control erosion. Rehabilitation includes, but is not limited to, water barring and reseeding.
- Prescribed burns will be used as a tool to reach management objectives planned for areas in conjunction with other goals such as range and wildlife habitat management projects.

These management actions are common to all alternatives. The following alternative analysis considers adverse and beneficial impacts, direct and indirect impacts, as well as short- and long-term impacts to fuels and fire.

4.3.13.1. Evaluation Criteria

Because of the unpredictable nature of fire, and the general lack of long-term quantitative data, assessment of potential impacts from the management of other resources on fuels and fire is difficult to quantify.

The following definitions will be used for impacts to fuels and fire:

- *Negligible* – The effect on fuels and fire is barely detectable. This may include firefighting capacity, firefighter safety, increased or decreased fuels, ignition sources, and prescribed burns. A negligible change would be less than 1 percent of the FCPA.
- *Minor* – The effect on fuels and fires is slight but detectable; there would be a small change in firefighting capacity, increased or decreased fuels, ignition sources, and prescribed burns. A minor change would be from one to 10 percent of the FCPA, or there is a major impact, but on a short-term or highly localized basis.
- *Moderate* – The effect on fuels and fire is readily apparent; there would be a measurable change in firefighting capacity, increased or decreased fuels, ignition sources, and prescribed burns that could result in long-term or permanent change to the fuels and fire. This would be a change that affects 10 to 20 percent of the FCPA.
- *Major* – The effect on fuels and fire is readily apparent; there would be a measurable change in firefighting capacity, increased or decreased fuels, ignition sources, and prescribed burns that could result in long-term or permanent change to the fuels and fire. This would be a change that affects more than 20 percent of the FCPA.

4.3.13.2. Alternative Analysis

Impacts to fuels and fire are those that would inhibit firefighting ability or increase the chances for wildfire. Impacts to fuels and fire may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from fuels and fire management, as

well as those anticipated to result from the management actions proposed for wildlife and special status species, visual resources, and fluid minerals.

Alternative I (No Action Alternative)

Fuels and Fire Management

Alternative I, the No Action Alternative, would continue current management goals and objectives, including suppressing unwanted wildland fires, restricting heavy equipment in some areas, and reclaiming firelines on steep slopes. Additionally, prescribed burns may be used to enhance wildlife habitat. The continuation of current management includes application of prescribed fire on an average of 600 to 1,000 acres/year with a cumulative total over a 10-year period of up to 10,000 acres. However, an increase in the amount of CBNG development would limit the prescribed burns because of the risk of setting a well or pipeline on fire. Impacts would be minor and beneficial because of reduced threat of catastrophic wildland fire resulting from fuel reduction and an increase in fuel breaks.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values. Current restrictions for elk habitat are TLs; however, these are not in force during the driest and hottest part of the year when CBNG development would be occurring. These management actions would not have any impact on fuels and fire management. However, because there are no restrictions on the placement of water impoundments, they would be dispersed throughout the FCPA resulting in more water for firefighting and minor beneficial impacts.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify requirements, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA.

Current management actions for CBNG development under Alternative I include the potential for approximately 726 wells with associated infrastructure. These actions would result in minor adverse impacts to fuels and fire because additional development could require fire protection in approximately 3,592 acres (less than 4 percent of the FCPA). The amount of fuel in the FCPA would increase because of the gas and oil either produced or needed for power generation that will be in the area. Hot vehicles and equipment and tossed cigarettes could also increase the potential for wildfire. The incidence of equipment-caused fires in California is 27 percent, vehicle-caused fires 14 percent and smoking-caused fires 2 percent (California Department of Forestry and Fire, 1999). The California Department of Forestry and Fire (CDF) did not distinguish between wildland, wildland-urban interface, or urban areas in their statistics, nor did they distinguish between industrial or other fires. In general, fire is more prevalent in urban areas and wildland-urban interfaces. While this is not currently the case in the FCPA, increased development (roads, structures, and people) could result in a transition to a more urban area. Additionally, the CDF Office of the State Fire Marshal (OSFM) states that, historically, the gas development operation most likely to cause fires is welding (OSFM, USFS, BLM 1999). This is not likely in the FCPA because most of the pipe used is polyethylene. CBNG development

would likely reduce the risk of wildfire because sparks would fall on bare ground. However, increased disturbance from CBNG development and a subsequent increase in cheatgrass would increase fuels for wildland fires in the long term.

Under Alternative I, no overhead power lines are allowed on BLM lands; however, there would likely be 73 miles of overhead power lines on non-Federal lands. These management actions would result in a slight reduction in the potential for fire caused by overhead power lines as a fire ignited on non-Federal surface could spread onto BLM surface. In the state of California overhead power lines caused approximately 1 to 3 percent of wildland fire ignitions (State of California PUC 2008).

The increase in CBNG water impoundments that could be used as water sources during wildfires would be a negligible beneficial impact, as would the increase in roads that would provide better access for firefighting and additional firebreaks. There would be a safer environment for the firefighters to address wildland fuels but some additional risk or increased hazard from concentrations of produced fossil fuels. Impacts would be minor and beneficial.

Overall, impacts from fluid minerals management on fuels and fire are minor and adverse, because while the firefighting environment would be safer, there would be more fuels available and fewer prescribed burns in developed areas.

Other Resources Management

Vegetation Resources

Under this alternative, vegetation resources management would result in minor adverse impacts to fuels and fire because hazardous fuels would not be controlled by prescribed burns in areas of CBNG development and production (less than 5 percent of the FCPA). Therefore, fuels would not be reduced.

Alternative II

Fuels and Fire Management

Alternative II would continue current management goals and objectives, including suppressing unwanted wildland fires, restricting heavy equipment in some areas, and reclaiming firelines on steep slopes. The continuation of current management includes application of prescribed fire on an average of 600 to 1,000 acres/year with a cumulative total over a 10-year period of up to 10,000 acres. However, an increase in the amount of CBNG development would limit the prescribed burns because of the risk of setting a well or pipeline on fire. Prescribed burns may be used to enhance wildlife habitat. Impacts would be minor and beneficial because of reduced threat of catastrophic wildland fire resulting from fuel reduction and increased fuel breaks.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values. Additionally, current restrictions for elk habitat are TLs that are not in force during the driest and hottest part of the year. This management action would have no impact on fuels and fire management. Under this alternative, water impoundments that could be used as water sources during wildfires would be restricted to areas outside of the elk yearlong range. This action would result in a negligible beneficial impact because there would be more water for firefighting, although the impact would be restricted to areas outside of the elk

yearlong range. Overall, there would a safer environment for the firefighters to address wildland fires.

Fluid Minerals Management

Management actions for CBNG development under Alternative II include the potential for approximately 468 wells and well pads with associated infrastructure. These actions would result in minor adverse impacts to fuels and fire because additional development could require fire protection in approximately 2,168 acres (less 2 percent of the FCPA). The amount of fuel in the FCPA would increase because of the gas and oil either produced or needed for power generation in the area. Hot vehicles and equipment and tossed cigarettes could also increase the potential for wildfire. The incidence of equipment-caused fires in California is 27 percent, vehicle-caused fires 14 percent, and smoking-caused fires 2 percent (California Department of Forestry and Fire 1999). The CDF did not distinguish between wildland, wildland-urban interface, or urban areas in their statistics, nor did they distinguish between industrial or other fires. In general, fire is more prevalent in urban areas and wildland-urban interfaces. While these conditions are not currently the case in the FCPA, increased development (roads, structures, and people) could result in a transition to a more urban area. Additionally, CDF OSFM states that, historically, the gas development operation most likely to cause fires is welding (OSFM, USFS, BLM 1999). This is not likely in the FCPA because most of the pipe used is polyethylene. CBNG development would likely reduce the risk of wildfire because sparks would fall on bare ground. However, increased disturbance from CBNG development and a subsequent increase in cheatgrass would increase fuels for wildland fires in the long term.

There would be no net increase in road density, which would have no impact because there would not be an overall increase in firebreaks or access for firefighters. The associated increase in water impoundments that could be used as water sources during wildfires would be a negligible beneficial impact because there would be more water for firefighting, although it would be restricted to areas outside of the elk yearlong range. Overall, there would a safer environment for the firefighters to address wildland fires but some additional risk or increased hazard from concentrations of produced fossil fuels. Impacts would be negligible and beneficial.

Under Alternative II, overhead power lines would be constructed in road corridors. This management action would result in minor adverse impacts to fuels and fire because the additional infrastructure may require fire protection and the overhead power lines would result in a safety risk for firefighters. Additionally, there is a very small risk (approximately 1 to 3 percent) (State of California PUC 2008) of a power line causing a fire.

Overall, impacts from fluid minerals management on fuels and fire are minor and adverse, because while the firefighting environment would be safer, there would be more fuels available and fewer prescribed burns in developed areas.

Other Resources Management

Vegetation Resources

Under this alternative, vegetation resources management would result in minor adverse impacts to fuels and fire because hazardous fuels would not be controlled by prescribed burns in areas of CBNG development and production (less than 5 percent of the FCPA) and fuels would not be reduced.

Alternative III

Fuels and Fire Management

Alternative III would continue current management goals and objectives, including suppressing unwanted wildland fires, restricting heavy equipment in some areas, and reclaiming firelines on steep slopes. The continuation of current management includes application of prescribed fire on an average of 600 to 1,000 acres/year with a cumulative total over a 10-year period of up to 10,000 acres. However, an increase in the amount of CBNG development would limit the prescribed burns because of the risk of setting a well or pipeline on fire. Prescribed burns may be used to enhance wildlife habitat. Impacts would be minor and beneficial because of a reduced threat of catastrophic wildland fire resulting from fuel reduction and breaking up of fuel continuity.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative III include restrictions and limitations for wildlife values. These management actions would have negligible adverse impacts on fuels and fire management. Additionally, current restrictions for elk habitat are TLs that are not in force during the driest and hottest part of the year. There would be no impact from this action. CBNG water impoundments would be located outside the elk winter and calving ranges. This action would result in water sources for wildfires, but would be a negligible beneficial impact because additional water would only be readily available outside of the crucial ranges.

Fluid Minerals Management

Management actions for CBNG development under Alternative III include the potential for approximately 574 wells and well pads with associated infrastructure. These actions would result in minor adverse impacts to fuels and fire because additional development could require fire protection in approximately 2,541 acres (less 5 percent of the FCPA). The amount of fuel would increase because of the gas and oil either produced or needed for power generation. Hot vehicles and equipment, and tossed cigarettes could also increase the potential for wildfire. The incidence of equipment-caused fires in California is 27 percent, vehicle-caused fires 14 percent, and smoking-caused fires 2 percent (California Department of Forestry and Fire 1999). The CDF did not distinguish between wildland, wildland-urban interface, or urban areas in their statistics, nor did they distinguish between industrial or other fires. In general, fire is more prevalent in urban areas and the wildland-urban interface. While these land uses do not currently exist in the FCPA, increased development (roads, structures, and people) could result in a transition to a more urban area. Additionally, the CDF OSFM states that, historically, the gas development operation most likely to cause fires is welding (OSFM, USFS, BLM 1999). This is not likely in the FCPA because most of the pipe used is PVC. The amount of area disturbed for CBNG development would likely reduce the risk of wildfire because sparks would fall on bare ground.

Under Alternative III, overhead power lines would be constructed in road corridors. This management action would result in minor adverse impacts to fuels and fire because the additional infrastructure may require fire protection and the overhead power lines would result in a safety risk for firefighters. Additionally, there is a very small risk (approximately 1 to 3 percent) (State of California PUC 2008) of a power line causing a fire.

An increase of 20 percent in road density in the FCPA would result in negligible beneficial impacts because there would be better access for firefighting equipment and more firebreaks. The associated increase in water impoundments (outside the crucial elk ranges) that could be used as water sources during wildfires would be a negligible beneficial impact because additional water would only be available outside the crucial elk ranges. There would be a safer environment for the firefighters to address wildland fires but some additional risk or increased hazard from concentrations of produced fossil fuels. Overall, impacts would be minor and adverse.

Other Resources Management

Under this alternative, vegetation resources management would result in minor adverse impacts to fuels and fire because hazardous fuels would not be controlled by prescribed burns in areas of CBNG development and production (less than 5 percent of the FCPA) and fuels would not be reduced.

Summary

The summary of impacts to fuels and fire is shown in Table 4-21.

Table 4-21 Summary of Impacts to Fuels and Fire			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Fuels and Fire Management	Minor (+) Fuel reduction plus increase in fuel breaks	Minor (+) Fuel reduction plus increase in fuel breaks	Minor (+) Fuel reduction plus increase in fuel breaks
Wildlife and Special Status Species Resources Management	Minor (+) Water impoundments dispersed	Negligible (+) Water impoundments outside yearlong range	Negligible (+) Water impoundments outside crucial ranges
Fluid Minerals Management	Minor (-) Increased fire risk	Minor (-) Increased fire risk	Minor (-) Increased fire risk
Other Resource Management			
Vegetation Resources	Minor (-) Fewer prescribed burns, more fuels	Minor (-) Fewer prescribed burns, more fuels	Minor (-) Fewer prescribed burns, more fuels

4.3.13.3. Cumulative Impacts

Cumulative impacts to fuels and fire management may include smoke dispersion, escaped fire from private lands and the surrounding wildland-urban interface, and potential flash flooding into FCPA streams from destabilized burned areas on private lands. Almost all non-Federal

mineral estate in the FCPA has been developed. This development is primarily along the edges of the FCPA and within the southeastern third of the FCPA. Currently, there are approximately 217 producing gas wells on non-Federal mineral estate in the FCPA. Current conditions in developed portions of the FCPA and adjacent to the FCPA include cheatgrass invasion, insect infestation, poor soil conditions, and long-term drought, which may collectively increase the likelihood of high-intensity wildfires. The risk of fires from CBNG development (from fuel, electrical lines, compressors, and other CBNG-related activity) increases with the number of wells installed.

4.4 Resource Uses

4.4.1. Rangeland Resources

Management goals for rangeland resources within the FCPA are: (1) manage livestock grazing in order to be consistent with Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Lands Administered by the Bureau of Land Management in the State of Wyoming (BLM 1997); and (2) maintain a thriving natural ecological balance, multiple-use relationships, and productive forage resources.

Most management actions related to these goals are common to all alternatives and include:

- Livestock grazing is allowed on all public lands in the resource area.
- Any permanent increases in the amount of forage produced are considered for wildlife and watershed protection before additional livestock use is authorized.
- Fences in important habitat areas will be constructed to maintain wildlife mobility in these important habitat areas. Fences on public land that are hindering natural movement of wildlife will be modified to conform to BLM standards.
- Reservoirs, wells, troughs, and pipelines will be constructed to provide water in dry areas and to disperse grazing use. The grazing lessee or other cooperators will be required to maintain water in all troughs located on public land during the frost-free period (April through October) for wildlife.
- All stock tanks will include a ramp to enable trapped small birds and mammals to escape.

The following alternative analysis considers adverse and beneficial impacts, and direct and indirect impacts to rangeland resources.

4.4.1.1. Evaluation Criteria

Assumptions used in analyzing impacts to rangeland resources include the following:

- Federal lands within the boundary of the FCPA were used as the impact analysis area for both individual and cumulative impacts.

The degree of both beneficial and adverse estimated impacts to rangeland resources is described using the following categories. These are defined in both quantitative terms (percent impairment to lease terms and conditions), when such analyses are possible and in more qualitative terms (visibility, duration, and in the context of Wyoming Standards for Healthy Public Rangelands) when there are no quantitative parameters available for analysis.

- *None* – Effects are unlikely to affect the resource value, with no amount of physical disruption to the resources. Permittees would see no impacts to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Negligible* – Detectable effects could occur but would last no more than one year (that is, not detectable after one full growing season). Anticipated effects are unlikely to result in noticeable impairment or enhancement of the resource value in terms of Wyoming Standards for Healthy Public Rangeland (BLM 1995). Permittees would see no noticeable impacts to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Minor* – Effects are likely to result in noticeable but not substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangeland (BLM 1995), but the total area of disruption would include less than 5 percent of the resource. Permittees would see less than 5 percent impairment to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Moderate* – Effects would be noticeable and could include substantial impairment of the resource value in terms of Wyoming Standards for Healthy Public Rangeland (BLM 1995). These effects could increase over time, or be long term or permanent. The total area of disruption would include 6 to 15 percent of the resource. Permittees would see 6 to 15 percent impairment of current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- *Major* – Effects would be noticeable and are likely to include substantial impairment of the resource value. These effects may increase over time or be long term or permanent. Permittees would see more than 15 percent impairment in current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.

4.4.1.2. Alternative Analysis

A number of proposed management actions have the potential to impact rangeland resources. Direct impacts affect the quality of these resources in terms for forage quality and quantity because these factors influence the number of domestic grazers that can be supported. Impacts to forage quality and quantity may be adverse, such as reduced biomass production and increased prevalence of weeds. Introduction or expansion of noxious weeds through various vectors can poison livestock but more commonly they replace preferred forage with unpalatable and or less-productive plant species. Beneficial impacts such as increased biomass production and increased prevalence of desirable species may also result from specific management actions. Direct impacts to allotment permittees are defined as those that affect lease conditions.

A number of indirect impacts to rangeland health and management are also possible. Indirect impacts of surface disturbance include a general loss of forage area or availability of forage due to surface occupancy for other uses, construction or widening of roads, direct and indirect damage to soils and vegetation, and closure of specific areas to livestock to protect or enhance one or more other resources. Vehicular traffic and human visitors and their dogs may harass livestock.

In general, there is a direct and proportional relationship between impacts to vegetation and rangeland resources. Therefore, as with vegetation resources, direct impacts to rangeland

resources will be described in terms of the relative amount of surface disturbance due to any specific management action.

The estimated extent of ground-disturbing activities associated with fluid minerals management to each vegetation type, by alternative, was described in Vegetation Resources, Section 4.3.6, and summarized in Table 4-13.

The following sections describe the impacts under each alternative resulting from the management of rangeland resources, as well as those anticipated to result from the management actions proposed for wildlife and special status species, fluid minerals, and other resources management, including vegetation resources and special designations.

Alternative I (No Action Alternative)

Rangeland Resources Management

Alternative I, the No Action Alternative, would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including continuation of livestock grazing; limited authorization for increased stocking rates; fencing to maintain wildlife mobility in important habitat; water projects being allowable in dry areas and for the purposes of dispersing livestock; and stock tanks including escape ramps for wildlife and birds. Range improvements are less likely in the WSA because of non-impairment prescriptions.

Rangeland health assessments have not been completed on all of the 17 allotments in the FCPA. However, the allotments that have been assessed have all been found to be meeting the Standards for Healthy Public Rangelands (BLM 1995). Continuing current management for these resources is therefore expected to have no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values. Under this alternative TLs for elk crucial winter range limit surface-disturbing activities during parts of the year. Such actions indirectly benefit rangeland resources because they result in seasonal limitations to surface disturbance and vegetation and some limitations of other activities that may adversely impact livestock. However, the TLs do not result in permanent restrictions. Existing wildlife resources management, including specific elk management actions, would not have any measurable impact on rangeland resources.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not negatively impact resource values in the FCPA. Under Alternative I, the pace of CBNG development would be unrestricted. Current management actions for CBNG development under Alternative I include restrictions and limitations for wildlife values and overhead power lines limited to non-BLM surface. These restrictions are reflected in the estimated surface disturbance.

Development of CBNG under Alternative I would result in an estimated 4,523 acres of vegetation disturbance (4.5 percent of the total area) (Table 4-13). This would affect allotments in proportion to their relative size and location. Allotments near the edge of the FCPA would be

expected to be affected disproportionately by CBNG facility location because areas with slopes less than 25 percent will have most of the development. However, most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments would be affected to some degree. Direct impacts would include loss of forage and AUMs and would result in minor adverse impacts to rangeland resources. CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use structures for scratching posts or shade.

Current stock wells may go dry because of drawdown but will be replaced if covered under a well agreement. CBNG discharged water will continue to increase the availability of surface water in the FCPA even though there is no requirement for CBNG developers to provide additional water sources. Available water in an otherwise dry landscape tends to attract livestock to spend more time grazing in these areas and so may become more concentrated in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium.

Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a). These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and are expected to result in minor adverse impacts to rangeland resources.

Increased flows could result in conversion of reaches of ephemeral drainages that currently support upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall the impacts to vegetation resources from these conversions would be minor in extent. In terms of rangeland resources, this impact can be considered negative in that such conversions would replace upland forage in these drainage bottoms with less-palatable riparian species.

These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and location, but are overall expected to result in minor adverse impacts to rangeland resources.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes over 25 percent, badlands, rock outcrop, slopes susceptible to mass failure (erosive), and erosive soils. This would result in indirect minor beneficial impacts to rangeland resources that occur in these areas because erosion would be minimized on approximately 33,694 acres. However, the restriction of CBNG development to slopes less than 25 percent results in concentrating development in areas preferred by livestock and impacts the best forage types. With CBNG infrastructure and livestock both avoiding the steep slopes the remaining narrow drainage bottom areas would likely be the most impacted. Additionally, this restriction results in more development on the edges of the FCPA, where slopes are gentler. Because most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments would be affected to some degree. This alternative results minor adverse impacts to rangeland resources.

Vegetation Resources

Vegetation resources management under Alternative I (Section 4.3.6) would result in beneficial impacts to vegetation as well as rangeland resources because a number of management actions

specifically address controlling existing noxious weed populations and limiting the spread of noxious weeds. Management actions under Alternative I are expected to result in minor beneficial impacts.

Special Designations

Special area designations often indirectly benefit vegetation and therefore rangeland resources, because of limiting surface-disturbing activities in this area. Under Alternative I, the WSA (approximately 12,185 acres) would continue to be managed to maintain wilderness characteristics. Some grazing allotments coincide with the WSA. In these areas, continued restrictions on the construction of permanent structures and facilities, and on surface-disturbing activities would continue to result in beneficial impacts because forage would not be disturbed in these areas. However, livestock operators often find it easier, and more effective, to manage their livestock through the construction of some facilities. Because this is a continuing situation, no impacts to rangeland resources are expected from this action. No ACEC or WHMAs would be designated; therefore, there would be no impacts to rangeland resources in these areas.

Alternative II

Rangeland Resources Management

Like Alternative I, Alternative II would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including continuation of livestock grazing; limited authorization for increased stocking rates; fencing that maintains wildlife mobility; water projects being allowed in dry areas and for the purposes of dispersing livestock; and stock tanks including escape ramps for wildlife and birds.

Under Alternative II, performance based, tri-phased development would be implemented. This may include rest from livestock grazing for up to two years following interim reclamation. This is expected to result in more complete revegetation, contributing to minor beneficial impacts to rangeland resources in these areas.

Rangeland health assessments have not been completed on all of the 17 allotments in the FCPA. However, the allotments that have been assessed have all been found to be meeting the Standards for Healthy Public Rangelands (BLM 1995). Continuing current management for these resources is therefore expected to have negligible impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values. Such actions indirectly benefit rangeland resources to some degree, because they result in limitations to vegetation disturbance as well as some limitations to other activities that may adversely impact livestock. However, the TLs do not result in permanent restrictions. Existing wildlife resources management, including specific elk management actions, would not have any measurable impact on rangeland resources. Two-year rest from livestock grazing in interim reclamation areas would be expected to result in more complete revegetation, contributing to minor beneficial impacts to rangeland resources.

Under Alternative II, the requirement for permanent, frost-free water sources to be provided with CBNG projects may result in minor beneficial impacts to rangeland resources because livestock as well as elk would use these water sources.

Fluid Minerals Management

Management actions for CBNG development under Alternative II include restrictions and limitations for wildlife values, no surface disturbance, with no exceptions for slopes greater than 25 percent and soils with a severe erosion hazard, badlands, rock outcrop, or slopes susceptible to mass failure. Alternative II also specifies that there will be no net increase in road density from existing conditions. New roads can be built if others are reclaimed. Overhead power lines could be constructed along road corridors. These restrictions are reflected in the estimated surface disturbance.

Development of CBNG under Alternative II would result in an estimated 3,160 acres of vegetation disturbance (3.1 percent of the total area) (Table 4-13), less than under Alternative I. This would affect approximately 6.8 percent of agricultural lands. All other vegetation types would experience less than 5 percent surface disturbance. This would affect allotments in proportion to their relative size and location. Allotments near the edge of the FCPA would be expected to be affected disproportionately by CBNG facility location because areas with slopes less than 25 percent will have most of the development. However, because most of the allotments have gentle and steep slopes, some portions of all of the allotments would be affected to some degree. Additionally, under Alternative II, CBNG reservoirs and facilities would be concentrated outside yearlong range (in approximately 22,404 acres) along the edges of the FCPA. Direct impacts would result in minor adverse impacts to rangeland resources through loss of forage and AUMs.

CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use structures for scratching posts or shade.

Current stock wells may go dry because of drawdown but will be replaced where well agreements are in place. Because there will be fewer wells under Alternative II, less drawdown will occur. CBNG developers would provide permanent year-round water sources. CBNG discharged water will increase the availability of surface water in the FCPA attracting elk and livestock. However, impoundments will only be allowed outside of the elk yearlong range resulting in minor beneficial impacts to livestock in these areas. Available water in an otherwise dry landscape tends to attract livestock to spend more time grazing in these areas and so they may become more concentrated in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium. Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a).

Increased flows could result in conversion of reaches of ephemeral drainages that currently support upland grassland vegetation to perennial stream habitat that supports riparian vegetation. The magnitude of this impact cannot be estimated at this time. Overall the impacts to vegetation resources from these conversions would be minor in extent. In terms of rangeland resources, this impact can be considered negative in that the increased flows would replace upland forage in these drainage bottoms with less-palatable riparian species.

These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and location, but are overall expected to result in minor adverse impacts to rangeland resources.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes more than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure (erosive), and erosive soils. There would be no exceptions to this restriction. This would result in indirect minor beneficial impacts to rangeland resources that occur in these areas because erosion would be minimized on approximately 33,694 acres. However, the restriction of CBNG development to slopes less than 25 percent results in concentrating development in areas preferred by livestock and in impacts to the best forage types. With CBNG infrastructure and livestock both avoiding the steep slopes, the remaining narrow drainage bottom areas are the most affected. Additionally, this restriction results in more development where slopes are gentler, disproportionately affecting those allotments. Because most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments are affected to some degree. This alternative results minor adverse impacts to rangeland resources.

Vegetation Resources

Vegetation resources management under Alternative II would result in beneficial impacts to vegetation as well as rangeland resources because a number of management actions specifically address controlling existing noxious weed populations and limiting the spread of noxious weeds. Management actions under Alternative II are expected to result in minor beneficial impacts.

Special Designations

Special designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area. Under Alternative II, the WSA (approximately 12,185 acres) would continue to be managed to maintain wilderness characteristics. Some grazing allotments coincide with the WSA. In these areas, continued restrictions on the construction of permanent structures and facilities, and/or on surface-disturbing activities may continue to result in beneficial impacts due to the fact that forage may not be disturbed in these areas. However, livestock operators often find it easier, and more effective, to manage their livestock through the construction of such facilities. Because this is a continuing situation, no impacts to rangeland resources are expected from this action.

Under Alternative II, an ACEC would be designated for elk calving (approximately 59,293 acres) and crucial winter range (approximately 25,690 acres). A WHMA for elk yearlong range (approximately 78,251 acres) would also be designated. It is expected these actions would result in minor beneficial impacts to vegetation as well as rangeland resources because management prescriptions for these areas would be designed to protect the Fortification Creek elk herd and would include restrictions on surface disturbance.

Alternative III

Rangeland Resources Management

Like the other alternatives, Alternative III would continue the current management goals and objectives summarized above. Most of the specific management actions are common to all alternatives, including continuation of livestock grazing; limited authorization for increased stocking rates; fencing to maintain wildlife mobility; water projects being allowed in dry areas

and for the purposes of dispersing livestock; and stock tanks including escape ramps for wildlife and birds.

Under Alternative III, performance based, tri-phased development would be implemented. This may include rest from livestock grazing for up to one year following interim reclamation. This could be expected to result in better revegetation than Alternative I, contributing to minor beneficial impacts to rangeland resources in these areas.

Rangeland health assessments have not been completed on all of the 17 allotments in the FCPA. However, the allotments that have been assessed have all been found to be meeting the Standards for Healthy Public Rangelands (BLM 1995). Continuing current management for these resources is therefore expected to have negligible impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative III include restrictions and limitations for wildlife values. Such actions indirectly benefit rangeland resources to some degree, because they result in limitations to vegetation disturbance as well as limitations on other activities that may adversely impact livestock. However, these restrictions do not result in permanent restrictions. Existing wildlife resources management, including specific elk management actions, would not have any measurable impact on rangeland resources.

One-year rest from livestock grazing in interim reclamation areas would be expected to result in more complete revegetation, contributing to minor beneficial impacts to rangeland resources. Also under Alternative III, the requirement for permanent, summer water sources to be provided with CBNG projects may result in minor beneficial impacts to rangeland resources because livestock as well as elk would use these water sources.

Fluid Minerals Management

Continuing current management actions for CBNG development under Alternative III include restrictions and limitations for wildlife values, slopes greater than 25 percent, and erosive soils. No surface disturbance would be allowed in areas with badlands, rock outcrop, and slopes susceptible to mass failure. Development of CBNG under Alternative III would allow up to a 20 percent increase in road density from current conditions. These conditions and restrictions are reflected in the estimated surface disturbance.

Alternative III would result in less surface disturbance than Alternative I, but more than under Alternative II. An estimated 3,826 acres of vegetation disturbance (3.8 percent of the total area) (Table 4-13) would result to rangeland resources. This would affect approximately 7 percent of agricultural lands. All other vegetation types would experience less than 5 percent surface disturbance. This would affect allotments in proportion to their relative size and location. Allotments near the edge of the FCPA would be expected to be affected disproportionately by CBNG facility location because areas with slopes less than 25 percent will have most of the development. However, because most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments would be affected to some degree.

Additionally, under Alternative III, CBNG reservoirs and facilities would be concentrated outside the elk winter (25,690 acres) and calving ranges (approximately 59,293 acres) along the edges of the FCPA. Direct impacts would result in minor adverse impacts to rangeland resources through loss of forage. CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion.

Livestock may also be curious about CBNG structures or use structures for scratching posts or shade. CBNG construction activities can temporarily require the removal of allotment fencing, although all fencing is required to be repaired upon construction completion. Livestock may also be curious about CBNG structures or use the structures for scratching posts or shade.

There will be less drawdown than under Alternative I. Current stock wells may go dry because of drawdown but will be replaced where well agreements are in place. CBNG operators would provide permanent summer water sources. CBNG discharged water will increase the availability of surface water in the FCPA attracting elk and livestock. However, impoundments will only be allowed outside of the elk crucial winter and calving ranges resulting in minor beneficial impacts to livestock in these areas. Available water in an otherwise dry landscape tends to attract livestock to spend more time grazing in these areas, which may lead to more concentrated livestock grazing in CBNG areas (BLM 2003a). In some cases, CBNG discharged water may be high in selenium. Concentrations of selenium do not limit the use of water for stock watering; however, certain vegetation could become toxic to livestock through the uptake of selenium (BLM 2003a). These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and are expected to result in minor adverse impacts to rangeland resources.

Seepage from impoundments could result in conversion of upland vegetation to wetland vegetation. Overall, the impacts to vegetation resources from these conversions would be minor in extent. In terms of rangeland resources, this impact can be considered negative because such conversions would replace upland forage with less-palatable species.

These indirect impacts to rangeland resources would affect allotments in proportion to their relative size and location, but are overall expected to result in minor adverse impacts to rangeland resources.

Other Resources Management

Soil Resources

Under this alternative, surface-disturbing activities may be restricted or excluded on slopes greater than 25 percent, badlands, rock outcrop, slopes susceptible to mass failure (erosive), and erosive soils. There could be exceptions to this restriction if the operator proposed adequate site-specific mitigation that meets the parameters in the BLM Wyoming reclamation policy (BLM 1990). This would result in indirect minor beneficial impacts to rangeland resources that occur in these areas because erosion would be minimized on approximately 33,694 acres. However, the restriction of CBNG development to slopes less than 25 percent results in concentrating development in areas preferred by livestock and impacts the best forage types. With CBNG infrastructure and livestock both avoiding the steep slopes the remaining narrow drainage bottom areas are the most impacted. Additionally, this restriction results in more development on the gentler slopes, disproportionately affecting those allotments. Because most of the FCPA allotments contain both gentle and steep slopes, some portions of all of the allotments are affected to some degree. This alternative results in minor adverse impacts to rangeland resources.

Vegetation Resources

Vegetation resources management under Alternative III would result in beneficial impacts to vegetation as well as rangeland resources because a number of management actions specifically

address controlling existing noxious weed populations and limiting the spread of noxious weeds. Management actions under Alternative III are expected to result in minor beneficial impacts.

Special Designations

Special designations often indirectly benefit vegetation as a result of limiting surface-disturbing activities in this area. Under Alternative III, the WSA (approximately 12,185 acres) would continue to be managed to maintain wilderness characteristics. Some grazing allotments coincide with the WSA. In these areas, continued restrictions on the construction of permanent structures and facilities, and/or on surface-disturbing activities may continue to result in beneficial impacts because forage may not be disturbed in these areas. However, livestock operators often find it easier, and more effective, to manage their livestock through the construction of such facilities. Because this is a continuing situation, no impacts to rangeland resources are expected from this action.

Under Alternative III, an ACEC would be designated for resources including the Fortification Creek elk herd, erosive soil, and scenic values. This 33,757-acre area represents 33 percent of the vegetation resources in the FCPA. In addition, a WHMA for the elk crucial winter range (approximately 25,690 acres) and elk calving range (approximately 59,293 acres) would also be designated. It is expected these actions would result in minor beneficial impacts to vegetation and rangeland resources.

Summary

Table 4-22 summarizes estimated impacts to rangeland resources, by alternative.

Table 4-22 Summary of Impacts to Rangeland Resources			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Rangeland Resources Management	No Impact	Minor (+) Two-year rest	Minor (+) One-year rest
Wildlife and Special Status Species Resources Management	No Impact	Minor (+) Two-year rest permanent water sources	Minor (+) One-year rest permanent summer water sources
Fluid Minerals Management	Minor (-) 3,593-acre disturbance Water impoundments dispersed	Minor (-) 2,168-acre disturbance Water impoundments outside yearlong range	Minor (-) 2,541-acre disturbance Water impoundments outside crucial ranges
Other Resource Management			
Soil Resources	Minor (-) Loss of preferred forage	Minor (-) Loss of preferred forage	Minor (-) Loss of preferred forage

Table 4-22 Summary of Impacts to Rangeland Resources

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Vegetation Resources	Minor (+) Reduction in noxious weeds	Minor (+) Reduction in noxious weeds	Minor (+) Reduction in noxious weeds
Special Designations	No Impact	Minor (+) WHMA 78,251 acres	Minor (+) WHMA 52,069 acres

4.4.1.3. Cumulative Impacts

Cumulative impacts to rangeland resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Potential cumulative impacts to rangeland resources from CBNG development around the FCPA include increased surface disturbances that introduce non-palatable vegetation or weed species. Reclamation on private lands is negotiated between the landowner and CBNG operator and may be less stringent in terms of plant species composition, cover, and/or structure. Failure to perform adequate reclamation may result in impacts to rangeland in the FCPA because a seed source for noxious weed infestations could be created. Increased weeds and non-palatable vegetation would reduce the grazing capacity of the rangelands.

4.4.2. Recreation

The goals for recreation in the FCPA are to provide outdoor recreational opportunities while providing for resource protection, visitor services, and the health and safety of public land visitors. The primary recreation activity in the FCPA is big game hunting.

Public recreational use in the FCPA is limited by access to BLM lands. Because the areas inside the FCPA generally most desired by recreationists (proposed ACEC and WSA) are surrounded by private land, hunters and other recreationists must be granted permission to cross private land before they can access most of recreation resources in the FCPA. The major recreational use in the FCPA is elk hunting, even though the area is suitable for many other uses including dispersed camping, small game hunting, horseback riding, and hiking.

Organized group recreation such as guided hunts in the FCPA is managed with Special Recreation Permits (SRPs). The SRP includes requirements that are designed to protect other resources while allowing recreational use. Currently, there are four active SRPs for the FCPA held by big-game hunting outfitters.

The FCPA is a popular hunting destination for elk and a Fortification Creek “any Type 1 elk” is highly sought after. In the 2007 draw, a Fortification Creek elk license ranked as the toughest resident draw statewide, with only a 4.07 percent success rate among resident applicants (Wyoming Public Lands 2008). Even after successfully drawing a license, a hunter must gain permission from the surrounding landowners to access the WSA.

4.4.2.1. Evaluation Criteria

Assumptions used in analyzing recreation impacts include the following:

- Public access to BLM recreation resources in the FCPA,
 - Surrounding landowners have legal access,
 - Public with permission from surrounding landowners has legal access, and
 - Illegal access could occur because many of the access points are not physically controlled (e.g. locked gates).
- Hunters generally use motorized vehicles and are required to travel on designated roads;
- Hunting inside the WSA is by foot or on horseback. Access to the WSA is restricted by private landowners surrounding the WSA. The hunter must gain permission to cross private land to access the WSA. In recent years, fewer landowners have been granting permission to cross their land for hunting.
- Hunting statistics from WGFD represent a maximum for recreation visitor-days in the FCPA. Based on 2006 WGFD data and the area of the associated Hunt Unit in the FCPA, the BLM estimated that there are about 229 recreation visitor-days annually in the FCPA as shown in Table 4-23.

Table 4-23 Estimated Number of Recreation Use Days in the FCPA	
Permit	Hunter Days 2006
Elk Hunt Unit #2	
Resident	203
Nonresident	26
TOTAL	229

- The PRB O&G FEIS (BLM 2003a) anticipates that most recreational activities will increase by 5 percent every five years. In FCPA hunt units, between 2001 and 2006, total hunt-days dropped in half for Elk Hunt Unit #2. The elk hunter days have decreased primarily because of access difficulty.
- A recent survey of deer hunters in Wyoming found that, “Hunters more commonly look for social and naturalistic things in a quality hunt (an outdoor experience, an opportunity to spend time with family/companions, recreation, and solitude) than for utilitarian things (harvest success and large-antlered bucks)” (WGFD 2006b).

- Access to local hunting areas is also important. The deer hunter survey found that the leading reason for selecting a hunting area among Wyoming residents is that the area is close to home (WGFD 2006b).

Based on these findings, changes to hunting areas, particularly surface disturbance, are assumed to decrease the quality of a hunting experience in the FCPA. Some of the potential impacts of CBNG development on recreation in the FCPA are based on findings from the PRB O&G FEIS (BLM 2003a), and include:

- The primary effect of the CBNG development on recreational opportunities would be the alteration of the experience on lands used for hunting. Direct effects occur when recreational opportunities are enhanced, limited, or curtailed within an area; when recreational uses are created, displaced, or eliminated by proposed CBNG facilities; or if objectives for recreation cannot be met. Effects on recreational resources occur if recreational facilities undergo substantial change or degradation.
- Direct effects to recreational uses would occur because additional wells would add new industrial features to the landscape and new sources of noise that could diminish the recreational experience and affect the rural ambience sought by recreationists. Construction and operation of the CBNG facilities also could affect recreation by changing access opportunities and by directly disrupting recreational activities. New roads would provide access for vehicles and promote an increase in human activity. Additional development could adversely affect hunting, viewing of wildlife, and fishing. Development of certain facilities, such as reservoirs for impounding produced water, could enhance some wildlife-related recreational opportunities by providing areas for viewing wildlife and hunting waterfowl.
- Indirect effects to recreation would occur if the CBNG development resulted in a change in the level of visitation to the area or would alter growth in the affected counties, thereby changing the use of existing recreational facilities and uses.
- Construction disturbance could affect the existing landscape character by adding noise and dust. Construction activities could conflict with recreational uses because they would be visually and audibly apparent to the recreational experience. The loss of solitude and the natural experience would affect local users in the particular area of construction. Pipeline installation and other activities along road corridors are likely to inconvenience recreationists who use the roads to gain access to recreation in the area.

Evaluation criteria include the following:

- Actions that improve or protect wildlife habitat have a positive impact on recreation because they could increase and diversify game within the FCPA for hunting or viewing.
- Surface disturbance is to be used as proxy for changes in recreation use and quality of experience. Actions with the least total amount of surface disturbance have the lowest level of negative impact on recreation.
- Road density is also used a proxy for changes in recreation use and quality of experience. Actions with the lowest road density have the lowest level of negative impact to recreation. Current CBNG disturbance is estimated in Table 4-24.

Table 4-24 Current Estimated Surface Disturbance from CBNG Development Fortification Creek Planning Area				
	Estimated Existing	Alternative I	Alternative II	Alternative III
Estimated Total Surface Disturbance from CBNG Development				
Initial disturbance (acres)	4,000	3,593	2,168	2,541
Long term (acres)	2,000	1,001	571	641

The following definitions will be used for recreation impacts:

- *Negligible* - Total amount of initial and long-term disturbance is changed by less than 5 percent of existing disturbance and road density is unchanged.
- *Minor* – Total amount of initial and long-term disturbance is changed by more than 5 percent and less than 10 percent from existing disturbance and road density.
- *Moderate* – Total amount of initial and long-term disturbance is changed by more than 10 percent and less than 25 percent from existing disturbance and road density.
- *Major* – Total amount of initial and long-term disturbance is changed by more than 25 percent from existing disturbance and road density.

4.4.2.2. Alternative Assessment

Recreation impacts may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from the recreation management as well as those anticipated to result from the management actions proposed for wildlife and special status species and fluid minerals.

Alternative I (No Action Alternative)

Recreation Management

Alternative I, the No Action Alternative, would continue current management goals and objectives. Proposed management actions require SRPs for commercial competitive and large-scale nonprofit organized recreational events on a case-by-case basis. Recreation in the WSA would be limited by access and permission required to cross private land surrounding this part of the FCPA. There would be no impact from these management actions.

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. Because wildlife management actions are also fluid minerals management actions, the impacts of these actions are discussed under Fluid Minerals Management, below, and will not be addressed here.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. Current wildlife management actions under Alternative I include restrictions and limitations such as TLs in elk crucial winter range between November 15 and April 30. While the TLs have potential to limit the timing of CBNG development, they do not restrict the extent of development. Under Alternative I, there are no restrictions on well metering and visitation, water management facility locations, road density standards, or elk security habitat. Estimated surface disturbance under Alternative I would almost double and there are no restrictions on road density. Therefore, the CBNG management actions under Alternative I would have major negative impacts on recreation.

Alternative II**Recreation Management**

Alternative II would continue current management goals and objectives. Proposed management actions require SRPs for commercial competitive and large-scale nonprofit organized recreational events on a case-by-case basis. Recreation in the WSA and proposed ACEC would be limited by access and permission required to cross private land surrounding these parts of the FCPA. There are no impacts from this alternative.

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. Because wildlife management actions are also fluid minerals management actions, the impacts of these actions are discussed under Fluid Minerals Management, below, and will not be addressed here.

Fluid Minerals Management

Management actions specific to Alternative II include a phased approach to CBNG development that includes up to a two-year grazing rest after interim reclamation before development can occur in other areas. Management actions for wildlife resources under Alternative II include restrictions and limitations such as TLs prohibiting surface disturbance and disruptive activity in elk crucial winter range between November 15 and April 30. Well metering and all POD monitoring and maintenance activities would be restricted to weekly visitation in elk crucial winter range between November 15 and April 30, and in elk calving areas from May 1 through June 30. While the TLs have the potential to limit the timing of CBNG development, they do not restrict the extent of development. Water management facilities and secondary compressors would be located outside the elk yearlong range. Permanent year-round frost-free water sources would be provided by CBNG projects. There would be no net change from BLM base data (both planning and project areas) for elk security areas and road density. Estimated long-term surface disturbance for Alternative II is about 50 percent higher than existing levels and road density would not change. Therefore, CBNG management actions under Alternative II would have major negative impacts to recreation.

Alternative III**Recreation Resources**

Alternative III would continue current management goals and objectives. Proposed management actions require SRPs for commercial competitive and large-scale nonprofit organized recreational events on a case-by-case basis. Recreation in the WSA and proposed ACEC would be limited by access and permission required to cross private land surrounding these parts of the FCPA. There are no impacts from this alternative.

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. Because wildlife management actions are also fluid minerals management actions, the impacts of these actions are discussed under Fluid Minerals Management, below, and will not be addressed here.

Fluid Minerals Management

Management actions specific to Alternative III include a phased approach to CBNG development that includes up to a one-year grazing rest after interim reclamation before development can occur in other areas. Ancillary and water treatment facilities for CBNG development would be located outside of elk crucial winter range and calving areas, and well metering and POD visitations would be prohibited within elk crucial winter range and elk calving areas during specified times of the year. Well metering and all POD monitoring and maintenance activities would be prohibited in elk crucial winter range between November 15 and April 30, and in elk calving areas from May 1 through June 30. While these restrictions have potential to limit the timing of CBNG development, they do not restrict the extent of development. Permanent summer water sources would be provided by CBNG projects. There would be up to a 20 percent change from BLM base data (both planning and project areas) for elk security areas and road density. Estimated surface disturbance under Alternative III would increase by about half from existing levels. Therefore, the CBNG management actions under Alternative III would have major negative impacts on recreation.

Summary

The summary of impacts to recreation resources is shown in Table 4-25.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Recreation Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	See Fluid Minerals Management		
Fluid Minerals Management	Major (-) 3,593-acres of disturbance	Major (-) 2,163-acres of disturbance	Major (-) 2,541-acres of disturbance

4.4.2.3. Cumulative Impacts

Cumulative impacts to recreation resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Increased CBNG development outside the FCPA and development on non-Federal mineral estate within the FCPA would create more roads and potentially increase access to the FCPA that could expand access for hunters and the general public. There are currently 252 miles of road in the FCPA on non-BLM surface, which provides access to interior portions of the FCPA. However, increased development results in impacts to visual resources, the isolated nature of the area, and the elk herd. Taken together, these impacts reduce the recreational value of the FCPA.

4.4.3. Transportation

The primary goal for transportation infrastructure in the FCPA is to manage access to CBNG leases to ensure that the BLM non-impairment standard is met. The management actions related to this goal include:

- Long-term occupancy of the public lands for roads, power lines, pipelines, communication sites, and irrigation ditches is authorized by granting a right-of-way (ROW). ROWs are to be removed and reclaimed upon termination of the grant.
- Transmission lines and transportation facilities will be located within identified corridor areas to the extent feasible.

These management actions are common to all alternatives. The following alternative analysis considers adverse and beneficial impacts, direct and indirect impacts, as well as short- and long-term impacts to transportation infrastructure inside the FCPA and to traffic patterns and density on the roads and highways inside and surrounding the FCPA.

4.4.3.1. Evaluation Criteria

The existing roads inside and surrounding the FCPA are shown on Figure 3-10. Two county roads, Echeta Road (Campbell County Road 29) and Fortification Creek Road (Campbell County Road 36) provide the primary access to the FCPA. The remainder of the roads in the FCPA are BLM or private roads providing access for ranching and CBNG development. The existing road network in the FCPA totals about 454 miles and is detailed in Table 4-26. Historic roads inside the WSA are not used or maintained and have returned to a natural state.

Area	Miles of Road
Fortification Creek Planning Area	454
ACEC	43
Elk Crucial Ranges	178

Transportation impacts are managed by BLM through ROWs. The BLM has granted about 60 ROWs through the FCPA, including:

- 17 road ROWs;
- 8 power line ROWs;
- 35 oil and gas pipeline ROWs; and
- 1 railroad ROW along the eastern boundary of the FCPA.

As part of ROW authorization, impacts specific to the proposed route are evaluated and mitigation measures recommended. Roads, power lines, and pipelines associated with fluid mineral development are generally authorized as part of the POD for the unit or project.

The estimated number of new wells, well pads, roads, overhead power lines, and pipelines associated with each alternative are shown in Table 4-27.

Table 4-27 Projected New Wells, Roads, and Overhead Power Lines Fortification Creek Planning Area			
	Alternative I	Alternative II	Alternative III
Number of Wells	726	468	574
Miles of New Roads			
Improved	125	63	63
Two-track	54	27	27
Total Miles	179	90	90
Disturbance from Roads			
Initial (acres)	1,038	522	522
Long term (acres)	519	261	261
Disturbance from Overhead Electric			
Miles	73	47	57
Initial acres	263	168	207
Long term acres	37	23	29
Disturbance from Pipelines			
Miles	384	248	304
Initial (acres)	1,539	992	1,217
Long term (acres)	0	0	0

Assumptions used in analyzing transportation impacts include the following:

- All new roads in the FCPA will be constructed to the non-impairment standard from BLM Handbook H-8550-1.
- Public access to BLM routes in FCPA is based on the following assumptions:
 - Surrounding landowners have legal access,
 - Public with permission from surrounding landowners has legal access, and
 - Illegal access could occur because many of the access points are not physically controlled (e.g., locked gates).
- Routes are not designated – use is limited to designated roads and vehicle routes and closed to motor vehicles December 1 to April 15.
- The major uses of BLM routes in the FCPA are related to oil and gas development, livestock management, and elk hunting.

Transportation impacts were assessed for all the alternatives in terms of short-term increases in daily traffic that were based on the daily travel of the average number of estimated workers for the peak activity year for all CBNG field activities. Because travel statistics are not available for the FCPA or the surrounding highways, current traffic conditions were estimated from existing CBNG activities.

Annual peak number of workers for CBNG activities was estimated using employment requirements developed for the PRB O&G FEIS (BLM 2003a). Each worker was assumed to make one round trip per day. An average of 1.5 workers per vehicle was assumed to compute changes to average daily traffic count for the roads in and around the FCPA. To compute vehicle trips and associated traffic, it was assumed that the construction and installation phase for any of the alternatives would occur over a 7-year period. Equipment needed for construction and installation of the proposed facilities for any of the alternatives would include heavy equipment (mobile drilling rig, bulldozers, graders, track hoes, trenchers, and front-end loaders), and heavy- and light-duty trucks. No new public roadways or new intersections would be built under any of the alternatives. Using these assumptions, the employment estimates from the PRB O&G FEIS (BLM 2003a), and the estimated CBNG development for each alternative, daily vehicle trips for the peak number of workers was calculated and is shown in Table 4-28. By using peak number of workers, the estimates of vehicle trips used in the transportation impact assessment represent a possible maximum impact.

**Table 4-28 Estimated Daily Vehicle Trips for Peak Number of Workers
(Alternatives are in addition to current conditions)**

	Current Conditions	Alternative I	Alternative II	Alternative III
Peak Number of Workers in FCPA	60	100	70	80

	Current Conditions	Alternative I	Alternative II	Alternative III
Vehicle Trips per Day	80	140	90	110
Difference*		275%	210%	240%
* Current trips plus increase in trips/current trips				

Currently, it is estimated that a maximum of 80 vehicle trips per day occur inside the FCPA on existing roads and contribute to local traffic on surrounding county roads. Because there has been little new Federal CBNG development in the FCPA recently, these vehicle trips are associated with well maintenance and operations (rather than drilling). Therefore, it is assumed that these vehicle trips will continue at least 10 years into the future. Daily vehicle trips associated with new CBNG development in the FCPA will be in addition to the existing 80 vehicle trips per day. Current CBNG development in the FCPA is concentrated in the southeastern quadrant. Traffic patterns are likely to change as CBNG development occurs in other parts of the FCPA.

CBNG development has already impacted county road maintenance by increasing traffic. According to the Johnson County Road and Bridge Department, "...traffic counts taken on roads in eastern Johnson County indicate that close to 850 vehicles per day likely travel there. That is about 500 times the traffic the roads were designed for. Needless to say, upkeep is difficult at best" (Johnson County 2008). These roads were not built to handle this volume of traffic, much of which is heavy, industrial traffic.

To assess transportation impacts using daily vehicle trips for the peak number of workers, the following evaluation criteria are considered based on findings from the PRB O&G FEIS (BLM 2003a):

- A significant traffic volume impact would occur if the CBNG-related vehicle trips generate a 25 percent or more increase in the average daily traffic count compared with the existing (background) average daily traffic counts for the major access roads.
- An increase in the accident rate is likely at intersections, or other locations such as where a lanes merge, if the increase in number of vehicles that enter existing intersections is significantly higher (10 percent or more) than background conditions on roads inside or surrounding the FCPA.

The following definitions will be used for transportation impacts:

- *Negligible* – Daily vehicle trips on roads inside and surrounding the FCPA change less than 10 percent.
- *Minor* – Daily vehicle trips on roads inside and on surrounding the FCPA change more than 10 percent and less than 25 percent.
- *Moderate* – Daily vehicle trips on roads inside and surrounding the FCPA change more than 25 percent and less than 50 percent.

- *Major* – Daily vehicle trips on roads inside and surrounding the FCPA more than double or change by more 50 percent.

4.4.3.2. Alternative Analysis

Transportation impacts may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from transportation management as well as those anticipated to result from the management actions proposed for fluid minerals and wildlife and special status species.

Alternative I (No Action Alternative)

Transportation Management

Alternative I, the No Action Alternative, would continue current management goals and objectives. Proposed management actions require ROW authorization for roads, power lines, pipelines, communication sites, and irrigation ditches. It is assumed that the ROW authorization would evaluate impacts specific to the proposed route and include mitigation measures to meet the BLM non-impairment standard from BLM Handbook H-8550-1. No new public roadways or intersections would be built under this alternative and there would be no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values such as TLs for elk and special status species. These restrictions would limit development and access to some roads and transportation infrastructure such as pipelines and overhead power lines. However, these restrictions are not likely to change the total number of vehicle trips associated with Alternative I, only the seasonal pattern of travel inside the FCPA and the surrounding highway routes used to access the FCPA. There would be no impact from these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management actions specific to Alternative I include an unrestricted development pace and no restrictions on ancillary and water management facilities in the crucial elk ranges. Alternative I has the highest potential for unmitigated traffic growth on county roads and highways surrounding the FCPA and serving as collector routes for traffic associated with CBNG development in the FCPA. Daily vehicle trips are estimated to increase by almost three times (275 percent) as shown in Table 4-28. Therefore, transportation impacts would be major and adverse. It is likely that new roads and transportation infrastructure (pipelines and overhead power lines) would be managed under the POD for the CBNG project rather than ROW authorization. Some mitigation measures could include requiring operators to provide payment or resources for county road maintenance such as dust suppression.

Alternative II

Transportation Management

Because the transportation management actions are common to all of the alternatives, Alternative II would continue current management goals and objectives. Proposed management actions require ROW authorization for roads, power lines, pipelines, communication sites, and irrigation

ditches. It is assumed that the ROW authorization would evaluate impacts specific to the proposed route and include mitigation measures to meet the BLM non-impairment standard from BLM Handbook H-8550-1. No new public roadways or intersections would be built under this alternative and there would be no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values such as TLs for elk and special status species. These restrictions would limit development and access to some roads and transportation infrastructure such as pipelines and overhead power lines. However, these restrictions are not likely to change the total number of vehicle trips associated with Alternative II, only the seasonal pattern of travel inside the FCPA and the surrounding highway routes used to access the FCPA. Road density will stay at current levels. There would be no impact to transportation from these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Management actions specific to Alternative II include requiring that ancillary and water treatment facilities for CBNG development be located outside the yearlong elk range and that road density stay at current levels. Daily vehicle trips are estimated to increase by more than two times (210 percent) from present use as shown in Table 4-28. Therefore, transportation impacts would be major and adverse. It is likely that new roads and transportation infrastructure (pipelines and overhead power lines) would be managed under the POD for the CBNG project rather than ROW authorization. Some mitigation measures could include requiring operators to provide payment or resources for county road maintenance such as dust suppression. The phased CBNG development approach would give counties and other local governments more time to prepare and respond to increases and changes to traffic patterns associated with CBNG development.

Alternative III

Transportation Management

Because the transportation management actions are common to all of the alternatives, Alternative III would continue current management goals and objectives. Proposed management actions require ROW authorization for roads, power lines, pipelines, communication sites, and irrigation ditches. It is assumed that the ROW authorization would evaluate impacts specific to the proposed route and include mitigation measures to meet the BLM non-impairment standard from BLM Handbook H-8550-1. No new public roadways or intersections would be built under this alternative and there would be no impacts.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative III include restrictions and limitations for wildlife values such as TLs for elk and special status species. These restrictions would limit development and access to some roads and transportation infrastructure such as pipelines and overhead power lines. However, these restrictions are not likely to change the total number of vehicle trips associated with Alternative III, only the seasonal pattern of travel inside the FCPA and the surrounding highway routes used to access the FCPA. There are no impacts from this alternative.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Management actions specific to Alternative III include a phased approach to CBNG development that includes up to one-year grazing rest after interim reclamation before development can occur in other areas. Ancillary and water treatment facilities for CBNG development would be located outside of elk crucial winter range and calving areas, and well metering and POD visitations would be restricted during specified times of the year. Road density would be allowed to increase by 20 percent.

Daily vehicle trips are estimated to increase by more than two times (240 percent) from present use as shown in Table 4-28. Therefore, transportation impacts would be major and adverse. It is likely that new roads and transportation infrastructure (pipelines and overhead power lines) would be managed under the POD for the CBNG project rather than ROW authorization. Some mitigation measures could include requiring operators to provide payment or resources for county road maintenance such as dust suppression. The phased CBNG development approach would give counties and other local governments more time to prepare and respond to increases and changes to traffic patterns associated with CBNG development.

Summary

The summary of impacts to Transportation Resources is shown in Table 4-29.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Transportation Management	No Impact	No Impact	No Impact
Wildlife and Special Status Species Resources Management	No Impact	No Impact	No Impact
Fluid Minerals Management	Major (-) Vehicle trips increase by 275%	Major (-) Vehicle trips increase by 210%	Major (-) Vehicle trips increase by 240%

4.4.3.3. Cumulative Impacts

Cumulative impacts to transportation resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). Approximately 17,754 miles of new roads would be needed for CBNG development in the PRB. The increase in roads would expand access to the FCPA, potentially resulting in wildlife disturbance, increased erosion, and destruction of cultural and paleontological resources. Increased traffic on new and existing roads will increase erosion, particulates, and noise potentially affecting air, water, soil, cultural, paleontological, wildlife, and vegetation resources.

The estimated number of roads for new development in the FCPA is between 90 and 179 miles of roadway. This is less than or approximately 1 percent of that required for the entire PRB. The number of vehicle trips per day in the FCPA is expected to rise from 210 to 275 percent in response to CBNG development. Approximately 7,627 vehicle trips throughout the entire PRB as a result of new CBNG roads would be expected. This level of traffic would result in traffic-related accidents and the affected counties experiencing a greater need for road upkeep. The affected counties have already seen an increase in upkeep of about 25 percent.

4.4.4. Lands and Realty

4.4.4.1. Evaluation Criteria

Under all of the alternatives BLM would continue current management. New ROW grants would be considered for corridors and access roads for CBNG development that is “off lease,” consistent with other aspects of this RMPA/EA. Access roads that lie fully within a lease tract would be permitted as part of the POD. No lands are considered for acquisition or disposal as part of this RMPA/EA. BLM would consider exchange for the State School section in the WSA under its existing planning authorities.

Any direct impacts to the lands and realty program would be administrative in nature; there would be no direct environmental impacts.

4.4.4.2. Alternative Analysis

Fluid Minerals Management

Given that the existing (as of the date of publication of this Draft RMPA/EA) state mineral lease on the School Section within the WSA will expire in November 2008, no mineral exchange is anticipated. The leaseholder will lose its rights to develop the minerals and will forego any monetary return. It is not known how much CBNG would have been extracted from the leased area. However, the lease was acquired with the full understanding that the tract was difficult to access because of the WSA designation. An assessment of the impacts to fluid minerals management, therefore, would be speculative.

4.4.4.3. Cumulative Impacts

There are no cumulative impacts to lands and realty management.

4.4.5. Fluid Minerals

The goal of fluid mineral management is to facilitate the extraction of CBNG while minimizing effects to the landscape that would adversely impact the resource values in the FCPA.

Management actions would be implemented through revised stipulations, COAs, and BMPs for CBNG development. This section presents the environmental consequences on development of these CBNG reserves resulting from implementation of the alternative management actions.

4.4.5.1. Evaluation Criteria

The principal negative impact to the CBNG fluid mineral resource would be a reduction in recoverable reserves resulting from:

- The imposition of additional costs that make new CBNG development uneconomical or shorten the economic life of existing individual wells or areas.

The ultimate recoverable reserves from wells within the FCPA are shown in Table 4-30.

Table 4-30 Estimated Recoverable CBNG Reserves within the FCPA for Each Alternative			
Reserve Scenario	Alternative I	Alternative II	Alternative III
Number of CBNG Wells ¹	726 Wells	468 Wells	574 Wells
High – 0.50 bcf	363 bcf	234 bcf	287 bcf
Moderate – 0.35 bcf	254 bcf	164 bcf	201 bcf
Low – 0.20 bcf	145 bcf	94 bcf	115 bcf

¹Includes Federal mineral estate within the FCPA.

4.4.5.2. Alternative Analysis

The following definitions will be used for impacts to fluid mineral resources:

- *Negligible* – The effect on fluid mineral resources is barely detectable. Less than 10 percent of the access to the mineral resources is restricted.
- *Minor* – The effect on fluid mineral resources is slight but detectable; there would be a small change in accessing the resource. This could include restrictions and stipulations that restrict access to more than 10 percent of the resource. Or there is a major impact, but on a short-term or highly localized basis.
- *Moderate* – The effect on fluid mineral resources is readily apparent; there would be a measurable change in accessing the resources that could result in long-term or permanent change to the ability to access the resources. This could include restrictions and stipulations that restrict access to more than 20 percent of the resource.
- *Major* – The effect on fluid mineral resources is large; there would be a highly noticeable, long-term, or permanent measurable change in accessing the mineral resource. This could include restrictions and stipulations that restrict access to more than 30 percent of the resource.

The following sections describe the anticipated impacts to fluid minerals from each alternative for fluid minerals management, wildlife and special status species resources management, and other resources management.

Alternative I (No Action Alternative)

Fluid Minerals Management

Alternative I, the No Action Alternative, would continue current management goals and objectives, including managing multiple-use activities to preserve fluid mineral rights and access to CBNG. Management actions for Alternative I include an unrestricted development pace, no road density restrictions, and no restrictions on ancillary and water management facilities. There would continue to be no CBNG development within the WSA. These management actions would result in no impact to the fluid mineral resource.

Wildlife and Special Status Species Resources Management

Current management actions for CBNG development under Alternative I include restrictions and limitations for certain wildlife values. Those that most directly affect CBNG development within the FCPA include TLs for crucial elk habitat and surface-disturbing restrictions for sharp-tailed grouse leks and nesting areas and raptor nesting areas.

No surface disturbance or disruptive activities may be implemented within elk crucial winter range between November 15 and April 30. The elk crucial winter range is 25,690 acres (26 percent of the FCPA). These TLs and distance restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and impose minor additional costs on development.

Other Resources Management

Soil Resources

Under this alternative, exceptions may be allowed to the 25 percent slope restriction. There would be exceptions to these stipulations if the operator proposed adequate site-specific mitigation that met the requirements in the BLM Wyoming Policy on Reclamation standards (BLM 1990). This would not generally result in adverse impacts, because access would be maintained.

Water Resources

Discharge of water to drainages would be permitted without downstream monitoring or mitigation. This would be a minor beneficial impact, as it is the lowest cost approach to water resource management.

Alternative II

Fluid Minerals Management

Alternative II would limit the pace of development in the short term, including specific performance-based scheduling. In addition, a livestock rest period of up to two years would be implemented following interim reclamation and prior to development of additional areas. There would be no net increase in road density, reducing the area available for CBNG development.

The restriction on the increase in road density would be a major negative impact on the fluid mineral resource, because approximately 36 percent of the available surface locations for roads and well pads could not be constructed. This would result in the elimination of up to 258 wells and between 51 bcf and 129 bcf of CBNG reserves. The elimination of available reserve would impact both operators and the Federal government by reducing operator revenue and Federal royalties. However, lease purchasers were aware there might be additional restrictions identified by the BLM at the APD/POD stage to prevent significant impacts to other resources such as elk.

Because the price of CBNG fluctuates, it is not possible to calculate the dollar value of the decrease in revenue and royalties. However, a 36 percent reduction in the number of wells would equate to a 36 percent reduction in revenue and royalties. Federal royalties are paid for each well producing from Federally owned oil and gas mineral estate. After administrative costs are deducted, half of the royalties are retained by the Federal government and half are distributed to the state. Federal royalties are further discussed in Economic Impacts, Section 4.6.1.

Additionally, these actions would collectively greatly reduce operating flexibility and increase

costs. Flexibility for siting roads and wells would be limited, drainage from nearby wells could occur in some areas, and costs would increase because development could not be implemented efficiently.

Wildlife and Special Status Species Resources Management

Management actions for CBNG development under Alternative II include additional restrictions and limitations for the elk ranges. No surface disturbance or disruptive activities would be allowed for elk crucial winter range between November 15 and April 30. Well metering and POD visitation would be restricted to once weekly and the locations of ancillary facilities would be restricted to areas outside of the elk yearlong range. These TLs and distance restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and impose minor additional costs on such development.

Other Resources Management

Soil Resources

Under Alternative II, there would be no exceptions to the 25 percent slope stipulations. This stipulation is currently included in all CBNG leases and because the impact was already evident, there are no additional impacts.

Water Resources

Water discharge to drainages would be permitted under this alternative but downstream monitoring and mitigation would be required. Additionally, water management facilities would be restricted to areas outside the elk yearlong range. These actions would have a minor adverse impact on CBNG development because of increased cost and reduced flexibility.

Alternative III

Fluid Minerals Management

Alternative III would limit the pace of development, including specific performance-based scheduling. In addition, a livestock rest period of up to one year would be implemented following interim reclamation and prior to development of additional areas. Project area disturbance and road density would be limited to a 20 percent increase above current levels during CBNG development.

These actions would result in a moderate negative impact on the fluid mineral resource, because approximately 21 percent of the available surface locations for wells could not be constructed. This may result in the elimination of up to 152 wells and between 30 bcf and 76 bcf of CBNG reserves. The elimination of available reserves would impact both operators and the Federal government by reducing operator revenue and Federal royalties. Because the price of CBNG fluctuates, it is not possible to calculate the dollar value of the decrease in revenue and royalties. However, a 21 percent reduction in the number of wells would equate to a 21 percent reduction in revenue and royalties (see Section 4.6.1). However, lease purchasers were aware there might be additional restrictions identified by the BLM at the APD/POD stage to prevent significant impacts to other resources such as elk.

Additionally, these management actions would collectively reduce operating flexibility and increase costs. Flexibility for siting roads and wells would be limited, drainage from nearby

wells could occur in some areas, and costs would increase because development could not be implemented efficiently.

Wildlife and Special Status Species Resources Management

Well metering and POD visitation would be prohibited within the elk crucial winter range from November 15 to April 30 and in elk calving areas from May 1 through June 30. The locations of ancillary facilities would be restricted to areas outside of the elk crucial winter range and elk calving areas. These restrictions would result in minor adverse impacts to fluid minerals because they may delay development within a portion of the FCPA and limit the ability of the operator to restore production from wells that require servicing. Exceptions would apply for emergencies.

Other Resources Management

Soil Resources

Under Alternative III, no surface disturbance would be allowed on badlands, rock outcrop, slopes susceptible to mass failure, and slopes greater than 25 percent. There would be exceptions to these stipulations if the operator proposed adequate site-specific mitigation that met the requirements in the BLM Wyoming Policy on Reclamation standards (BLM 1990). This stipulation is currently included in all CBNG leases, and because the impact was already evident, there are no additional impacts.

Water Resources

Water discharge to ephemeral drainages would not be permitted under this alternative. Additionally, water management facilities would be restricted to areas outside elk crucial ranges. These actions would have a minor adverse impact on CBNG development because of increased costs and reduced flexibility.

Summary

The summary of impacts to Fluid Minerals is shown in Table 4-31.

Table 4-31 Comparison of Impacts to Fluid Minerals			
Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Fluid Mineral Resources	No Impact 726 potential new wells	Major (-) 468 potential new wells	Moderate (-) 574 potential new wells
Wildlife and Special Status Species Resources Management	Minor (-) Elk winter range TLs No visitation restrictions	Minor (-) Elk winter range TLs Weekly visitation restrictions	Minor (-) Season-long visitation restrictions
Other Resource Management			
Soil Resources	No Impact Stipulations already	No Impact Stipulations already	No Impact Stipulations already

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
	in leases	in leases	in leases
Water Resources	Minor (+) Stream discharge without impact monitoring	Minor (-) Stream discharge with impact monitoring Facilities outside yearlong range	Minor (-) No additional stream discharge Facilities outside crucial ranges

4.4.5.3. Cumulative Impacts

Cumulative impacts to fluid mineral resources were evaluated for the entire PRB, including the FCPA, in the PRB O&G FEIS (BLM 2003a). CBNG development would result in an increase of approximately 39,367 wells over a 10-year period in the PRB. Approximately 468 to 726 new well locations will be constructed in the FCPA. Impacts from CBNG development outside the FCPA may degrade air quality and visibility through emissions from generators associated with a large number of wells. Particulate material from travel on new unpaved roads needed to support CBNG development will reduce visibility throughout the area. Offsite water sources will be affected from increased erosion and sedimentation while development in the FCPA will affect the downstream reaches of streams and the Powder River. Wildlife in the FCPA would be impacted because of increased disturbance from CBNG activities, which could degrade habitats and further reduce available habitat for wildlife. Habitat reduction and increased noise from well development and production would result in wildlife avoiding areas and concentrating in the more protected portions of the FCPA, further stressing wildlife. Scenic values would diminish across the landscape.

4.5 Special Designations

The primary goals for special designations management in the FCPA are (1) to ensure continued public use and enjoyment of recreational activities while protecting and enhancing natural and cultural values; improve opportunities for high-quality outdoor recreation; and improve visitor services related to safety, information, interpretation, and facility development and maintenance; and (2) allow orderly development of mineral resources while protecting wildlife habitat and watershed areas, and maintaining wilderness values (naturalness, solitude, and primitive and unconfined recreation). The management actions related to these goals include:

- The WSA will be managed to maintain wilderness characteristics.
- Vehicle travel is limited to designated roads and vehicle routes.

Important resources identified by the BLM include an isolated elk herd and its habitat; high visual quality; the 12,185-acre Fortification Creek WSA; steep slopes with erosive soils; and cultural, historic, and paleontological values (BLM 2007b).

4.5.1.1. Evaluation Criteria

The following definitions will be used for special designation impacts:

- *Negligible* – The values for designation are changed by less than 1 percent.
- *Minor* – The values for designation are changed by 1 to 10 percent.
- *Moderate* – The values for designation are changed by 10 to 20 percent.
- *Major* – The values for designation are changed by greater than 20 percent.

4.5.1.2. Alternative Analysis

Impacts to special designation are those that affect public use and enjoyment, orderly development of mineral resources, wildlife habitat, watershed areas, and wilderness values. Impacts to special designation may differ in extent and severity, depending on specific management actions proposed under each alternative for different resource uses. The following sections describe the impacts under each alternative resulting from special designation management, as well as those anticipated to result from the management actions proposed for wildlife and special status species and fluid minerals.

Alternative I (No Action Alternative)

Special Designation Management

Alternative I, the No Action Alternative, would continue current management goals and objectives for the WSA. Current management actions for the proposed ACEC would be maintained and no WHMA would be designated in the FCPA.

A relevance and importance evaluation was conducted by the BLM (BLM 2002c) (Appendix E). The proposed ACEC met the relevance criteria for scenic values and wildlife and the importance criteria for wilderness characteristics, plains elk herd, and minimal impacts from man. However, the proposed ACEC boundaries are already essentially within the elk yearlong and most of the proposed ACEC is within elk crucial ranges. Proposed management prescriptions for the ACEC are the same as current management prescriptions and an ACEC designation would be a name change not a change in management. There would be no impacts from this management action.

Wildlife and Special Status Species Resources Management

Current management actions for wildlife resources under Alternative I include restrictions and limitations for wildlife values. These management actions would not have any impact on special designation management.

Fluid Minerals Management

Current management actions for CBNG development under Alternative I include the potential for approximately 726 wells with associated infrastructure. CBNG development is not allowed in the WSA and all roads associated with CBNG development would be outside of the WSA. Under this alternative, approximately 179 miles of new roads could be constructed.

Because CBNG development would occur all around the WSA, development would result in a number of impacts. There would be a minor adverse impact to special designations because the increase in roads and workers around the WSA could increase illegal motorized travel (off-

highway vehicles [OHVs] and trucks) into the WSA with the associated noise and erosion impacts. These impacts would degrade the wilderness character of the WSA.

CBNG development in the area of the proposed ACEC would be higher than in the WSA. The proposed ACEC meets the relevance criteria for scenic value and wildlife and the importance criteria for local significant qualities; has circumstances that make it fragile and unique (isolated elk herd and minimal impacts from man [Appendix E]); and has been recognized as warranting protection to satisfy national priority concerns (BLM 2003a). Under this alternative, the ACEC would not be designated. Roads and development would be allowed in all portions of the ACEC that are outside of the WSA (approximately 21,570 acres). With the increase in development and roads, the values for which the ACEC was proposed would be degraded, resulting in minor negative impacts.

Alternative II

Special Designation Management

Alternative II would continue current management goals and objectives, including managing multiple-use activities to preserve the values of the WSA. Under this alternative, the BLM would evaluate and establish, if warranted, an ACEC within the elk calving and crucial winter ranges (59,797 acres) and identify management prescriptions. Management prescriptions would include no net road density increase, no net loss of elk security habitat, limitations on well visitation, and restrictions on water management facilities within the ACEC. The elk yearlong range (78,251 acres) would be designated a WHMA. These management actions would result in a major beneficial impact to special designations because the area of special designations would increase by more than 20 percent.

Wildlife and Special Status Species Resources Management

Management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values. These management actions would not have any impact on special designation management.

Fluid Minerals Management

Management actions for CBNG development under Alternative II include the potential for approximately 468 wells with associated infrastructure. Because CBNG development would occur all around the WSA, development would result in a number of impacts. Additionally there would be impacts in the area of the proposed ACEC and WHMA. There would be a minor adverse impact to special designations because the increase in roads and workers around the WSA could increase illegal motorized travel (OHVs and trucks) into the WSA with the associated noise and erosion impacts. These impacts would degrade the wilderness character of the WSA.

Alternative III

Special Designation Management

Alternative III would continue current management goals and objectives, including managing multiple-use activities to preserve the values of the WSA. Under this alternative, the BLM will designate an ACEC based on the proposed boundaries (33,757 acres) (Figure 1-2) for the elk herd, erosive soils, and scenic values. In the relevance and importance evaluation, conducted by the BLM (BLM 2002b), the proposed ACEC met the relevance criteria for scenic values and

wildlife and the importance criteria for wilderness characteristics, plains elk herd, and minimal impacts from man (Appendix E).

Management prescriptions would include no net road density increase, no net loss of elk security habitat, limitations on well visitation, and restrictions on water management facilities within the ACEC. The elk calving and crucial winter ranges (52,069 acres) would be designated a WHMA. These management actions would result in a major beneficial impact to special designations because the area of special designations would increase by more than 20 percent.

Wildlife and Special Status Species Resources Management

Management actions for wildlife resources under Alternative II include restrictions and limitations for wildlife values. These management actions would not have any impact on special designation management.

Fluid Minerals Management

Management actions for CBNG development under Alternative III include the potential for approximately 574 wells with associated infrastructure. Because CBNG development would occur all around the WSA, development would result in a number of impacts. Additionally there would be impacts in the area of the proposed ACEC and WHMA. There would be a minor adverse impact to special designations because the increase in roads and workers around the WSA could increase illegal motorized travel (OHVs and trucks) into the WSA with the associated noise and erosion impacts. These impacts would degrade the wilderness character of the WSA.

Summary

The summary of impacts to special designations is shown in Table 4-32.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Special Designation Management	No Impact	Major (+) Increase protected areas by 20%	Major (+) Increase protected areas by 20%
Wildlife and Special Status Species Resources Management	No Impact	No Impact	No Impact
Fluid Minerals Management	Minor (-) 726 new wells	Minor (-) 468 new wells	Minor (-) 574 new wells

4.5.1.3. Cumulative Impacts

There are no cumulative impacts from special designations management.

4.6 Socioeconomics and Environmental Justice

The area that could experience economic and social impacts from BLM management actions in the FCPA includes Campbell, Johnson, and Sheridan counties. These counties comprise the affected area for economic and social impacts.

The economic impact assessment focuses on changes to employment, income, and government revenues that would be generated by proposed management actions. The resource management actions in the FCPA that are expected to have the most significant economic impacts are fluid minerals. Wildlife, special status species, and special management areas are likely to have smaller economic impacts. Non-market values for prairie elk, sage-grouse, and sagebrush steppe ecosystem existence is also considered in the assessment.

The social impact assessment considers potential changes to social cohesion and quality of life. The estimated rate of change to population and personal income as a result of proposed BLM management actions is used to measure social impacts.

4.6.1. Economic Impacts

4.6.1.1. Evaluation Criteria

The area that could be economically impacted by management actions in the FCPA includes Campbell, Johnson, and Sheridan counties. Population estimates for 2005 through 2020 for these counties and major towns is shown in Table 4-33.

Location	2005	2010	2015	2020
Campbell County	37,000	43,100	47,650	52,600
Gillette	22,700	26,100	28,800	31,800
Wright	1,400	1,700	1,850	2,000
Johnson County	7,700	8,800	9,500	10,350
Buffalo	4,300	4,900	5,300	5,750
Kaycee	270	310	340	365
Sheridan County	27,200	28,800	29,700	30,700
Sheridan	16,300	17,100	17,700	18,300
Clearmont	117	120	130	130
State of Wyoming	506,500	540,000	559,200	579,100
Source: WY EAD 2006a				

Employment and Income

Changes to employment and income in the affected area will depend on the number of jobs associated with fluid mineral development and increased recreation/tourism in the FCPA as well as the wages for these jobs. Total employment in the affected area and employment in key sectors likely to be affected by FCPA management actions are shown in Table 4-34.

Average annual wages for Campbell County are \$42,800. Annual wages for mining sector jobs (which includes oil and gas) are five times wages for leisure and hospitality sector jobs as shown in Table 4-34. It should be noted that in Campbell County almost three-quarters of the mining sector jobs are related to coal mining, not oil and gas development. In Johnson County, average annual wages are \$25,900 and mining jobs pay about three times that of tourism jobs. In Sheridan County, average annual wages are \$32,700 and mining jobs pay about four times more than tourism jobs.

Sector	Employment	% of Total Employment	Average Annual Wage
Campbell County	23,100	100%	\$42,800
Mining	6,800	29%	\$62,700
Leisure and Hospitality	1,800	8%	\$11,100
Agriculture, Forestry, and Hunting	50	0%	\$27,400
Johnson County	3,200	100%	\$25,900
Mining	210	7%	\$39,600
Leisure and Hospitality	500	15%	\$11,400
Agriculture, Forestry, and Hunting	50	2%	\$18,000
Sheridan County	15,500	100%	\$32,700
Mining	280	2%	\$55,500
Leisure and Hospitality	1,550	10%	\$12,321
Agriculture, Forestry, and Hunting	270	2%	\$28,300
Source: Headwaters Economics, 2007a, 2007b, and 2007c.			

Because of high mining sector wages, this sector contributes a relatively large share to total county income. For example, in Campbell County in 2005, the mining sector comprised 26 percent of non-farm labor employment and 44 percent of non-farm labor income (Headwaters Economics 2007a). In Johnson County where mining wages are about 1.5 times the average wage, the mining sector comprised six percent of non-farm labor employment and eight percent of non-farm labor income in 2005 (Headwaters Economics 2007b). Similarly, in Sheridan County, the mining sector comprised 3 percent of non-farm labor employment and 5 percent of non-farm labor income in 2005 (Headwaters Economics 2007c).

In all three counties in 2005, farm income comprised 2 percent or less of total personal income. Therefore, potential impacts to farm income related to FCPA management actions, specifically rangeland management, are not considered because they are unlikely to have a significant impact on total personal income in the affected area.

New tourism jobs (Leisure and Hospitality sector) would be primarily related to elk hunting in the FCPA, the major recreation activity. Because elk hunting is highly seasonal, it does not support year-round employment, although elk hunting provides support for the tourism industry in a key shoulder season between summer and winter. Additionally, elk hunting in the FCPA supports about five local outfitters.

Overall, elk hunting in the FCPA is not expected to have a measurable impact on employment or income in the affected area. Furthermore, it has been found that much of the lodging tax increase in other counties in Wyoming with CBNG development (such as Sublette, Sweetwater, and Carbon counties) was not attributed to typical tourists, but to out-of-state mining workers who occupied blocks of lodging spaces on a regular basis during recent years of energy development. Therefore, the fluid mineral management activities in the FCPA are the only management activities that are anticipated to have measurable employment and income impacts on the affected area.

The number of mining sector jobs associated with fluid mineral development in the FCPA was estimated using assumptions from Table 2-16 of the PRB O&G FEIS (BLM 2003a) for Employment Requirements and the estimated number of new wells and associated facilities for the proposed management alternatives (see Table 4-1). Estimates for direct and indirect employment for each of the management alternatives are shown in Table 4-35.

Parameter	Current Conditions	Alternative I	Alternative II	Alternative III
Number of New Wells	480	726	468	574
Peak Number of Workers in FCPA	60	100	70	80
New mining sector jobs in affected area	0	100	70	80

Parameter	Current Conditions	Alternative I	Alternative II	Alternative III
Indirect employment (2.4 multiplier)	0	240	170	190
Total employment (Direct + Indirect)	0	340	240	270
% change to 2006 employment in affected area (41,800)	0	1%	0.5%	0.5%

Based on the current availability of labor in the affected area (unemployment rates in the three counties are below state and national levels and near 3 percent) and that the CBNG development proposed in the FCPA is part of a much larger development plan for the entire PRB, it is assumed that there are no new jobs associated with the proposed development. This is consistent with the assumptions in the PRB O&G FEIS (BLM 2003a), which assumes most workers would be drawn from the surrounding area. In this case, it is assumed that development in the FCPA would retain jobs that may have been eliminated without further mining sector development. These jobs for peak workers conducting well construction, operations, maintenance, and deconstruction would have a duration of about 10 years from 2009 and 2019.

Indirect employment associated with these mining sector jobs is estimated using a multiplier of 2.4 (PRB O&G FEIS) (BLM 2003a). This multiplier represents the number of jobs created by purchases and expenditures made by mining sector employees within and outside the affected counties. The impact on total employment from these jobs is relatively small. Because it is difficult to predict where workers will reside, the change to employment is estimated from total employment for 2006 in Campbell, Johnson, and Sheridan counties (almost 42,000 jobs). The effect on total employment from FCPA fluid mineral management actions would amount to less than 1 percent for direct and indirect employment. The mining sector jobs (100) would amount to less than 1 percent of mining sector employment (7,300 jobs) as well.

Government Revenues

The other significant impact associated with CBNG development in the FCPA would be to State and county tax revenues from severance, ad valorem, and sales taxes as well as Federal mineral royalties. The payments related to CBNG development in the FCPA that are most likely to have a measurable economic impact on Campbell, Johnson, and Sheridan counties are federal mineral royalties, state severance taxes, and county ad valorem or property taxes. Other payments such as sales and use taxes are estimated to impact total sales tax in these counties by less than 1 percent.

Federal royalties are paid for each well producing from Federally owned oil and gas mineral estate. After administrative costs are deducted, half of the royalties are retained by the Federal government and half are distributed to the State of Wyoming and used for schools, roads, and other public works. For this analysis, royalties are estimated as percentage of the total project yield for each well multiplied by the market price for the product. For this analysis, Federal

royalties as a result of CBNG activity have been estimated using 12.5 percent of the estimated sales value for each well. Half of this total would be distributed to the Federal government and the remaining half would go the State of Wyoming and be distributed to towns and cities. In fiscal year 2005, over \$850 million in Federal mineral royalties was distributed in Wyoming, almost three times more than what was distributed in fiscal year 2000 (CBNGA 2008). Table 4-36 shows total Federal royalty distributions to towns and cities within each county for fiscal year 2006 (WY EAD 2006b).

Location	Federal Mineral Royalty Distribution	State Severance Tax Distribution	Property Tax Revenue
Campbell County	\$1,400,000	\$1,335,000	\$46,700,000
Johnson County	\$279,000	\$322,000	\$31,600,000
Sheridan County	\$837,000	\$1,133,000	\$37,800,000

Source: State Treasurers Report 2005 and CBNGA 2008

State severance taxes in Wyoming are collected on oil, gas, and other minerals produced in the state. Currently, the tax rate for natural gas production is 6 percent. These severance taxes are distributed back to the counties, cities, and towns throughout the state. Table 4-36 totals state severance tax distributions to municipalities and counties for Campbell, Johnson, and Sheridan counties in 2006.

County ad valorem taxes are dependent on CBNG equipment and property values as well as natural gas sales. This assessed valuation is the foundation for determining property tax revenues each year. In Johnson County, county valuation went from \$210 million, in tax year 2005, to \$446 million, for the 2006 tax year because of increased CBNG production. Similarly, property tax revenues more than doubled, increasing from \$14 million in fiscal year 2005 to almost \$32 million in fiscal year 2006. CBNG ad valorem revenue contributed 60 percent of total property tax revenue in Johnson County in 2006 (CBNGA 2008). Table 4-36 shows property tax revenues for fiscal year 2006 for the counties in the affected area.

Table 4-37 outlines estimated natural gas production, sales, and tax from CBNG development in the FCPA. The number of new wells for each alternative is allocated according to FCPA land area inside each county as follows: 58 percent of FCPA in Campbell County, 37 percent in Johnson County, and 5 percent in Sheridan County. Based on assumptions from the PRB O&G FEIS (BLM 2003a), natural gas production for each new CBNG well is estimated at 400,000 thousand cubic feet (mcf) over a seven-year lifetime, or an average of 57,000 mcf annually. Price forecasts for gas in Wyoming from the Consensus Revenue Estimating Group (CREG) are for natural gas prices to stabilize over the next few years at \$4.00 per mcf for CBNG (CREG 2008). Tax revenues related to natural gas sales are estimated for total CBNG well production over its seven-year lifetime.

Table 4-37 Estimated Natural Gas Production, Sales, Tax Revenues			
Location	Alternative I	Alternative II	Alternative III
Campbell County			
New Wells	421	271	333
Total Gas Production (400,000 mcf/well) (million mcf)	168	108	133
Total Gas Sales [\$4.00 per mcf] (\$ million)	\$671	\$432	\$530
Federal Mineral Royalty Revenue (\$ million)	\$84	\$54	\$66
State Severance Tax Revenue (\$ million)	\$40	\$26	\$32
County Ad Valorem Tax Revenue (\$ million)	\$47	\$30	\$37
Annual County Ad Valorem Tax Revenue (\$ million)	\$7	\$4	\$5
Johnson County			
New Wells	268	173	212
Total Gas Production [400,000 mcf/well] (million mcf)	107	69	85
Total Gas Sales [\$4.00 per mcf] (\$ million)	\$427	\$276	\$338
Federal Mineral Royalty Revenue (\$ million)	\$53	\$34	\$42
State Severance Tax Revenue (\$ million)	\$26	\$17	\$20
County Ad Valorem Tax Revenue (\$ million)	\$33	\$21	\$26
Annual County Ad Valorem Tax Revenue (\$ million)	\$5	\$3	\$4
Sheridan County			

Table 4-37 Estimated Natural Gas Production, Sales, Tax Revenues			
Location	Alternative I	Alternative II	Alternative III
New Wells	36	24	29
Total Gas Production [400,000 mcf/well] (million mcf)	14	9	11
Total Gas Sales [\$4.00 per mcf] (\$ million)	\$58	\$41	\$50
Federal Mineral Royalty Revenue (\$ million)	\$7	\$5	\$6
State Severance Tax Revenue (\$ million)	\$4	\$2	\$3
County Ad Valorem Tax Revenue (\$ million)	\$5	\$3	\$4
Annual County Ad Valorem Tax Revenue (\$ million)	\$0.7	\$0.5	\$0.6

Comparing estimated annual government revenue to recent county budgets, assuming that half of the Federal mineral royalty, 75 percent of the state severance tax, and all of the county ad valorem tax is sent to the counties, CBNG development in the FCPA is estimated to impact total county revenues by less than 10 percent annually.

As shown in Table 4-36, county property tax revenues amount to much more than severance and Federal royalty tax distributions to the counties. Therefore, the economic impacts to government finances are estimated using changes to property tax revenues. Because county tax revenues are linked to natural gas production, such as in Johnson County where 60 percent of the total property taxes are from CBNG ad valorem taxes, the estimated annual tax revenues from CBNG development in the FCPA will only occur for a relatively short period of seven years. This could lead to some county finance problems, even though total revenues are increasing because the timing of revenues does not coincide with budget requirements. For example, during CBNG well construction, counties would experience increased traffic to access well locations. But the tax revenues that could be used to maintain or improve county roads to handle this increased traffic will not be realized for a year or two after the wells have been completed and begin production.

Non-Market Values Relevant to the FCPA

Stakeholders have revealed that there is more value to the FCPA than what can be measured by market values for natural gas and associated jobs and tax revenues. Federal and public lands are becoming increasingly popular with recreationists, retirees, and businesses all vying to extract benefits from these natural resources. Therefore, this section on non-market values is included to balance the economic assessment.

Some recent findings relevant to the FCPA:

- Living near public lands offers benefits and amenities to the local residents and communities. Understanding what local residents value in a public land is accomplished by measuring the benefits associated with public land use. Two studies by Blevins and Jenkins have attempted to do this. These studies were carried out by University of Wyoming researchers in conjunction with a plan revision for the Bighorn National Forest and the Medicine Bow National Forest. Surveys (Blevins and Jenkins 2004) were used in these studies to obtain an overview of how residents value their respective national forest. The Social Assessment of the Four-County Area (SAFCA) of the Bighorn National Forest included Big Horn, Johnson, Sheridan, and Washakie counties (Blevins and Jenkins 2002). Respondents were asked to rank possible U.S. Forest Service (USFS) missions on a scale of one (most important) to nine (least important). Results for Johnson and Sheridan counties showed that residents strongly agreed that providing and protecting sources of water for human use was a priority (most important), as was making sure the forests were available for future use and providing a home for wildlife (UWYO 2007).
- Researchers applied a general bio-economic model for charismatic wildlife that includes the notion of a minimum viable population, and hunting and preservation values to determine desirable sizes for sage-grouse populations in Nevada. Using this model, they found that desirable population of sage-grouse depends crucially on (1) the minimum viable population, (2) the ecosystem carrying capacity for sage-grouse, and, most importantly, (3) the functional form of the marginal non-use benefits function. These are important findings because all three of these factors tend to be quite uncertain. The most sensitive variable was carrying capacity, and the desirable population values were in the range of 50 to 60,000 birds (Van Kooten and Eiswerth 2007).
- A survey of Teton County, Wyoming residents on open space preservation options estimated a mean willingness-to-pay of about \$10 for 100 acres of land being kept in public management (JARE 2004).
- In a recent study of the value of the 42 million acres of roadless lands in the U.S., researchers estimated that these lands could provide almost \$600 million in recreation benefits each year, more than \$280 million in passive use values, and nearly 24,000 jobs. As for environmental benefits, they estimated these lands annually provide between \$490 million and \$1 billion in carbon sequestration services and \$490 million in waste treatment services. Extrapolating these results to the roadless portion of the FCPA, the passive use value, defined as a combination of keeping the land available for visits in the future (option value), or simply knowing that natural areas exist (existence value) and that their protection today sustains them for future generations (bequest value), was about \$7 per acre annually for roadless western lands (Loomis and Richardson 2000).
- A recent analysis estimated the value of ecological function in shrub-steppe dryland habitat similar to the FCPA. The values that these researchers found are summarized in Table 4-38. Soil stabilization function was found to have the highest values. The Fortification Creek elk herd contains rare prairie elk, which increase the value of the FCPA. Additionally, the prairie breaks/badlands landscape is underrepresented in protected public lands and is also of high value.

- A relatively recent biological function of the FCPA is carbon sequestration achieved through plant growth and soil function. Recent market prices for carbon emissions reduction for biological carbon sequestration projects are in the range of \$5 to \$10 per metric ton of carbon dioxide (CCAR 2008). The carbon sequestration capacity of the lands in the FCPA would have to be determined before a more precise value (\$/acre) could be estimated.

Table 4-38 Summary of Selected Values Estimated for Shrub-Steppe Habitat (\$/acre/year)		
Parameter	Measurement Technique	Annual Value Per Acre (\$)
Function		
Soil Stabilization	Contingent Valuation: benefits transfer to reduce PM ₁₀	4 to 14
	Cost of Conservation Reserve Program Land Acquisition Program	47
	Cost of Soil Stabilization Program with Farming (analog)	6 to 21
	Expected Cost of Traffic Accidents and Road Closures	15 to 50
	Extra Cleaning and Maintenance	48 to 169
Recreation	Hunting Club Annualized Rental Club (analog)	75
Species Diversity	Annualized Restoration Costs, adjusted for productivity	52 to 75
Opportunity Costs		
Grazing	Annualized Value of Grazing Land	3.35
Farming	Annualized Value of Farmland (Dry)	12.40
	Annualized Value of Farmland (Irrigated)	74.20
Urban	Annualized Value of Building Sites	460.40

Economic impact valuation criteria include the following:

- *Negligible* – Total employment or total county revenues are changed by less than 10 percent from current levels.
- *Minor* – Total employment or total county revenues are changed by more than 10 percent and less than 25 percent from current levels.
- *Moderate* – Total employment or total county revenues are changed by more than 25 percent and less than 50 percent from current levels.
- *Major* – Total employment or total county revenues are changed by more than 50 percent from current levels.

4.6.1.2. Alternative Assessment

Alternative I (No Action Alternative)

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There are no restrictions on well metering and visitation, water management facility locations, road density standards, or elk security habitat. There would be negligible economic impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPS, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. Under Alternative I, there are no restrictions on well metering and visitation, water management facility locations, road density standards, or elk security habitat. Estimated total employment in the affected area associated with actions in the FCPA under this alternative would be retention of 340 jobs; amounting to 1 percent of current levels. Annual ad valorem revenues from CBNG development over the seven-year production period would amount to a 15 percent increase from 2006 property tax revenues in Campbell and Johnson counties. In Sheridan County, ad valorem taxes would amount to less than 10 percent change from 2006 property tax revenues. Therefore, economic impacts from fluid mineral management in the FCPA under this alternative would be minor and beneficial.

Alternative II

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible economic impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and

reclamation to ensure that activities would not affect resource values in the FCPA. Management actions specific to Alternative II include a phased approach to CBNG. Estimated employment under this alternative would be retention of 240 jobs in the affected area amounting to one-half of a percent of current employment. Annual ad valorem revenues from CBNG development over the seven-year production period would amount to an increase of less than 10 percent of 2006 property revenues for Campbell, Johnson, and Sheridan counties. Therefore, economic impacts from fluid minerals management in the FCPA under this alternative would be negligible.

Alternative III

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible economic impacts associated with these management actions.

Fluid Minerals Management

The BLM goals for CBNG management are to facilitate the extraction of CBNG and to minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. Management actions specific to Alternative III include a phased approach to CBNG. Estimated employment under this alternative would be retention of 270 jobs amounting to one-half of a percent of current employment in the affected area. Annual ad valorem tax revenues from CBNG development over the seven-year production period would amount to an increase of about 10 percent of 2006 property tax revenues for Campbell, Johnson, and Sheridan counties. Therefore, economic impacts from fluid minerals management in the FCPA under this alternative would be negligible.

Summary

The summary of economics impacts is shown in Table 4-39.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Wildlife and Special Status Species Resources Management	Negligible Elk herd protection	Negligible Elk herd protection	Negligible Elk herd protection
Fluid Minerals Management	Minor (+) Additional 340 jobs in surrounding counties	Negligible Additional 240 jobs in surrounding counties	Negligible Additional 270 jobs in surrounding counties

4.6.2. Social Impacts

Social impacts caused by management actions in the FCPA could include:

- Social instability caused by rapid changes to a community such as influx of temporary workers and their families especially if these workers are a different race or culture than existing society.
- Changes in quality or quantity of social services such as health, education, and infrastructure. Counties and municipal governments use tax revenues to fund these services; however, rapid increase in demand can exceed the capacity of existing facilities and programs.
- Changes from rural agricultural landscape to rural industrial landscape.

Most of these impacts can be signs of a vibrant growing society. However, it is the rapid rate of change (boom or bust) that can cause social instability and social impacts. The management actions in the FCPA that are anticipated to have social impacts are fluid minerals management because of the potentially rapid increase in population, employment, and income associated with CBNG development.

One measure of social stability is the net migration rate. In Wyoming, this is generally measured by the net of surrendered or exchanged drivers' licenses (Wyoming Housing Database Partnership 2008). In a recent housing needs analysis, it is reported that, "Driver's license exchange data indicated the net in-flow of migrants remains strong, increasing from 5,810 in 2006 to 6,002 in 2007. This is an all-time high. These data indicate that those in the age group from 26 to 45 are flocking to the State." The northeast region of Wyoming (including Campbell, Crook, Johnson, Sheridan, and Weston counties) is experiencing the same pattern as Wyoming overall with a substantive increase in net in-migration between 2004 and 2006, with an annual rate of about 300 in 2004 to 1,400 in 2006 (Wyoming Housing Database Partnership 2008). In addition to the number of migrants moving into the affected area (Campbell, Johnson, and Sheridan counties), these migrants are generally younger than the existing population. In Sheridan County, for example, where there was a net in-migration of 1,320 persons between 2000 and 2007 the median age of county residents is 40.6 and the median age of the migrants is about 35 (Sheridan County 2008). This age difference can create stress in demand for county services with young families moving into the area and demanding more education and youth services, while the existing older population is looking toward retirement and is less willing or able to pay for these services.

A recent survey in Sheridan County highlights some of the reasons why people are moving into the area. In response to one of the survey questions designed to identify what respondents currently like and value about their county, over 80 percent of the respondents identified opportunities for wildlife viewing, solitude, scenic beauty, and air and water quality, as well as the friendliness of the residents as important attributes of the county (Sheridan County 2008). These amenities can be threatened by development, whether it is residential development to provide new housing for the migrants or industrial development such as CBNG development. Social stress can occur when development comes in conflict with "the reasons people live here."

Many of these social stresses can be alleviated if the changes creating the stresses occur slowly or at a steady pace giving local governments and social institutions time to respond. However, Wyoming has been experiencing a population and income boom over the last decade as a result of energy development. Because the Wyoming economy is not well diversified and is highly

dependent on energy development, it is vulnerable to a bust when the coal, oil, or gas is depleted or if energy prices drop drastically (WY EAD 2007b). Therefore, the social impact analysis focuses on the rate of change in population and income related to fluid mineral management actions, because these most likely would be the major drivers in creating social stresses in the affected area.

4.6.2.1. Evaluation Criteria

Social impacts are measured in terms of rate of change in population and income in the counties that would be affected by the FCPA management actions including Campbell, Johnson, and Sheridan counties. Table 4-40 shows the average rate of change in population and personal income by decade from 1970 to 2020.

Location	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020
Campbell County					
Population	93%	17%	16%	27%	23%
Personal Income	688%	52%	71%	n/a	n/a
Johnson County					
Population	20%	-9%	15%	24%	18%
Personal Income	225%	58%	69%	n/a	n/a
Sheridan County					
Population	40%	6%	11%	8%	7%
Personal Income	300%	62%	37%	n/a	n/a
State of Wyoming					
Population	42%	-4%	9%	9%	7%
Personal Income	326%	47%	72%	n/a	n/a

Source: BEA 2000 and WY EAD 2006a.

Rate of change in population and personal income are used as indicators because they measure the rate at which people are entering or leaving a community as well as the change in overall standard of living in the community. If both population and income are increasing rapidly (as they did in Wyoming in 1970s), the resulting boom can be very destabilizing to a small community as demands and costs for housing, health services, and education skyrocket. If the boom is followed by a bust (Wyoming in the 1980s), then the remaining community members are left with empty schools, oversized community facilities, and worthless homes that must be supported by a decreasing tax base. Currently, Sheridan County is experiencing a boom of retirees as noted in the county's comprehensive plan (2008), "The arrival of these newcomers has had significant implications for Sheridan County; housing and land prices have outstripped growth in income and employment."

The changes to population and personal income associated with CBNG development in the FCPA are estimated as follows:

- A population increase would be related to peak workers and their families associated with an alternative. This assumes that regional workers would relocate closer to the FCPA (in Campbell, Johnson, and Sheridan counties) for the duration of the CBNG development in the FCPA. If the total number of peak workers for the alternative was estimated at 100 and assuming 1.5 additional persons per peak worker, then the maximum population increase in the three counties would be 250. This population increase would probably occur in a one-to two-year period and last for at least seven years. With a total population in the counties of approximately 88,000, this increase would be negligible.
- Personal income would increase in proportion to the difference between the wages for new mining jobs and the average wage. Overall, mining jobs pay about 50 percent higher than the average wage in the affected counties. However, the number of new mining jobs (100) associated with CBNG development in the FCPA is relatively small (because total employment – 42,000 and mining jobs – 7,300). The change to personal income would be negligible.

Social impact evaluation criteria include the following:

- *Negligible* – Rate of change of population or personal income is less than 5 percent from current levels.
- *Minor* – Rate of change of population or personal income is more than 5 percent and less than 10 percent from current levels.
- *Moderate* – Rate of change of population or personal income is more than 10 percent and less than 20 percent from current levels.
- *Major* - Rate of change of population or personal income is more than 20 percent from current levels.

4.6.2.2. Alternative Assessment

Alternative I (No Action Alternative)

Wildlife and Special Status Species Resources Management

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There are no restrictions on well metering and visitation, water management facility locations, road density standards, or elk security habitat. There would be negligible social impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. Under Alternative I, there are no restrictions on well metering and visitation, water management facility locations, road density standards, or elk security habitat. The estimated maximum increase in population would be 250 (in Campbell, Johnson, and Sheridan counties), which would occur over a two- to 10-year period. The rate of change in population and income, and therefore the social impacts, would be negligible.

Alternative II**Wildlife and Special Status Species Resources Management**

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible social impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would affect the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not affect resource values in the FCPA. The estimated maximum increase in population is 175 (in Campbell, Johnson, and Sheridan counties), which and would occur over a two- to 10-year period. The rate of change in population and income, and therefore the social impacts, would be negligible.

Alternative III**Wildlife and Special Status Species Resources Management**

Wildlife resources management goals and objectives include specific elk management actions designed to promote and protect elk habitat and the Fortification Creek elk herd. There would be negligible social impacts associated with these management actions.

Fluid Minerals Management

The BLM goal for CBNG management is to facilitate the extraction of CBNG and minimize the effects to the landscape that would impact the resource values in the FCPA. Associated objectives are to identify stipulations, BMPs, and COAs for exploration, development, production, and reclamation to ensure that activities would not impact resource values in the FCPA. The estimated maximum increase in population in the three counties is 200, which would occur over a two- to 10-year period. The rate of change in population and income, and therefore the social impacts, would be negligible.

Summary

The summary of social impacts is shown in Table 4-41.

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
Wildlife and Special Status Species Resources Management	Negligible Elk herd protection	Negligible Elk herd protection	Negligible Elk herd protection
Fluid Minerals Management	Negligible Population increase of 250 and an additional 340 jobs in the surrounding	Negligible Population increase of 175 and an additional 240 jobs in the surrounding	Negligible Population increase of 200 and an additional 270 jobs in the surrounding

Land Use or Management Action	Alternative I (No Action)	Alternative II	Alternative III
	counties	counties	counties

4.6.3. Environmental Justice

Executive Order 12898 on Environmental Justice in Minority and Low-Income Populations, issued on February 11, 1994, identifies and addresses, as appropriate, disproportionately high, and adverse human health and environmental effects of programs, policies, or activities on minority or low-income populations. Conclusions reached in the PRB O&G FEIS (BLM 2003a) indicated that, “Implementing the Proposed Action would not have significant disproportionate adverse affects on the social, cultural, and economic well being, and health of minorities and low-income groups.”

The area that would be affected by environmental justice impacts related to management actions in the FCPA includes Campbell, Johnson, and Sheridan counties. In these counties, potential minority and low-income populations are summarized in Table 4-42. Generally, the affected area has the same racial profile and poverty rate as the rest of Wyoming. The minority and low-income populations in the affected area would not be disproportionately impacted by management actions in the FCPA. Therefore, there would be no environmental justice impacts.

Location	Percentage Population White by Race	Median Household Annual Income	Average Poverty Rate	Average Poverty Rate in Children
Campbell County	96%	\$61,000	7%	8%
Johnson County	97%	\$42,000	9%	12%
Sheridan County	96%	\$41,000	9%	14%
State of Wyoming	92%	\$45,500	11%	14%

Source: Headwaters Economics 2007 a, b, and c and U.S. Census Bureau 2008