CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

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4.0 INTRODUCTION

The purpose of this chapter is to determine the potential for significant impact of the "federal action" on the "human environment." The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA) states that the "human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment [40 Code of Federal Regulations (CFR) §1508.14]. The "federal action" is the Bureau of Land Management's (BLM) selection of an alternative plan on which future land use actions would be based.

4.0.1 Impact Analysis

Analysis of the alternatives focuses on identifying types of impacts and estimating their potential significance. Throughout this chapter the terms "impact" and "effect" are synonymous. While impacts may be perceived as positive (beneficial) or negative (adverse), those determinations are left for the reader of this document to decide. An overview of the types of impacts is presented below. Cumulative impacts are defined and discussed separately in Chapter 5.

Direct Impacts - These are effects that are caused by the action and occur at the same time and place. Examples include the elimination of original land use due to the erection of a structure. Direct impacts may cause indirect impacts, such as ground disturbance resulting in resuspension of dust.

Indirect Impacts - These are effects that are caused by the action but occur later in time or are farther removed in distance, but are still reasonably foreseeable and related to the action by a chain of cause and effect. Indirect impacts may reach beyond the natural and physical environment (e.g., environmental impact) to include growth-inducing effects and other effects related to induced changes to resource users (e.g., non-environmental impact).

Significant Impacts - Both direct and indirect impacts may be significant. "Significant" requires consideration of both the context and intensity of the impact. This means that an action must be analyzed in several contexts – such as the immediate vicinity, affected interests, and the locality. Both short-term and long-term effects are relevant. Intensity refers to the severity of impact. Thus, significant impacts have intensity greater than negligible, minor, or substantial impacts (see Section 4.0.2).

BLM manages public lands for multiple uses in accordance with the Federal Land Policy and Management Act (FLPMA). Land use decisions are made that protect the resources while allowing for multiple-use of those resources, such as livestock grazing, energy development, and recreation. Where there are conflicts between resource uses, or a land use activity may result in irreversible or irretrievable impacts to the environment, BLM may restrict or prohibit some land uses in specific areas. To ensure that BLM meets its mandate of multiple-use in land management actions, the impacts of the alternatives on resource users are identified and assessed as part of the planning process. The projected impacts on land use activities and the

associated environmental impacts of land uses are characterized and evaluated for each of the alternatives.

4.0.2 Significance Criteria

Significance criteria are developed to gauge the magnitude an impact would have on the human environment. An adverse impact on resources as a result of human activities would be considered potentially significant if its magnitude was such that special mitigation is warranted or it persists indefinitely.

The concept of significance encompasses several factors, including the degree of change from existing conditions and the likelihood of the change to occur. The context and intensity of the impact are also considered. Context refers to the environmental circumstances at the location of the impact. Intensity refers to the severity or extent of an impact, including the potential for violation of laws or regulations, and the recovery or resilience of the resource.

Determining significance is complex, in that impacts are dynamic and may change during the planning period. Significance can be real and supportable by fact, or perceived and perhaps not fully supportable even with rigorous study. For this analysis, the approach to establishing significance criteria was based on legal issues (i.e., government regulatory standards), public perception, available scientific and environmental documentation, and professional judgment of resource specialists.

4.1 GEOLOGY/MINERAL RESOURCES/PALEONTOLOGY

4.1.1 Introduction

4.1.1.1 Geology (Surface Environment)/Geological Hazards

Impacts could occur to the geologic environment due to project implementation and operation as a result of removal of vegetation or soils or alteration of existing local topography—steepening slopes. Removal of vegetative or soil cover could lead to flooding as a result of decreased infiltration rates and increase overland flow rate. If unmitigated, accelerated erosion that could result may cause gullying in some areas and rapid deposition or siltation in other areas with associated negative affects. Mass movements, including landsliding could be triggered in areas that become oversteepened by erosional removal of slope supporting material. Altering existing topography, particularly by steepening slopes, could also trigger mass movements and accelerated erosion.

The proposed action or its alternatives would not contribute to increased risks of earthquakes. Earthquake-induced ground shaking could result in damage to above ground structures although the likelihood of earthquakes is low as indicated by the absence of recorded epicenters in the ARPA. Buried structures would only be affected if shaking induces ground failure or subsurface rupture. Pyrophoricity and subsidence affects to the geologic (surface) environment have been discussed in Chapter 3 and are not considered a concern.

The magnitude of impacts to the geology and geological hazards associated with the proposed action or its alternatives would be reduced by the implementation of mitigation measures for geology, soils, vegetation, and water described for described in Appendix H, Required Best Management Practices and adherence to the Great Divide RMP and draft Rawlins RMP.

4.1.1.2 Mineral Resources

Petroleum and CBNG reserves could be considerably depleted by implementation of the proposed action or alternatives within the ARPA. The proposed action and its alternatives would allow recovery of federal natural gas resources, and therefore, loss of reserves in the ground, as per 43CFR 3162.1(a), and generate private and public revenues if drilling leads to petroleum discovery and development.

No economical locatable mineral resources have been identified in the ARPA. Demand for local sand, gravel, and clinker (disposed of through the mineral materials program) for building materials for roads, well pads and other ancillary facilities, may increase. Currently permitted sources are considered adequate to meet the demand for minerals materials. Although there is the potential for mining uranium within the ARPA, no development is expected in the near future. The potential for other mineral development, including locatables (gold, other minerals) or coal is considered low.

4.1.1.3 Paleontology

Excavation of pipeline trenches and construction of well pads, access roads and ancillary facilities associated with the proposed action or its alternatives could result in the exposure and possible destruction of fossil resources of scientific significance either directly as a consequence of construction or indirectly as a result of increased erosion rate. Increased access resulting from development may increase the visibility of fossil resources and lead to increased poaching.

Conversely, excavation of pipelines and construction of project facilities could result in new fossil resources being discovered. If these newly discovered resources are properly recovered and catalogued into the collections of a museum repository, thereby making them available for study and scientific evaluation, a positive affect of the proposed action or its alternatives could occur. In addition as a positive benefit, increased access would allow easier access by professional, permitted paleontologists and geologists, who hope to make scientifically significant discoveries.

The magnitude of impacts associated with the loss of fossil resources associated with the proposed action or its alternatives would be reduced by the implementation of paleontologic resource mitigation measures described in Appendix K and 4.1.5.3.

4.1.2 Impact Significance Criteria

4.1.2.1 Geology (Surface Environment)/Geological Hazards

Impacts to geology would be significant if project implementation results in increased runoff and erosion, leading to mass movement (including landsliding), subsidence, flooding, increased erosion, or in some cases increased deposition or siltation.

4.1.2.2 Minerals

Depletion of petroleum and CBNG reserves from subsurface reservoirs resulting from the proposed action or its alternatives could be considered a significant impact.

4.1.2.3 Paleontology

Impacts to paleontological resources would be significant if scientifically important fossils are damaged or destroyed directly or indirectly as a result the proposed action or its alternatives.

4.1.3 Direct and Indirect Impacts

4.1.3.1 Proposed Action

4.1.3.1.1 Geology (Surface Environment)/Geological Hazards

Direct impacts to geology as a result of proposed action would include damage to the surface environment such as alteration of existing local topography that directly or indirectly causes increase risk of mass movements (including landslides), or results in flooding, or accelerated erosion or deposition. Indirect impacts to geology would include increased erosion that if unmitigated increases the risk of mass movements, including landslides.

4.1.3.1.2 Mineral Resources

Inventory of mineral resources in the ARPA revealed no known mineral resources that would be directly or indirectly impacted by implementation of the proposed action other than petroleum and CBNG reserves. Successful field development would result in petroleum production and depletion if permitted by federal and state agencies. Depletion, the result of production, is the purpose of this project.

Successful implementation of the Proposed Action could substantially increase petroleum and CBNG production in Carbon County, Wyoming.

Construction grade materials are likely to be used from local as yet unidentified sources for surfacing materials for petroleum and CBNG facilities. If development is extensive, accumulations of local materials may become depleted and additional sources outside of or within the ARPA would need to be identified and used.

4.1.3.1.3 Paleontology

Direct impacts to fossils would include damage or destruction of important fossils during construction, with subsequent loss of scientific information. The Proposed Action could result in direct and indirect impacts to fossil resources caused by surface disturbance, especially if disturbances affect geological formations documented in Chapter 3 within the ARPA to have a high potential to contain fossils of scientific importance (BLM Paleontology Condition 1 and 2 and Probable Fossil Yield Classes 3, 4, and 5).

However, excavation could reveal fossils of scientific significance that would otherwise have remained buried and unavailable for scientific study. If newly discovered fossils are properly collected and catalogued into the collections of a museum repository along with associated geologic data, would be available for future scientific study. In this way significant positive consequences, could result from the unanticipated discovery of previously unknown scientifically significant fossils.

4.1.3.2 Alternative A – No Action

4.1.3.2.1 Geology (Surface Environment)/Geological Hazards

No impacts to geology are anticipated under this alternative.

4.1.3.2.2 Minerals

No documented mineral resources other than oil and gas and CBNG would be affected by implementation of Alternative A.

4.1.3.2.3 Paleontology

Under the No Action Alternative, no drilling would be conducted on public lands.

4.1.3.3 Alternative B

4.1.3.3.1 Geology/Geological Hazards, Minerals, Paleontology

The number of wells drilled under this alternative is identical to the proposed action so indirect and direct impacts remain the same as the proposed action. Alternative B would restrict development to a two or three PODset where industry would drill /complete/produce/reclaim and revegetate the pods before being allowed to proceed elsewhere. Limiting disturbance to a more restricted area could have positive affect on the geology by having less surface disturbed at any one time that could be subject to erosion. Alternatively, it may result in some areas being more intensively disturbed in a smaller area, which could lead to increased erosion potential.

4.1.3.4 Alternative C

4.1.3.4.1 Geology/Geological Hazards, Minerals, Paleontology

The number of wells drilled under this alternative is identical to that under the proposed action so indirect and direct impacts remain the same as the proposed action. Alternative C would utilize a more intensive analysis and may lead to the identification of areas where multiple resources are impacted and where additional mitigation needs to be implemented. This could lessen disturbance in these areas and reduce the potential affects to geology (surface environment)/geological hazards and paleontology. However restrictions or delays in drilling and production might result, and this could have economic effects and reduce mineral extraction.

4.1.4 Impacts Summary

Implementation of the Proposed Action or alternatives B and C involve the development of surface and subsurface facilities and as a result has the potential for direct and indirect impacts to geology (surface environment), mineral, and fossil resources. The extent of ground disturbance associated with the proposed action, as well as other alternatives is described in Chapter 2. No adverse impacts to the geologic or mineral resources are anticipated under the Proposed Action or it alternatives, with the mitigation discussed in Appendix H, Required Best Management Practices. Application of this mitigation to all lands, private or public, included in the Proposed Action and its alternatives would further reduce potential direct and indirect impacts to these resources.

With the appropriate pre-disturbance surveys/inventories required in high probability occurrence areas for Paleontology (Paleontology Condition 1 and 2 areas and Probable Fossil Yield Class 3, Class 4, and Class 5 areas), and case-by-case inventories in these same areas, and as required by mitigation measures identified in Appendix H, Required Best Management Practices, the likelihood that significant fossil resources would be damaged or destroyed is reduced.

4.1.5 Additional Mitigation Measures

4.1.5.1 Geology

Mitigation measures presented in the Soils and Water resources sections would avoid or minimize the potential impacts to the surface geologic environment and lessen the possibility of mass movement, flooding, and therefore, no additional mitigation measures are required.

4.1.5.2 Minerals

No additional mitigation measures that would address petroleum depletion are proposed.

4.1.5.3 Paleontology

With implementation of mitigation measures identified in Appendix H, Required Best Management Practices for Paleontology, no additional mitigation measures are required.

4.1.6 Residual Impacts

Given the application of the mitigation measures outlined in Appendix H, Required Best Management Practices and considering that no additional mitigation measures are proposed, no residual impact discussion is required.

4.2 AIR QUALITY

Direct, indirect, and cumulative air quality impacts were analyzed to determine potential near-field ambient air pollutant concentrations, and to determine potential impacts on far-field ambient air pollutant concentrations, far-field visibility (regional haze), far-field atmospheric deposition (acid rain), and in-field (within the ARPA) concentrations.

This air quality impact assessment is based on the best available engineering data and assumptions, meteorology data, and dispersion modeling procedures, as well as professional and scientific judgment. Assumptions representing most likely operating conditions were incorporated into the analysis whenever possible. For example, for the far-field analysis, compression in the field was assumed to operate at 90% of permitted capacity. Other parameters, for which no reliable most likely operating projections were available, were assumed to occur at maximum proposed levels. For example, potential impact assessments for the Proposed Action assume that all proposed wells would be productive (no dry holes).

Air pollution potential impacts are limited by state and federal regulations, standards, and implementation plans established under the *Clean Air Act* and administered by the applicable air quality regulatory agency--specifically, the WDEQ/AQD and the EPA. Colorado, and other

regional states have similar jurisdiction over potential air pollutant emissions sources in those states, and those sources may have a cumulative potential impact when combined with WDEQ/AQD-regulated sources. The applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices prior to construction and/or operation. The U.S. Congress (through the *Clean Air Act* Section 116) authorizes these local, state, and tribal air quality regulatory agencies to establish air pollution control requirements of equal or greater stringency than federal requirements. Any proposed emissions source is required to undergo a permit review by the applicable air quality regulatory agency before construction can begin. The agencies review the specific air pollutant emission sources proposed and, depending upon the magnitude of air emissions and other factors, may require additional site-specific air quality analysis and/or additional emission control measures (including a Best Available Control Technology [BACT] analysis and determination) to ensure protection of air quality.

Under FLPMA and the *Clean Air Act*, BLM cannot authorize any activity that does not conform to all applicable local, state, tribal, and federal air quality laws, statutes, regulations, standards, and implementation plans. An air quality impact assessment technical support document was prepared to document analyses of potential impacts from the proposed development alternatives, as well as other reasonably foreseeable emission sources within a defined cumulative analysis area. The *Atlantic Rim Natural Gas Project and the Seminoe Road Gas Development Air Quality Technical Support Document* (TRC Environmental Corporation [TRC EC] 2004) provides additional detail on this air quality evaluation and is available for review at the RFO.

4.2.1 Impact Significant Criteria

The Great Divide Resource Area RMP ROD (BLM 1990) and state (WSLUC 1979) land use plans prescribe the following management objectives associated with air quality:

- To prevent the deterioration of air quality beyond applicable local, state, or federal standards and to enhance air resources where practicable and;
- To prevent impairment of important scenic values that may be caused by declining air quality.

The significance criteria for potential air quality impacts include state and federally enforced legal requirements to ensure that air pollutant concentrations would remain within specific allowable levels, as well as adherence to the aforementioned RMP and land use plan goals and objectives. Potential impacts are considered significant if:

- Potential total near-field concentrations are greater than WAAQS or NAAQS;
- Potential total far-field concentrations are greater than applicable state ambient air quality standards or NAAQS;
- Potential cumulative near-field concentrations are greater than PSD Class II increments;
- Potential cumulative far-field concentrations in Parks and Wilderness Areas in the region are greater than PSD Class I increments;

- Potential decrease in visibility in Parks and Wilderness Areas in the regions is greater than FLAG, USFS, and /or NPS thresholds;
- Potential decrease in ANC in sensitive lakes in the region is greater than levels of acceptable change (LAC);
- Potential increases in deposition from the project are greater than deposition analysis thresholds (DAT); or
- Potential cumulative total deposition is greater than USFS levels of acceptable change.

Legal requirements include the NAAQS and WAAQS, which set maximum limits for several air pollutants, and PSD Increments, which limit the incremental increase of certain air pollutants (including NO_2, PM_{10}, and SO_2) above legally defined baseline concentration levels. These standards and increments have been presented in Table 3-6.

4.2.2 Direct and Indirect Impacts

This NEPA analysis compares potential air quality impacts from the Proposed Alternatives to applicable ambient air quality standards and PSD increments, but comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD Increment Consumption Analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. For a new source review air quality permit application for a major source, the applicable air quality regulatory agencies may require a regulatory PSD increment analysis. More stringent emission controls beyond Best Available Control Technology may be stipulated in the air quality permit if potential impacts are predicted to be greater than PSD Class I or II increments.

Where legal limits have not been established, the BLM uses the best available scientific information to identify thresholds of significant potential impacts. Thresholds of levels of concern have been identified for Hazardous Air Pollution (HAP) exposure, incremental cancer risks, a "just noticeable change" in potential visibility impacts, and potential atmospheric deposition impacts to sensitive lake water chemistry. These thresholds or levels of concern are described later in this chapter.

Air quality potential impacts from the Project would occur from pollutants emitted during construction (due to potential surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well completion and testing, and drilling rig and vehicle engine exhaust) and production (natural gas well-site production equipment, reciprocating pipeline compression engine exhausts, vehicle traffic engine exhausts, and fugitive dust). Pollutants emitted from these activities include PM_{10}, $PM_{2.5}$, NO_x, CO, SO_2, VOC, and HAPs (benzene, toluene, ethylbenzene, xylene, n-hexane, and formaldehyde). O_3 may also develop from NO_x and VOC emissions. The amount of air pollutant emissions during construction and production may be controlled in part by BACT requirements implemented by WDEQ-AQD and using mitigation methods outlined in this document. Actual air quality potential impacts from these air pollutants would depend on the amount, duration, location, and emission characteristics of potential emissions sources, as well as meteorological conditions (wind speed and direction, precipitation, relative humidity, etc.).

The assessment of direct Project potential impacts included a near-field analysis and a far-field analysis. The near-field analysis assessed direct project potential impacts in the immediate vicinity of Project activities resulting from a single phase of construction or production reflective of maximum emissions. The far-field analysis assessed direct Project potential impacts from field-wide Project emissions at in-field locations within the ARPA and at far-field locations (i.e., sensitive Class I and Class II areas). The far-field analysis also assessed regional emission sources located within the model domain illustrated in Appendix M: PSD Class I and Class III Sensitive Areas and Sensitive Lakes to predict cumulative potential impacts at in-field and far-field locations. While there may be additional gas processing and/or transmission requirements due to the development of this and other natural gas projects regionally and nationally, the potential effects of these developments are not quantified herein since these developments are speculative and would likely require additional WDEQ/AQD permitting if they eventually are proposed. The near-field and far-field potential impact analyses were completed for the Proposed Action and No Action Alternative.

Near-Field Analysis

The near-field analysis analyzed direct Project potential impacts within the ARPA and utilized air pollutant emission rates which were calculated for all phases of construction and production based on WDEQ/AQD guidance. The AERMOD model was used to assess modeled impacts from the phase of either: 1) single-well construction, or 2) field production that produced the highest emissions. The near-field analysis for PM_{10}, $PM_{2.5}$, and SO_2 focused on localized modeled impacts from construction and drilling activities at a single well pad. The near-field analysis for NO_x, CO, and HAPs modeled 2,000 developed wells, to reflect the maximum number of wells in production, of which 10 percent were considered conventional natural gas wells and the remaining 90% CBNG wells. NO_x, CO, and formaldehyde modeling included emissions from 12 compressor stations to be located within the project area: Blue Sky, Brown Cow, Cow Creek, Doty Mountain, Jolly Roger, Muddy Mountain, Red Rim, Sun Dog, and four additional planned stations.

A near-field analysis of O_3 potential impacts was conducted separately. O_3 is formed through the chemical reaction of NO_x and VOCs within the atmosphere in the presence of sunlight. A nomograph developed from the Reactive Plume Model (RPM) (Scheffe 1988) was used to estimate the maximum ozone potential impacts based on NO_x and VOC emissions generated from the Project. Emissions from a representative localized production area consisting of 17 conventional natural gas wells and the Jolly Roger compressor station were used in this analysis.

Acute (short-term) HAP potential impacts were modeled by assuming that a person would not persistently remain at a location closer than 100 m (328 ft) from a well pad or a compressor station due to site operations safety considerations. Long-term (chronic) health-based HAP potential impacts and long-term (chronic) cancer risk were modeled using the realistic estimate of long-term exposure, which assumed that a person would not be closer than the nearest residence just west of the ARPA, located 5.5 miles from a well pad or compressor site, when averaged over a lifetime. Two estimates of cancer risk were made: 1) one that corresponds to a most-likely-exposure (MLE) over a national residency average of 9 years with some time spent away from home, and 2) one reflective of the maximally-exposed-individual (MEI) residing at one location for a lifetime with no time spent away from home. The estimated cancer risks were calculated based on EPA (1997) unit risk factors for carcinogenic constituents

Far-Field Analysis

The far-field analysis utilized the EPA CALMET/CALPUFF modeling system to predict maximum air quality impacts at mandatory federal PSD Class I and other sensitive PSD Class II areas, as well as designated acid-sensitive lakes within these areas. The analysis also included a potential air quality impact assessment at in-field locations within the ARPA to determine maximum concentrations that could occur from all sources operating simultaneously in the field.

The air emissions modeled for Project and non-Project sources in the far-field analysis are presented in Table 4-1. The modeling scenario developed for the Proposed Action assumed the maximum field emissions that could potentially occur concurrently: during the final year of construction representing the maximum annual construction activity rate combined with nearly full-field production. Maximum emissions scenarios include production emissions (producing wellsites and ancillary equipment including compressor stations) and construction emissions (drilling rigs and associated traffic), both occurring continuously over the year. Compressor stations were modeled at currently known or anticipated locations within the ARPA, and wellsites and construction activities were modeled evenly throughout the entire ARPA. Details on modeling methodology are presented in the Air Quality Technical Support Document (TRC EC 2004).

Table 4-1. Project and Non-Project Emissions (tons/yr) Included in Far-Field Analysis, Atlantic Rim Natural Gas Drilling Project, Carbon County, Wyoming, 2004.[1]

Source Category	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Project Sources				
Proposed Action	1,278.5	58.2	780.4	170.6
No Action	0.0	0.0	0.0	0.0
Non-Project Sources				
RFD	6,224.2	55.5	48.1	48.1
RFFA	4,568.8	-1,394.3	-833.6	-330.0
State-permitted	2,868.0	118.2	-14.8	-133.1

[1] Non-Project emissions sources (RFD and RFFA) are described in Section 4.2.3; WDR = well development rate.

Predicted pollutant concentrations were compared to applicable ambient air quality standards, PSD Class I and Class II increments and were used to assess potential impacts to AQRVs--visibility (regional haze) and atmospheric deposition--at sensitive PSD Class I and II areas. The PSD Class I areas and sensitive Class II areas analyzed in the far-field analyses include:

- the Bridger Wilderness Area (Class I);
- the Fitzpatrick Wilderness Area (Class I);
- the Popo Agie Wilderness Area (Class II);
- the Wind River Roadless Area (Class II);
- the Mount Zirkel Wilderness Area (Class I);
- the Rawah Wilderness Area (Class I);

- the Savage Run Wilderness Area (Federal Class II, Wyoming Class I);
- Rocky Mountain National Park (Class I); and
- Dinosaur National Monument (Federal Class II, Colorado Class I).

Because emissions sources under the Proposed Action consist of many small sources spread out over a large area, discrete visible plumes are not likely to impact the distant sensitive areas. However, visible plumes may be noticeable within the ARPA and from nearby travel routes, especially during flaring upset conditions. Nonetheless, the potential for cumulative visibility potential impacts (increased regional haze) is a concern. Regional haze is caused by light scattering and light absorption by fine particles and gases. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change in visibility" when compared to background conditions. The BLM considers that a 1.0 dv change would be a reasonably foreseeable significant impact, although there are no applicable local, state, tribal, or federal regulatory visibility standards. Other federal agencies are using a 0.5 dv change as a screening threshold for significance. The USFS and NPS compare direct Project potential impacts to the 0.5 dv level and those comparisons are included in the Air Quality Technical Support Document (TRC EC 2004).

The NPS, USFS, and USFWS have published the *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report* (FLAG 2000) that prescribes a process for assessing the potential impacts of new and existing sources on AQRVs including visibility. The FLAG Report describes a cumulative potential impacts analysis of new growth sources (defined as PSD increment-consuming sources) on visibility. If visibility impairment from a proposed new source, in combination with cumulative new source growth, is less than an extinction of 10% (1.0 dv) for all days, the federal land managers would likely not object to the proposed new source. However, if predicted visibility impacts are above the visibility threshold, factors such as the magnitude of dv change, frequency, seasonal variations, and meteorological conditions may be considered when assessing the significance of predicted impacts.

A 1.0-dv change is considered a small but noticeable change in haziness as described in the EPA regional haze regulations (40 C.F.R. 51.300). One dv is defined as approximately equal to a 10% change in the extinction coefficient (corresponding to a 2-5% change in contrast for a "black target" against a clear sky at the most optically sensitive distance from an observer). This is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory Class I areas. However, this NEPA analysis is not designed to predict potential visibility impacts for specific views in mandatory Class I areas based on specific Project designs, but to rather characterize reasonable foreseeable visibility conditions that are representative of a large geographic region based on reasonable emission source assumptions. This approach is consistent with the nature of regional haze and the requirements of NEPA.

Potential changes in regional haze at PSD Class I and sensitive PSD Class II areas were estimated by comparing CALPUFF modeled impacts to background visibility conditions in the Class I or sensitive Class II area. This comparison was performed using two different representations of background visibility conditions. One method used visibility values provided in the FLAG Report for each Class I area to represent natural background visibility. The second method used estimated background visibility values from an analysis of recent long-term monitored data (1988–2002) from the IMPROVE program. This analysis consisted of estimating visibility parameters for representative Class I areas corresponding to the monitoring period of record quarterly average of the 20% best visibility days.

Fourteen lakes within the sensitive PSD Class I and Class II Wilderness Areas were identified as being sensitive to atmospheric deposition. These lakes are those for which the most recent and complete data are available, and include:

- Deep Lake in the Bridger Wilderness Area;
- Black Joe Lake in the Bridger Wilderness Area;
- Hobbs Lake in the Bridger Wilderness Area;
- Upper Frozen Lake in the Bridger Wilderness Area;
- Lazy Boy Lake in the Bridger Wilderness Area;
- Ross Lake in the Fitzpatrick Wilderness Area;
- Lower Saddlebag Lake in the Popo Agie Wilderness Area
- West Glacier Lake in the Glacier Lakes Ecosystem Experiments Site (GLEES);
- Lake Elbert in the Mount Zirkel Wilderness Area;
- Seven Lakes in the Mount Zirkel Wilderness Area;
- Summit Lake in the Mount Zirkel Wilderness Area;
- Island Lake in the Rawah Wilderness Area;
- Kelly Lake in the Rawah Wilderness Area; and
- Rawah Lake #4 in the Rawah Wilderness Area.

The NPS (2001) has identified Deposition Analysis Thresholds (DATs) for total nitrogen (N) and sulfur (S) deposition in the western U.S., which are defined as 0.005 kilograms per hectare per year (kg/ha-year) for both N and S. The DAT is used as an analysis threshold for evaluating the potential impacts from project-related emissions. The exceedences of this threshold trigger a management concern but are not necessarily indicative of an adverse impact (NPS 2004). The USFS (Fox et al. 1989) has defined 5 kg/ha-yr for S and 3 kg/ha-yr for N, as levels of concern for potential total deposition impacts, and these are used for comparison of potential impacts from cumulative source emissions. It is understood that the USFS no longer considers these levels of concern to be protective; however, in the absence of alternative FLM-approved values, comparisons to these levels are made. The USFS Rocky Mountain Region has also developed a screening method (USFS 2000) that identifies a Limit of Acceptable Change (LAC) in lake chemistry. The LACs are: 1) no more than a 10% change in acid-neutralizing capacity (ANC) for lakes with an existing ANC of 25 microequivalents per liter (µeq/l) or greater, and 2) no more than a 1-µeq/l change for extremely acid sensitive lakes where the existing ANC is below 25 µeq/l. Of the fourteen lakes identified by the USFS as acid sensitive, Upper Frozen and Lazy Boy lakes are considered extremely acid sensitive.

4.2.3 Alternative A – No Action

Near-Field Impacts

Air quality impacts would occur within the ARPA under the No Action Alternative due to the development of 720 wells on private and state lands. Near-field impacts from air pollutants emitted during construction and production operations, which were analyzed within the immediate vicinity of these activities, would be less than or equal to those impacts analyzed for the Proposed Action and documented in Section 4.2.2. Direct project impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ would be below applicable WAAQS, NAAQS, and PSD Increments.

Far-Field Impacts

Direct project far-field air quality impacts under the No Action Alternative, resulting from air pollutants emitted during the construction and operation of 720 wells, would be less than those

impacts analyzed for the Proposed Action and documented in Section 4.2.2. Direct project impacts of NO_2, SO_2, PM_{10}, and $PM_{2.5}$ would be below applicable WAAQS, CAAQS, NAAQS, and PSD Increments. There would be no adverse impacts to visibility at any of the analyzed sensitive Wilderness Areas. In addition, emissions from the No Action Alternative would result in an ANC change less than the LAC at analyzed acid-sensitive lakes, and predicted maximum S and N deposition impacts would be below the DAT at sensitive Wilderness Areas.

4.2.4 Proposed Action

Near-Field Impacts

The single phase of construction or production proposed as part of the Proposed Action that would produce maximum emissions was identified by pollutant and analyzed. The maximum emissions configurations representative of the Proposed Action modeled were: PM_{10} and $PM_{2.5}$ during construction of a well pad, SO_2 from drilling activities, and NO_2, CO, and HAP from production wells and compressor stations.

The predicted impacts of NO_2, CO, SO_2, PM_{10}, $PM_{2.5}$, and O_3 are presented in Table 4-2 for comparison to the NAAQS and WAAQS. Maximum predicted concentrations of NO_2, CO, SO_2, PM_{10} and $PM_{2.5}$ were added to the ambient background pollutant concentrations, provided in Table 3-6, for comparison to ambient standards. O_3 maximum predicted concentrations were added to the average hourly background O_3 conditions monitored as part of the Green River Basin Visibility Study (ARS 2002) versus second high maximum values as presented in Table 3-6. The average value (75.2 $\mu g/m^3$) is consistent (slightly higher than) with the background ozone concentration of 62.6 $\mu g/m^3$ that was used in the RPM modeling to derive the Scheffe nomograph. In addition, the Scheffe method is a screening level modeling tool, and as such, it is overly conservative to add highest, second highest measured concentrations to screening level estimates. Predicted impacts from Proposed Action source emissions were shown to be below the applicable WAAQS and NAAQS. Table 4-3 presents a comparison of maximum predicted NO_2 impacts to the PSD Class II increment for NO_2. All NEPA analysis comparisons to the PSD Class II increments are intended to evaluate a threshold of concern, and do not represent a regulatory PSD Increment consumption analysis.

When reviewing the predicted near-field impacts, it is important to understand that the results reported reflect the maximum pollutant emission rates calculated for the field and that the resulting concentrations are combined with monitored background ambient pollutant concentrations. Monitored background air pollutant concentrations were assumed to occur throughout the LOP at all locations year-round. In addition, the maximum predicted air quality impacts from ARPA emission sources would occur in the vicinity of the ARPA; because potential impacts typically lessen with distance from an emissions source, potential impacts at locations more distant from the ARPA would be less than the predicted maximum concentrations. Finally, total air pollutant concentrations were assumed to be the sum of the maximum modeled concentration and the background concentration. This methodology is used for both long-term and short-term averaging periods. For short-term averaging periods, these maximum concentrations may occur under very different meteorological conditions and may not occur simultaneously.

Table 4-4 summarizes modeled HAP impacts based on emissions representative of the Proposed Action. All modeled acute and chronic impacts are below applicable health-based guidelines for the non-cancer compounds. Calculated cancer risk from formaldehyde and benzene are shown in Table 4-5. Both the incremental risk from benzene and formaldehyde

and the combined risk are less than the level of acceptable cancer risk of 1 x 10^{-6} for both the MLE and MEI scenarios.

Far-Field Impacts

Impacts from the Proposed Action maximum emissions scenario, which includes the last year of field construction, and nearly the full field in production, were modeled with CALPUFF. The emissions modeled are provided in Table 4-1. The maximum predicted concentrations, when added to ambient background pollutant concentrations, are below all applicable WAAQS, CAAQS, NAAQS, and PSD increments.

Direct visibility potential impacts from Proposed Action sources were predicted to be below the "just noticeable visibility change" (1.0 dv), at all sensitive Wilderness Areas using both the FLAG and IMPROVE background visibility data. The maximum predicted visibility change (0.2 dv) was predicted to occur at both the Savage Run Wilderness Area (both FLAG and IMPROVE background data) and Dinosaur National Monument (IMPROVE data only).

Table 4-2. Maximum Predicted Near-Field Impacts from Project Sources – Comparison to Ambient Air Quality Standards, Atlantic Rim Natural Gas Project.

Pollutant	Averaging Period	Maximum Predicted Impact of All Phases (µg/m^3)	Background Concentration (µg/m^3)	Total Predicted Impact (µg/m^3)	NAAQS/ WAAQS (µg/m^3)	Percent of NAAQS/WAAQS
NO_2	Annual	11.5	3.4	14.9	100	15
PM_{10}	24-Hour	20.8	33	53.8	150	36
	Annual	3.7	16	19.7	50	39
$PM_{2.5}$	24-Hour	7.0	13	20.0	65	31
	Annual	1.0	6	5.0	15	33
CO	1-Hour	222.6	3,336	3,559	40,000	9
	8-Hour	85.9	1,381	1,467	10,000	15
SO_2	3-Hour	20.2	132	152.2	1,300	12
	24-Hour	9.7	43	52.7	365 / 260	14 / 20
	Annual	3.2	9	12.2	80 / 60	15 / 20
O_3	1-Hour	23.0	75.2	98.2	235	42
	8-Hour	16.1	75.2	91.3	157	58

Table 4-3. Maximum Predicted Near-Field Impacts from Project Sources – Comparison to PSD Increments, Atlantic Rim Natural Gas Project.

Pollutant	Averaging Period	Maximum Predicted Impact of All Phases (µg/m^3)	PSD Class II Increment (µg/m^3)
NO_2	Annual	11.5	25

Table 4-4. Maximum Modeled HAP Impacts from Project Sources, Atlantic Rim Natural Gas Project.

Hazardous Air Pollutant	Averaging Period	Maximum Modeled Impact ($\mu g/m^3$)	Health Based Standards (Acute RELs and RfCs) ($\mu g/m^3$)
Benzene	1-Hour	926	1,300
	Annual	0.02	30
Toluene	1-Hour	1,414	37,000
	Annual	0.03	400
Ethylbenzene	1-Hour	154	35,000
	Annual	0.003	1,000
Xylenes	1-Hour	823	22,000
	Annual	0.02	430
n-Hexane	1-Hour	3832	39,000
	Annual	0.08	200
Formaldehyde	1-Hour	11	94
	Annual	0.003	9.8

Table 4-5. Long-term MLE and MEI Cancer Risk Analyses, Atlantic Rim Natural Gas Project.

Analysis	HAP Constituent	Modeled Concentration ($\mu g/m^3$)	Unit Risk Factor $1/(\mu g/m^3)$	Exposure Adjustment Factor	Cancer Risk
MLE	Benzene	0.019	7.8×10^{-6}	0.0949	1.39E-08
	Formaldehyde	0.0030	1.3×10^{-5}	0.0949	3.66E-09
Total Combined Risk					1.8×10^{-8}
MEI	Benzene	0.019	7.8×10^{-6}	0.71	1.04E-07
	Formaldehyde	0.0030	1.3×10^{-5}	0.71	2.74E-08
Total Combined Risk					1.3×10^{-7}

Direct Project source emissions from the Proposed Action would result in an ANC change less than the LAC at analyzed acid-sensitive lakes. The predicted maximum S and N deposition potential impacts from Proposed Action sources are below the 0.005 kg/ha-yr DAT at all the sensitive PSD Class I and Class II areas.

In-Field Impacts

The CALPUFF model was also used to predict maximum air quality impacts, from field wide emissions sources, at locations within and adjacent to the ARPA. The model-predicted concentrations of NO_2, SO_2, $PM_{10,}$ and $PM_{2.5}$ at locations within and nearby the ARPA were added to monitored background concentrations and compared to applicable ambient air quality standards. The estimated Project-related potential impacts are below applicable ambient air quality standards.

4.2.5 Alternative B – Spatial Alternative

Air quality impacts under Alternative B would be less than or equal to those predicted for the Proposed Action. The Proposed Action modeling analyzed a worst-case field development scenario; furthermore, any additional mitigation requirements due to the location of impacts from other resources would be expected to reduce air emissions below levels analyzed.

Near-field impacts would be less than NAAQS and WAAQS. Far-field concentrations would be below all applicable WAAQS, CAAQS, NAAQS, and PSD increments. Direct visibility potential impacts would be below the "just noticeable visibility change" (1.0 dv), at all sensitive Wilderness Areas using both FLAG and IMPROVE background visibility data. The predicted maximum S and N deposition potential impacts from Proposed Action sources are below the 0.005 kg/ha-yr DAT at all analyzed sensitive PSD Class I and Class II areas. ANC change would be less than the LAC at analyzed acid-sensitive lakes.

4.2.6 Alternative C – Temporal Alternative

Air quality impacts under Alternative B would be less than or equal to those predicted for the Proposed Action. The Proposed Action modeling analyzed a worst-case field development scenario, and any limitation on field development schedule would be expected to reduce short-term and annual air emissions within the ARPA, which would in turn reduce short-term and annual air quality impacts. An extension of the LOP (with no change in total field development) would result in the same amount of air emissions as the Proposed Action over the longer LOP and, as a result, less air emissions annually.

Near-field impacts would be less than NAAQS and WAAQS. Far-field concentrations would be below all applicable WAAQS, CAAQS, NAAQS, and PSD increments. Direct project visibility impacts would be below the "just noticeable visibility change" (1.0 dv), at all sensitive Wilderness Areas using both FLAG and IMPROVE background visibility data. The predicted maximum S and N deposition potential impacts from Proposed Action sources are below the 0.005 kg/ha-yr DAT at all analyzed sensitive PSD Class I and Class II areas. ANC change would be less than the LAC at analyzed acid-sensitive lakes.

4.3 SOILS

4.3.1 Introduction

Potential impacts resulting from construction/installation of drill pads, pipelines, ancillary facilities, and access roads would include a loss/reduction of vegetation cover and biological soil crusts, exposure of vulnerable sub-surface soil profiles, loss/reduction of sub-surface biological components (i.e., earthworms, nematodes), undesirable mixing of soil horizons, soil

compaction, and loss of topsoil productivity. These impacts, singly or in combination, would increase the potential for valuable soil loss due to increased water and wind erosion, invasive/noxious/poisonous plant spread, invasion and establishment, and increased sedimentation and salt loads to the watershed system.

4.3.2 Impact Significance Criteria

The following criteria serve as a basis to assess the intensity, duration, and magnitude of potential soil impacts associated with implementation of the Proposed Action and Alternatives. Soil impacts would be significant given the following:

- Soil erosion is increased beyond two tons per acre per year within five years of disturbance;
- Interim reclamation is not successful within three years of implementation;
- Water Resources significance criteria are not met
- Vegetation significance criteria are not met
- Soil productivity is reduced to a level that prevents the disturbed area from recovering to pre-disturbance soil/vegetation productivity levels;

4.3.3 Direct and Indirect Impacts

4.3.3.1 Proposed Action

The Proposed Action and resulting construction and operation of wells, pipelines, roads, and facilities in the ARPA would result in adverse impacts to the soil resource by:

- Removal/damage of existing native vegetation and surface litter thus increasing wind erosion potential, increasing raindrop impacts to exposed soils and water erosion potential, and increasing soil surface temperature;
- Removal/damage of biological soil crusts;
- Removal/damage of topsoil and sub-soil fauna (macro- and microorganisms);
- Compaction of soils;
- Mixing of topsoil horizons, especially when mixed with sub-soils of high salt content; thus increasing topsoil salinity content;
- Increasing potential for undesirable (invasive/noxious/poisonous) plant invasion and establishment;
- Increasing potential for sedimentation/salt loads to the watershed, including stock ponds;
- Decreasing topsoil productivity.

As described in the Soil Section of Chapter 3, most soils in the ARPA have been mapped and sensitive soils identified. Implementation of the Proposed Action may occur in/on soils that have severe existing limitations. Table 3-10 summarizes the total area (acres) that may be affected by these limiting factors identified in the ARPA.

Because sensitive soil mapping units are widely distributed throughout the ARPA, total avoidance of these areas is not feasible. Minimizing the locations of facilities in sensitive areas to the maximum extent possible would be required to reduce adverse impacts to an acceptable level. Strict adherence to Best Management Practices/Conditions of Approval (Appendix H), the RMP, Non-point Source Pollution (Appendix J), and the Reclamation Plan (Appendix B) would be necessary to minimize adverse impacts. With these measures implemented, and

Over the estimated 20-year development phase, the Proposed Action is estimated to initially disturb a total of 15,800 acres which represents about 6% of the total land surface of the project area. During the projected 30-50 year life-of-project (LOP), the initial disturbed acreage would be gradually reduced to about 4,300 acres dependent upon time required for successful reclamation. Approximately 1050 total well locations would be developed in the first six years. The entire project area would be developed over a twenty year period, with approximately 95% of the CBNG wells and 75% of the conventional wells being drilled within 15 years.

A large portion of the project area would be difficult to re-vegetate due to high erosion potentials and poor topsoil. Some areas of clayey soils, sandy soils, and slopes > 25% would be avoided by final site choices during the onsite inspections for each year's development plan.

In general, the extent of these impacts to the soil resource would be influenced by the success of mitigation and reclamation efforts. Reclamation success, in part, depends on the amount of surface area disturbed, quality of topsoil salvaged, stockpile/redistribution methods in disturbed areas, precipitation, soil type, and moisture availability.

Despite the difficulty of establishing vegetation on sites with <10 inches average annual precipitation, current technology exists to stabilize these areas and minimize soil erosion as natural succession returns the site to pre-existing conditions. The reclaimed areas within the interim drilling PODs have not shown this success to date, however. There are many disturbed areas with increased erosion, weed infestations, and low native vegetation cover. Erosion could be reduced and reclamation success improved, assuming construction, maintenance and operation of well pad sites and associated disturbances are in accordance mitigation measures in Chapter 2, BMPs, and the RMP requirements. The increased pace of development would intensify the rate of soil exposed and the need for reclamation. Many areas would exceed the significance criteria for soils; therefore the project would exceed the significance criteria.

Surface disturbing activities have the potential to disturb or destroy biological soil crusts, if they are present. Loss of biological soil crusts by burying is inevitable with road construction, trenching, and other operations that remove vegetation and top soil. Disturbance to biological soil crusts can be minimized by limiting off-road vehicle activity (especially heavy construction equipment, trucks, pickup, and cars). Vehicle tracks often channel water resulting in slowing or preventing crust recovery and increasing erosion potential. Vehicles with high-flotation tires (e.g. all-terrain vehicles or ATVs) exert less force to the soil surface but may still disrupt crusts by rapid turns which shear the topsoil. A one time pass with vehicles crush them and still result in a long-term loss; the length of time necessary to allow recovery is unknown but is estimated at 50-100 years (Belnap 2001). If crusts are removed or buried, recovery time is anticipated to be longer.

4.3.3.2 Alternative A – No Action

Under the No Action Alternative, direct and indirect disturbance of soil and crusts would continue under the interim drilling plan. The remainder of the project area soils would remain unaffected. Given the success of reclamation and weed control efforts during the interim drilling period to date, areas are exceeding the significance criteria for soils.

4.3.3.3 Alternative B

The Temporal Development alternative is the same as the Proposed Action in terms of number of wells drilled and the acres disturbed both short-term and long-term. The principle difference with the Temporal Development alternative is that the majority of disturbance would occur in phases, with the middle area first, followed by the northern then southern portion in subsequent order. Half of the proposed wells would be drilled within the first six years, only within eight sub-watersheds; however, the majority would be in one, Dry Cow Creek. This concentration of development would likely increase runoff and sediment/salt yields beyond the water resources significance criteria. Impacts would exceed the significance criteria for soils. Impacts to crusts would essentially remain the same as described under the Proposed Action.

There may be some benefits to soils related to concentrated development on a regional basis. This method of developing all wells, roads, pipelines and facilities at the same time may result in better planning, reduced well pad locations, and acreage of disturbance.

4.3.3.4 Alternative C

The Spatial Development alternative would proceed with development across the ARPA similar to the Proposed Action, but additional mitigation proposed by soils and other resources would limit the initial disturbance acres on sensitive sites to less than 20 acres per section. Additionally, pad locations would be reduced to 4 per section. Examples of some sensitive sites are: soils with high runoff potential and big game crucial winter range. These would reduce the total acres disturbed by 64 percent compared to the proposed action. Other mitigation measures proposed would further reduce erosion from disturbed sites.

These benefits would be realized to the greatest extent in the central and southern portions where there is a preponderance of BLM lands. The extreme southern portion and the northern half would realize some benefit of these additional mitigations, but their effectiveness would be reduced due the lack of equivalent mitigation on private and state lands.

This reduction in disturbance acres and application of erosion control techniques would directly reduce the acreage which would exceed the significance criteria as a result of the project. Although some small, localized areas still would exceed the criteria, overall, the project would not exceed the significance criteria.

4.3.4 Impacts Summary

With implementation of the Proposed Action, potential impacts would be reduced assuming construction, maintenance and operation of well pad sites and associated disturbances are in accordance with BMPs and the RMP requirements. Many areas would exceed the significance criteria for soils; therefore the project would exceed the significance criteria.

With implementation of the No Action Alternative, significance criteria would be exceeded.

With implementation of Alternative B, the majority of the impacts would occur in one sub-watershed, resulting in exceeding the significance criteria.

With implementation of Alternative C, impacts would be reduced in extent compared to the proposed action as 36% of the acreage of sensitive soils on public lands would be disturbed. This reduction in disturbance acres and application of erosion control techniques would directly

reduce the acreage which would exceed the significance criteria as a result of the project. Although some small, localized areas still would exceed the criteria, overall, the project would not exceed the significance criteria.

4.3.5 Additional Mitigation Measures

There is no additional mitigation proposed under Proposed Action:

There is no additional mitigation proposed under Alternative B:

Additional mitigation proposed under Alternative C:

- Restrict development to <20 acres total disturbance and 4 pad locations per section for soils with high runoff potential
- Crimp mulch to increase surface roughness on soils with high runoff potential and poor/fair topsoil ratings
- Require reclamation within one year of spud date on soils with poor/fair topsoil ratings
- Apply soil amendments to improve reclamation success on soils with poor/fair topsoil ratings

4.3.6 Residual Impacts

Under the Proposed Action and Alternative B, there would be small areas along roads and well pads with erosion rates and sedimentation/salt yields exceeding the significance criteria.

Under Alternative C, there would be fewer areas, as compared to the proposed action, with erosion rates exceeding the significance criteria.

4.4 WATER RESOURCES

4.4.1 Introduction

The Clean Water Act of 1987, as amended (33 U.S.C. 1251), established objectives to restore and maintain the chemical, physical, and biological integrity of the nation's water. The act also requires permits for point source discharges to navigable waters of the United States and the protection of wetlands, and includes monitoring and research provisions for protection of ambient water quality. Wyoming Water Quality Regulations implement permitting and monitoring requirements for the Wyoming Pollutant Discharge Elimination System (WYPDES), operation of injection wells, groundwater protection requirements, prevention and response requirements for spills, and Water Quality Standards for Salinity in Colorado River System as recommended by the Colorado River Basin Salinity Control Forum and adopted by the State of Wyoming, Department of Environmental Quality.

Protection of Wetlands (EO 11990) requires federal agencies to take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Floodplain Management (EO 11988) provides for the restoration and preservation of national and beneficial floodplain values, and enhancement of the natural and beneficial values of wetlands in carrying out programs affecting land use. Potential project related depletions to the Little Snake River are considered with regard to the Yampa River Basin

Management Plan and the recovery program for Colorado River native fish downstream (http://www.r6.fws.gov/crrip/).

Surface discharge from Federal Mineral Leases managed by the BLM, is subject to BLM approval. Once surface discharge is approved the operations from the point of discharge downstream are under the jurisdiction of EPA or the primacy State. In the general requirements section of Onshore Order #7 the following BLM regulations (bold and italics added):

> All produced water from Federal/Indian leases must be disposed of by (1) injection into the substance; (2) into pits; or (3) other acceptable methods approved by the authorized officer, including surface discharge under NPDES permit. ***Injection is generally the preferred method of disposal.*** **43 CFR 3160**

Below is an excerpt from Onshore Order #7, concerning surface discharge (bold and italics added):

> ***Operations from the point of origin to the point of discharge under the jurisdiction of the BLM.*** Operations from the point of discharge downstream are under the jurisdiction of EPA or the primacy State. **43 CFR 3160**

Some of the regulations described above require that certain permits/authorizations be obtained for project authorization including WYPDES permits for surface discharge of produced water; development of a surface runoff, erosion, and sedimentation control plan; oil spill containment and contingency plan; as well as CWA Section 404 permits in the Colorado River and North Platte River Drainage Basins. Since the Great Divide Basin is unconnected to navigable surface waters it is not subject to CWA Section 404 permits according to current court rulings.

For the purpose of analysis all actions and alternatives would be assumed to adhere to these plans and regulations for the protection of water resources. Discussions about how this would occur would be included in this section in regard to potential impacts to water resources.

Two BLM alternatives would be considered along with the proposed and no action alternatives. Many adverse impacts associated with gas development would be common to all alternatives and therefore would be analyzed for general impacts in section 4.4.3. As these impacts vary by alternative and can be expanded on they would be discussed in relation to each alternative.

4.4.1.1 Introduction to Surface Water Impacts

Potential impacts that would occur to the surface water system due to the proposed project include increased surface water runoff, wind erosion, and off-site sedimentation due to soil disturbance associated with construction activities (Soils Section 4.3), water quality impairment of surface waters, and stream channel morphology changes due to road and pipeline crossings. The magnitude of the impacts to surface water resources would depend on the proximity of the disturbance to a drainage channel, slope aspect and gradient, degree and area of soil disturbance, soil character, and duration of time within which construction activities occur, and the timely implementation and success/failure of mitigation measures. Impacts would likely be greatest shortly after the start of construction activities and would likely decrease in time due to stabilization, reclamation, and revegetation efforts (see Appendix B, H and J). Changes in surface flow patterns from road construction would continue through the live of the project and may extend beyond the project life if these roads are left in place. Petroleum products and other chemicals could be accidentally spilled resulting in surface water contamination. If these

spills occur they would be addressed with the Hazardous Materials Management and Release Contingency Plans for the Atlantic Rim Project.

4.4.1.2 Introduction to Groundwater Impacts

The primary effects on groundwater resources would be associated with the removal of groundwater contained in coal seam aquifers and the subsequent recharge of aquifers through injection of produced water. The removal of groundwater from the coal aquifer results in the reduction of the hydraulic pressure head. The hydraulic pressure head is the vertical distance between the static water level in a well and the top of the confined aquifer that the well is completed in. The lowering of water levels in an aquifer is also referred to as drawdown. The effects would result in progressive drawdowns within nearby wells completed in the same coal seam aquifers and/or the interruption of groundwater flow to existing nearby springs, seeps and flowing artesian wells receiving groundwater from the same coal aquifer. Another impact of the proposed project on groundwater resources, albeit minimal and relatively insignificant, would be an increase in the hydraulic pressure head in the aquifers receiving the injected coal bed water.

4.4.1.3 Assumptions for Analysis

Applicant committed measures (described in Appendix K), required BMPs (Appendix H) and BMPs for Non-Point Source Pollution (Appendix J) as applicable, as well as the regulation and plans described in Introduction would be adhered to under all alternatives. The ARPA presently contains several active fields, currently there are 210 active producing natural gas wells with accompanying production-related facilities, roads, and pipelines. While the ARPA environmental analysis is being prepared, BLM has allowed the interim drilling of a maximum of 200 natural gas wells, of which only 116 were drilled in nine POD locations specifically for the purpose of data acquisition necessary for the completion of the Atlantic Rim EIS.

The no action alternative as described in Chapter 2 would deny the proposed action. The existing pods would continue to be developed as described in the EAs for each pods (see Table 1-3. Current POD Status and General Location). Impacts would be similar to those described in the EAs for the pods and new proposals for developing gas leases in the project area would be considered as they are proposed. If impacts become significant for these proposals a new EIS process may be initiated.

All Action alternatives assume the construction of 2,000 wells and associated roads and pipelines based on the drilling schedule shown in Figure 4-6: Proposed Action Annual Drilling Assumptions by Well Type. The specific location of these facilities has not been provided by the operator under any alternative. The proposed action includes well pad locations in the modified EIS boundary described in Appendix K and would potentially be developed with 8 well pad locations per section anywhere within this boundary. This would result in approximately 3,420 (428 mi^2 x 8) potential well pad locations to analyze. As of 2005, there have been approximately 210 existing wells and 200 allotted for the interim drilling period. The proposed new well pad locations are 2,000 (CBNG and Conventional), this means that there are about 1,000 well pad locations that would not be used in the modified EIS boundary under all of the action alternatives.

Alternative B (Temporal Alternative) concentrates impacts into the middle, northern and finally the southern portion of the proposed action boundary. Impacts of individual well pads, roads, pipelines and other infrastructure would have the same impacts as the proposed action, their location and timing however would allow for economies of scale and potentially better planning.

Alternative C (Spatial Alternative) would not allow pad sites in some areas of environmental concern and would institute development protection measures that are based on resource concerns identified using spatial data (Geographic Information Systems). Many of these protection measures are specifically designed to reduce impacts to surface and ground water resources. Where these development protection measures don't apply impacts from individual well pads, roads, pipelines and other infrastructure would have the same impacts, this includes private and state lands.

4.4.1.3.1 Surface Water Assumptions

The analysis for surface water is based on the following specific assumptions:

- Disturbance to soil and vegetation, including compaction of soil or changes in vegetative cover, would increase water runoff and downstream sediment loads, and lower soil productivity thereby degrading water quality, channel structure, overall watershed health in some locations. The significance of this impact would depend on the alternative selected.

- The degree of impact attributed to any one disturbance or series of disturbances is influenced by several factors including location within the watershed, time and degree of disturbance, existing vegetation, and precipitation.

- Increased pollutants in surface waters would degrade habitat used by aquatic life and would affect other beneficial uses (e.g., stock-watering, irrigation, and/or drinking water supplies).

- BLM would continue to develop and maintain water sources in the uplands as a critical tool for managing grazing animals to reduce impacts on wetland/riparian areas.

- Access roads would follow standard practices. However, properly designed roads would still alter hillslope hydrology and concentrate overland flow in some areas. In areas with steep topography, these impacts would increase.

- Fine-textured soils are more susceptible to water erosion and compaction when wet, whereas coarse-textured soils are more susceptible to wind erosion (See Section 4.3 Soils).

The surface water analysis would look at 3,000 potential new well pad locations within the proposed action boundary, with only 2,000 actually constructed under all action alternatives. As described earlier the locations of these new pad locations can not be determined definitively under any of the action alternatives, therefore under each alternative assumptions for pad placement would be made.

4.4.1.3.2 Groundwater Assumptions

For the purposes of analysis the no action alternative for groundwater would only consider the impacts of approved development within the project area. This would include 210 conventional wells and 200 CBNG wells as described in the Interim Drilling Period (Appendix A). The

location of these wells would be in the originally approved POD boundaries and would include 1 injection well for every 12 CBNG wells.

For the purposes of analysis the potential locations of CBNG wells were determined to run the groundwater model. Assumptions were made based on the geology and unit boundaries described by the operator early in the process. The groundwater modeling assumptions are discussed in Section 4.4.3.

4.4.2 Impact Significance Criteria

Significance criteria are developed to gauge the magnitude an impact would have on the human environment. An adverse impact on water resources as a result of project actions would be considered potentially significant if its magnitude was such that special mitigation is warranted or it persists indefinitely.

Determining significance is complex, in that impacts are dynamic and may change during the planning period. Significance can be real and supportable by fact, or perceived and perhaps not fully supportable even with rigorous study. For this analysis, the approach to establishing significance criteria was based on legal issues (i.e., government regulatory standards), public perception, available scientific and environmental documentation, and professional judgment of resource specialists.

4.4.2.1 Surface Water Significance Criteria

Impacts to surface water resources would be considered significant if the following were to occur:

- Degradation of water quality beyond the designated use of the receiving water body, or other violations of federal or state water quality standards or negatively impacting a water body listed on the State 303d list of Impaired or Threatened Waterbodies.
- Increasing salt loading to the Colorado River System above background conditions.
- Unmitigated loss of wetlands or wetland function (EO 11990 and 11988).
- Project related activities that degrade wetland/riparian areas such that, as a minimum physical state, Proper Functioning Condition (PFC) is not being maintained.
- Streamflow characteristics of intermittent drainages or perennial streams are altered such that established users are affected.
- Accelerated erosion and runoff alters the physical characteristics of streams or drainages, beyond what would be expected with natural processes.
- Alteration of stream channel geometry or gradients that causes undesirable effects such as aggradation, degradation, or side-cutting.
- Disturbed areas are not adequately stabilized and accelerated erosion and runoff into intermittent drainages and perennial streams cause increased sedimentation that degrades the quality of water to the extent that does not support its designated use.

- If any of the actions would lead to non-compliance with regulations or plans described in 4.4.1 Introduction or Standards for Healthy Rangelands (BLM, 1997).

- Accidental spills of fuels, liquids, chemicals, or hazardous material affects the quality of surface water.

4.4.2.2 Groundwater Significance Criteria

Impacts to groundwater resources or springs would be considered significant if the following were to occur:

- The natural flow of groundwater to existing local springs, seeps, and flowing artesian wells is interrupted, regardless of use or non-use.

- Groundwater quality in any aquifer is degraded such that it can no longer be classified for its current use(s).

- The depth to groundwater is increased to a level that would require replacement or deepening of WSEO-permitted water wells in the project area (see Appendix H).

4.4.3 Direct and Indirect Impacts

4.4.3.1 Direct and Indirect Impacts Common to All Action Alternatives

The proposed new well pad locations are 2,000 (CBNG and Conventional) under all alternatives, this means that there are about 1,000 well pad locations that would not be used in the modified EIS boundary under all of the action alternatives. Under all the action alternatives, impacts of individual well pads, roads, pipelines and other infrastructure would have the same individual impacts if no specific mitigation is applied for these locations.

Between the time that the groundwater model was constructed and the Draft EIS was written, the proposed ARPA boundary was changed. The boundary change would not affect the groundwater model within the northern portion of the ARPA. However, within the central portion of the ARPA, the new boundary extends into some of the modeled wells. These wells would need to be moved in subsequent model runs. This would change the spatial distribution of wells, which would likewise change the shape of the drawdowns. Because in general the drawdowns do not propagate long distances, the drawdown figures within the EIS are not expected to change significantly. However, by moving the wells further into the basin and away from the outcrop, the recovery time for the project may increase; yet at the same time there is likely to be fewer impacts on the contact springs. The net change is not expected to change the impact analysis, even though the temporal distribution of the changes would be slightly different.

All action alternatives would remove water from the coal seams in the Mesaverde Formation and would result in lowering of pressure within the formation with associated impacts. These would be in slightly different locations and at different times depending on the action alternatives.

4.4.3.1.1 Surface Water Impacts Common to All

The main impacts of the project related to surface water resources are the removal of vegetation, increased soil surface exposure, mixing of soil horizons, soil compaction and decreased infiltration capacity, loss of topsoil productivity, and increased susceptibility of the soil to wind and water erosion. Therefore, the primary impact of the proposed project on surface water resources is increased surface runoff, erosion and off-site sedimentation that would cause channel instability and degradation of surface water quality in some locations.

4.4.3.1.1.1 Surface Hydrology Related to Soils Data and Topography

Soils with the potential for severe water erosion about comprise about 85% of the ARPA (261,000 acres of slight/severe, moderate/severe and severe/severe categories, see Table 3-13 and 3-14. Areas of Soil Factors of Concern). These tables summarize the data for these five categories (water erosion, wind erosion, runoff potential, topsoil rating, and road rating) and their individual ranking criteria for the contiguous ARPA. Since so much of the ARPA has the potential for severe water erosion, soil disturbance both during construction and during production can be expected to result in hillslope and channel erosion under each alternative above background conditions. Erosion in areas with sensitive soils can be either catastrophic or simply chronic. Surface disturbance combined with sensitive soils and highly variable precipitation can result in sudden and dramatic erosion in the form of rilling and gullying, even in relatively gentle terrain. These catastrophic failures can produce very high quantities of sediment and can appear to be random and unpredictable.

Soil depth ranges from shallow to deep, soil drainage from somewhat poor to somewhat excessive, permeability ranges from slow to rapid, water capacity ranges from very low to high, runoff from slow to rapid, and susceptibility to water erosion ranges from slight to very severe. The diversity of soil parameters would require a broad spectrum of reclamation techniques. In addition, low annual precipitation and wind and water erosion could make successful reclamation in the ARPA difficult to attain. Therefore, the overall potential for successfully stabilizing disturbed soils is poor to fair.

Slopes rated strong (15%) or greater occupy at least 21 percent (65,000 acres) and a much smaller percent of residual slopes and flats within the overall project area. In nearly half of the instances of strong slope, shallow depth to rock and/or high sand content may be anticipated as a further complication.

Since specific sites have not yet been identified for wells, pipelines, and roads, Tables 3-10 and 3-11 indicate a likelihood of encountering soil limitations that would require special attention. For example, large portion of the ARPA would likely experience difficulties during revegetation due to the presence of excess salts and/or clay in the soil.

4.4.3.1.1.2 Reclamation Success and Roads

It is important to note that even successful reclamation does not necessarily return an area to its previous function for surface hydrology. This is because perennial forbs, brush and trees generally are more effective at reducing rain splash and can provide structure on the soil surface that can reduce surface runoff energy, but are generally not required for reclamation. Anderson (1975) in a study of 23 watersheds found that conversion of a steep forest and brush lands to a grassland had multiplied sediment yields by 5 times. All though this is an extreme case, it points out that not all vegetation is the same hydrologically. Some areas where interim

reclamation has been successful may begin to get sagebrush and other brush regeneration within the project life, however many areas would not return to pre-disturbance function until 30 – 50 years after final reclamation.

New access roads would be constructed for the purpose of natural gas field development. There are three type of roads identified for the project. Collector and local roads are to access multiple well pad locations and resource roads are to access individual well pads. As described in the applicant committed measures (Appendix K), roads would be designed to BLM Manual 9113 standards and to minimize disturbance, and all surface disturbance would be contained within the road ROW. In the event drilling is non-productive, all disturbed areas, including the well site and new access roads, would be reclaimed to the approximate landform that existed prior to construction. If drilling is productive, all access roads to the well site would remain in place for well servicing activities. Partial reclamation would be completed on segments of the well pad and access road ROW no longer needed.

Road construction under all alternatives would modify the surface hydrology by intercepting and concentrating shallow groundwaters and increasing surface runoff. For example cut slopes can often capture soil macropores and road surfaces decrease infiltration and can concentrate flows. Roads would also contribute sediment to downstream drainages from the road surface and from surface disturbance based on construction and road maintenance activities. Properly designed roads would be more able to shed water in a non erosive manner and this would reduce impacts compared to roads that are improperly or inadequately designed. However, even with proper design using BLM Manual 9113 standards, there would be local impacts in terms of erosion and changes in hydrology. Where roads are in steep country and/or road densities are great these impacts can be expected to include accelerated erosion and increased runoff and could alter downstream stream channels significantly.

During drilling and completions operations, according to Table K-11 Traffic Estimates, roads could be used by about 13 heavy trucks per week for about two weeks, and about 5 to 10 small trucks per day. During production resource roads would be used less often (maybe 1 small truck per day) and would occasionally accommodate heavy trucks for water disposal, reclamation activities, and well maintenance. This means that road design needs to allow for heavy truck traffic and at least on visit per day in all kinds of weather. Road design and maintenance is therefore critical to reduce impacts from the project.

Site erosion and off-site sedimentation from pad sites would be reduced by revegetating unused portions of the pad sites in the first appropriate season (fall or spring) after drilling, and providing surface water drainage controls, such as berms, sediment collection traps, diversion ditches and erosion stops as needed. These measures would be described in the individual APD/ROW.

Under all action alternatives local impacts would include accelerated erosion and increased runoff leading to increased sedimentation and changes in hydrology from surface disturbance for the construction of pad sites, roads and pipelines. Depending on the alternative considered these impacts could be significant based on section 4.4.2 Impact Significance Criteria.

4.4.3.1.1.3 Surface Water Quality Impacts from Salinity Offsets

Surface discharge at the Cow Creek POD can be expected to continue through the life of the project under all alternatives according to the WYPDES permit # WY0042145 and #WY0035858 which allows for 1.34 tons/day and 180,600 gallons/day of total discharge under both permits. As an offset for an oil well (as defined by the Colorado River Salinity Control Forum) and the

permit allows for the same volume of water and salt as was discharged by the oil well plugged (#1X-12).

This discharge is in to a reservoir on a tributary to Dry Cow Creek; this reservoir would be improved and maintained according to this use. The discharge permit is currently being modified to allow for water releases from the reservoir in a similar manner as what occurred historically when #1X-12 was in operation; however volume restrictions would still be in place. The permit would have a new point of compliance upstream of the confluence with Cow Creek. This point of compliance would be monitored for flow, according to the permit it should only have water during storm events, i.e. in response to natural precipitation and not a result of project discharges since Dry Cow Creek is ephemeral.

The Colorado River Salinity Forum established by the 1974 Colorado River Basin Salinity Control Act, Public Law 93-320 regulates in terms of salt loads. Current loads approved by the State exceed the 1 ton per day limit because of the offset value of plugging #1X-12. Allowing for offsets with volume restrictions limited to historical levels with flowing wells is not expected to have any significant impacts, since project related discharges would be almost identical to current conditions.

4.4.3.1.2 Groundwater Impacts Common to All

The primary effects on groundwater resources would be associated with the removal of groundwater contained in coal seam aquifers and the subsequent recharge of aquifers through injection of produced water. The removal of groundwater from the coal aquifer results in the reduction of the hydraulic pressure head. The hydraulic pressure head is the vertical distance between the static water level in a well and the top of the confined aquifer that the well is completed in. The lowering of water levels in an aquifer is also referred to as drawdown. The effects would result in progressive drawdowns within nearby wells completed in the same coal seam aquifers and/or the interruption of groundwater flow to existing nearby springs, seeps and flowing artesian wells receiving groundwater from the same coal aquifer. Another impact of the proposed project on groundwater resources, albeit minimal and relatively insignificant, would be an increase in the hydraulic pressure head in the aquifers receiving the injected coal bed water.

Between the time that the groundwater model was constructed and the Draft EIS was written, the original proposed ARPA boundary was changed. The boundary change would not affect the groundwater model within the northern portion of the ARPA. However, within the central portion of the ARPA, the new boundary extends into some of the modeled wells. These wells would need to be moved in subsequent model runs. This would change the spatial distribution of wells, which would likewise change the shape of the drawdowns. Because the drawdowns do not propagate long distances, the drawdown figures within the EIS would not change significantly. However, by moving the wells further into the basin and away from the outcrop, the recovery time may increase; yet have less impact on the contact springs. The net change would not be significant, only the temporal distribution of the changes would be slightly different.

Groundwater could also be affected during construction of drill pads and wells or by other project development activities. Improper casing and cementing of wells, undetected spills, or leachate from produced water or mud pits could introduce contaminants into the groundwater. Chemicals used for production drilling could cause local contamination of soils and groundwater if not managed properly. Construction of drilling pads, proper disposal practices, proper well casing and cementing, and recycling of drilling fluids would be in accordance with BLM guidelines and should minimize adverse effects on groundwater quality. If accidental spills occur

they would be addressed with the Hazardous Materials Management and Release Contingency Plans for the Atlantic Rim Project (Appendix C).

Appropriate measures would be taken during project development to prevent adverse impacts on existing groundwater quality during dewatering. Given the present state and federal regulations regarding general water quality, as well as salinity in the Colorado River Basin, surface discharge of produced water is not anticipated. Water would be used during construction, drilling activities, and dust abatement subject to State permits. Most of this water would come from the Coalbed Natural Gas wells however the source of this water, particularly for construction and dust abatement may come from sources that could impact surface resources. Therefore, water to be used for construction and dust abatement was estimated and depletions consulted on with the Fish and Wildlife Service in regard to the Upper Colorado Endangered Fish Recovery Program. Water produced from coal seams is assumed to be unconnected to surface water based on isotopic analysis, groundwater modeling and water quality characteristics.

If accidental surface discharges occur, they could adversely impact nearby surface water quality by increasing salinity levels. The extent of any impact would depend on the quality and quantity of the produced water and any fluids being released and would be addressed with the Release Contingency Plan.

4.4.3.1.2.1 Water Disposal Using Injection

Produced water would be disposed in underground injection wells, except in the case of the Cow Creek POD that has a surface discharge WYPDES permit that allows for the discharge of produced water as an offset for a flowing well (#1X-12) that was plugged in the same area. The conditions of this permit allow for the same volume of salt and water to be discharges as what would have occurred had not the well been plugged. Produced water would also be used for drilling, construction, dust abatement, and other project related water uses subject to approval from the State of Wyoming for this use. Water could also be used in closed-system stockwatering tanks. None of these uses would be for water disposal needs; primary water disposal would be through injection wells.

The underground disposal of produce water would be accomplished using deep injection wells. Depth of the injection wells, which would be completed in the Hatfield, Cherokee, and/or Deep Creek Sandstones, is expected to range from 3,200 to 6,400 feet. All injection wells would have permits prepared and submitted to the WOGCC and SEO. The only effect on the injection horizons would consist of an increase in the hydraulic head emanating from the injection well, which would dissipate with distance away from the well bore.

Produced water would be collected in a buried polyethylene flowline (pipeline) for transport to an injection well. Centrifugal pumps, reciprocating pumps, filter systems, and tanks at the disposal facility would be used to remove solids from the water stream and to pump the water at pressures sufficient to allow downhole disposal. In the event that an injection well ceases to operate properly due to formation over-pressuring or mechanical failure, the operator must still remain in compliance with all applicable regulations governing the operation of the produced water disposal system. Compliance options available to the operator include curtailing or halting the rate of water production or routing the discharge to additional injection wells.

Each deep injection well would have an approximate minimum injection capacity of 5,000 bbls/day and a maximum injection capacity of 15,000 bbls/day. A predicted volume of produced

water in the best success scenario for the proposed well development would be 250,000 to 450,000 bbls/day for approximately 6 to 8 years. The volume of water would be on a consistent decline as the coal seam is dewatered.

The deep injection wells would be drilled, cased, and cemented from total depth (approximately 50 feet below the base of the Hatfield, Cherokee, or Deep Creek Sandstones) to the surface. These sandstone units are isolated above by the Lewis Shale and below by the Baxter or Steel Shale, which are thick, competent marine clays that are effective barriers to groundwater flow. The deep sandstones would be tested to evaluate suitability for disposal before any water is injected. Maximum pressure requirements to prevent initiation and propagation of fractures through overlying strata to any zones of fresh water have also been determined and would be regulated by the State of Wyoming and the BLM. The results of the open-hole log and injectivity test would be provided to the regulatory agencies. The injectivity tests would be used to determine the fracture pressure limits that would be imposed to insure the overlying and underlying shale is not breached. The fracture gradient of the shale aquitards that overlie and underlie the injection horizons would not be exceeded based on injectivity tests and applicable permit limits. Thus, all injected water would be contained in the injection horizon and would not migrate vertically.

In summary, groundwater would be removed from a formation that is stratigraphically lower and hydraulically isolated from shallow groundwater sources that have been or are most likely to be developed by water wells used for purposes other than CBNG development. The proposed injection zone is stratigraphically lower than the shallow groundwater sources. Shallow groundwater sources (stratigraphically above the Mesaverde coal zones) are not likely to be affected by the project.

4.4.3.1.2.2 Groundwater Quality

Well drilling and completion should not have an adverse effect on existing groundwater quality if the project is in compliance with “On-Shore Oil and Gas Order No. 2”. However, poor drilling and completion techniques could result in degradation of groundwater quality due to the mixing of variable quality waters from different water-bearing strata that happen to be pierced by the borehole. The magnitude of mixing, if any, which would occur during the relatively short period of time during drilling would be relatively small. In addition, due to the state-of-the-art drilling and well completion techniques, the possibility of significant degradation of groundwater quality in any aquifers is low.

Well completion must be accomplished in compliance with “Onshore Oil and Gas Order No 2”. These guidelines specify the following:

“…proposed casing and cementing programs shall be conducted as approved to protect and/or isolate all usable water zones, potentially productive zones, lost circulation zones, abnormally pressured zones, and any prospectively valuable deposits of minerals. Any isolating medium other than cement shall receive approval prior to use.”

Usable water is defined as groundwater with a TDS of 10,000 ppm or less encountered at any depth. To comply with the order, wells must be completed such that either usable water is isolated from “unusable” water, or that unusable water is isolated from usable water through the use of cementing and other proven technologies. Assuming compliance with this order, no contamination of usable groundwater would likely occur. Well drilling and completion as proposed in Chapter 2 appears to comply with the on-shore order.

Injection of the CBNG-produced water is not expected to result in any deterioration in groundwater quality within the injection horizon. The proposed injection targets have been water quality tested to evaluate suitability for disposal, and the results show that groundwater to be of lower quality than the produced water from the coal beds of the Mesaverde Group. Sandstone strata of the injection zones are isolated above and below by competent shale barriers that would prevent the infiltration of the injected water into any overlying fresh water zones. BMPs would be implemented to ensure surface spills of produced water do not occur. All water disposal plans would be permitted with the state agency that regulates the facilities, including but not limited to the WOGCC and WDEQ/WQD.

The improbability of degradation of groundwater quality within any aquifers within and outside of the ARPA essentially eliminates the possibility of adverse effects to the area's groundwater right holders.

4.4.3.1.2.3 Springs and Seeps

The ARPA contains numerous springs, seeps, and flowing wells, which are important local water sources for livestock and wildlife. At least 16 flowing wells and 70 active springs are contained within the ARPA. Prolonged drought in southern Wyoming has reduced the number of seeps, especially in the Sand Hills portion of the project area, they are expected to recover along with the drought conditions.

Springs in the ARPA occur primarily at the contact between the Upper Cretaceous Mesaverde Group and the overlying Tertiary-age deposits of the Browns Park Formation. Springs also occur within the outcrop area of the Mesaverde Group itself. Springs located at the Browns Park/Mesaverde Group contact are far more common, generally have higher yields, and are of better water quality than those springs issuing from units within the Mesaverde Group. The quality of water sampled from many of the flowing wells in the ARPA indicates that the groundwater is from the Almond Formation coal seams. Groundwater level drawdowns in the Almond Formation coal seams resulting from the proposed project would likely cause a reduction or discontinuance of discharge from flowing wells that are completed in an affected coal seam aquifer.

Tertiary deposits in the ARPA near the surface are recharged by direct downward percolation of precipitation and snowmelt and from seepage losses from streams. Deep aquifers in the ARPA are also recharged by these processes in outcrop and subcrop areas and from slow leakage from overlying and underlying aquifers. The extent of the Tertiary units (Browns Park and North Park Formations) that lie atop the eroded, dipping Cretaceous units indicates a probable significant recharge of the underlying permeable Mesaverde Group exists at this angular unconformity-type contact area. Should groundwater withdrawals from Mesaverde Group coal beds in the ARPA result in water-level declines that propagate updip to their subcrop areas beneath the overlying Tertiary units, the Proposed Action could adversely affect some of the Cretaceous/Tertiary contact seeps and springs. However, the predicted groundwater drawdown analysis for this project does not indicate groundwater level declines would extend updip to the coal seam subcrop areas. Therefore, it is unlikely that the proposed project would have a dewatering effect on the overlying Tertiary deposits, which would diminish flows from the contact springs and seeps.

All construction activities and storage of petroleum products would be kept away from seeps and springs (a minimum distance of 200 to 600 feet depending on the type of spring). Therefore, contamination of seeps and springs and groundwater would be unlikely.

4.4.3.1.2.4 Flowing Wells

Flowing wells in the project area have been developed to supply water to wetland areas and stock watering facilities and may be impacted by reducing flow volumes or changing water quality characteristics. Many of these flowing wells are abandoned exploratory oil and/or gas wells that had some portion of the casing fail adjacent to strata under artesian pressure. It is likely that some of these flowing wells have casing failures adjacent to Almond Formation coal seams targeted by this project for production and therefore may be impacted by reducing flow volumes. The groundwater model predicts a 3 to 30% decrease in flowing well volumes by 2050, with full recovery in the year 3000 (WWC, 2005)

4.4.3.1.2.5 Water Rights Related to Groundwater

As discussed in Chapter 3, the SEO records identify 90 active permitted, non-CBNG-associated groundwater rights in the ARPA. Of the 90 permitted wells and springs, 58 reported positive yields, the majority of which are developed within the Mesaverde Group and the Browns Park Formation. Groundwater currently in use in the project area that is obtained from Tertiary-age units should not be adversely affected by groundwater level declines in the Mesaverde Group coal seams. Permitted water rights in the project area that obtains water from the Cretaceous-age coal seams that are dewatered by the proposed project may be adversely affected by the resulting groundwater level declines. However, the targeted coal seam aquifers are stratigraphically lower and hydraulically isolated from shallow groundwater sources that are typically developed and permitted with the SEO. This, combined with the improbable degradation of groundwater quality would essentially eliminate the potential occurrence of adverse impacts to groundwater right holders within and near the ARPA.

A numerical groundwater flow model was used to predict drawdown impacts to the groundwater system under the Proposed Action. Modeling was necessary because of the large extent of, variability in, and cumulative stresses imposed by development of CBNG on the coal seam aquifers of the Mesaverde Group. The assumptions used to support the predicted groundwater drawdown analysis, the computer model used in the analysis, and the predicted drawdown impacts for this project are describe in detail in the Atlantic Rim EIS Ground-water Modeling Technical Support Document.

4.4.3.1.2.6 Regional Groundwater Model Description and Findings

The regional model of groundwater flow for the ARPA is based on the geology and hydrogeology described in Chapter 3. The groundwater model encompasses the western flank of the Sierra Madres and extends into the Washakie Basin roughly 30 miles west of the ARPA. This model cannot be used to predict results at a localized scale and any attempts to do so would require additional data and additional modeling efforts. Between the time that the groundwater model was constructed and the Draft EIS was written, the original proposed ARPA boundary was changed. This could alter some of the groundwater modeling results, but should not result in appreciable changes that would change the impact analysis. The model would be re-run with the modified boundary for the Final EIS release. Atlantic Rim groundwater model Technical Report (WWC 2005) includes a detailed discussion on calibration of the groundwater flow model.

The hydrogeologic model code selected was the USGS Three Dimensional Finite Difference Modular Groundwater Flow Model, MODFLOW (MacDonald and Harbaugh 1988) and the pre/post processor, Groundwater Vistas (Rumbaugh and Rumbaugh 2002).

Hydrogeologic Groups in the ARPA

Within the ARPA, the Mesaverde Group strata dip westward off the Sierra Madre uplift at about 8 to 12 degrees. The total thickness of the Mesaverde Group is approximately 2,000 to 3,000 ft. The Mesaverde Group consists of four members, which in ascending order are the Haystack Mountains Formation, the Allen Ridge Formation, The Pine Ridge Formation, and the Almond Formation. The uppermost member, the Almond Formation, contains numerous carbonaceous shale intervals and coal beds. The lateral continuity of these coal units is considered sufficient such that they act as a regional aquifer system. Although individual coal seams may split and merge, there is sufficient hydraulic communication, on a regional scale, to allow movement of groundwater.

The coal-bearing Almond Formation ranges in thickness from 400 to 600 ft and occurs at depths of less than 100 ft in the center of the ARPA to about 1,800 ft below ground level along the western boundary. The Lewis Shale, which overlies the Almond Formation, reaches a thickness of 2,700 ft in the Washakie Basin and is consistently more than 2,000 ft thick in the ARPA except where it has been removed by erosion. The Lewis Shale is a low permeability unit considered to be a regional confining layer. Unconformably overlying the Cretaceous sediments is the Tertiary-age Browns Park Formation. Contact springs are relatively common at the base of the Browns Park Formation where it is in contact with the less permeable units of the Mesaverde Group. Due to the lack of contact between the Almond Formation and the Browns Park Formation, groundwater within the Browns Park could not be impacted by groundwater withdrawls from the Almond; therefore, the Browns Park Formation was not included in the model.

Assumptions for Groundwater

For the purpose of the modeling study, the primary unit of interest is the coal-bearing Almond Formation and Pine Ridge Sandstone of the Mesaverde Group. Specifically, the coal seams within the Almond Formation and Pine Ridge Sandstone are the aquifers of interest. Overlying the Almond Formation is the Lewis Shale, a regional confining layer. Underlying the Almond Formation is the Pine Ridge Sandstone and beneath the Pine Ridge is the Allen Ridge Formation, which is also considered a confining unit. Therefore, the Almond Formation and the underlying Pine Ridge Sandstone are primarily recharged from natural precipitation infiltration along their outcrop on the western flank of the Sierra Madres. The natural groundwater flow direction is then westward, down dip toward the basin center. Groundwater within the Almond coals is unconfined near outcrop recharge areas, but rapidly becomes confined away from the outcrop. The overlying Lewis Shale and underlying Allen Ridge Formations are sufficiently impermeable to prevent leakance into or out of the Almond Formation and Pine Ridge Sandstone. Infiltration of surface water that occurs in the small ephemeral and intermittent streams in the area can effectively be ignored in the model, as the streams are predominately located within the overlying Lewis Shale. Therefore, little if any recharge occurs anywhere other than the outcrop area.

A number of flowing wells completed within the Almond coals are located throughout the ARPA. Potentiometric data, albeit sparse, was compiled for the Almond coals in the ARPA and eastern Washakie Basin. A potentiometric surface map of the Almond Formation under current

conditions is included in the Atlantic Rim groundwater model Technical Report (WWC 2005). Hydraulic gradients are steeper near the outcrop and become less steep into the basin. In addition to the potentiometry data, drill stem test data and age-dating Almond coal groundwater indicate that groundwater velocities under natural gradient are extremely low.

The primary physical groundwater flow boundary is the Almond Formation's outcrop to the east. Near the center of the Washakie Basin, which would be along the western portion of the model domain, evidence suggests that there is little, if any, groundwater flow in the westward direction. Within the model, the western boundary is represented by a no flow boundary. The north and south boundaries are not marked by any natural geologic features, but are located far enough from the proposed production wells in the ARPA that their influence on the wells would be minimal. For this reason, the north and south edges of the model are artificial boundaries.

There is very little measured hydraulic conductivity data available for any of the five modeled layers within the ARPA. The hydraulic conductivities assigned to each layer were based on information that is presented in the Atlantic Rim groundwater model Technical Report (WWC 2005). To account for anisotropic conditions in the vertical direction, the vertical hydraulic conductivity would be 10 times less than the horizontal conductivity. Within the model, the hydraulic conductivity of the sand layers would vary based on the average hydraulic conductivity at burial depth. Like the sands within the Almond Formation, burial depth is assumed to affect hydraulic conductivity for the coals, with a lower value for the deeper coals and a higher value for the shallower coals. Coals would have slightly smaller hydraulic conductivity values than the sand units, but values would be varied with depth similar to the way hydraulic conductivity values for the sand units were varied.

The hydraulic connection between the sand layers and the coals is unknown. Locally, the hydraulic connection between the coal layer and sand layers may be enhanced if the integrity of the confining layer is compromised (e.g., by poorly plugged exploratory drill holes). Leakage from the sands into the coal production layer may also be enhanced if water levels in the coal are lowered as a result of dewatering. After a significant period of time (i.e., several years), a drawdown in the sands may become apparent due to the limited hydraulic communication between the coal and sand layers. There are three monitoring wells in the ARPA that were established during the interim drilling period and would be maintained through the life of the project. These monitoring wells would measure pressure in the producing coal seams and sand stone aquifers directly above and below the coal seam. At this time, there is very little reliable storativity or specific yield data for the modeled layers; therefore, values were based on USGS estimates, which are based on the thickness of the aquifer (WWC 2005).

Model Construction

The hydrogeologic model code selected was the USGS Three Dimensional Finite Difference Modular Groundwater Flow Model, MODFLOW (MacDonald and Harbaugh 1988) and the pre/post processor, Groundwater Vistas (Rumbaugh and Rumbaugh 2002). MODFLOW is a model code widely used and accepted by regulatory agencies and the BLM. Seven MODFLOW packages were used in the Atlantic Rim groundwater model (WWC 2005).

The model grid is oriented parallel to the geologic strike of the Almond Formation outcrop, which is generally north-south. The model area encompasses some 2,866 square miles. The regional model consists of five layers. The top layer represents the Almond Formation sandstones, the second layer represents the clay and siltstone parting below the Almond sandstones, the third layer represents the production coal packages within the Almond Formation and Pine Ridge

Sandstone, the fourth layer represents the clay and shale partings below the coal packages, and the fifth layer represents the Pine Ridge Sandstone sandstone units. The Lewis Shale acts as a confining layer above the Almond Formation and the Steel Shale acts as a confining layer below the Pine Ridge Sandstone. The model area is bounded on the east by the outcrop of the Almond Formation, on the west by a no-flow boundary, and due to the lack of natural geologic boundaries, prescribed constant head cells bound the north and south portions of the model domain.

The hydraulic parameters within the groundwater model area include hydraulic conductivity, storage, and recharge. Hydraulic conductivity is largely unknown in the model area and values assigned within the model were based largely on information obtained from testing conducted in oil and gas fields outside of the model area by the oil and gas industry, limited testing on coals within the ARPA, and testing of coals within the Powder River Basin in Wyoming. Based on bore hole logs within the ARPA, the bulk of the Almond Formation and Pine Ridge Sandstone is generally composed of sand, with the coals, siltstones, and shales making up a small portion of the formations. Within the model, the hydraulic conductivity of the sand layers would vary based on the burial depth (i.e., values decrease with depth). The hydraulic conductivity values assigned to the shales and siltstones were much lower than that of the sands and coals. Storage coefficients within the model were estimated based on the thickness of the modeled layer, which are from top to bottom: 420 ft, 30 ft, 50 ft, 30 ft, and 170 ft, respectively. To account for anisotropic conditions in the vertical direction, the vertical hydraulic conductivity was estimated to be 10 times less than the horizontal conductivity (Ky = Kx = 10Kz).

The principle source of recharge is natural precipitation infiltration at the Mesaverde Group outcrop on the western flank of the Sierra Madres. Within the model, recharge would occur within the portion of the Mesaverde Group containing the Almond Formation and Pine Ridge Sandstone and the total recharge would be 3 to 9 percent of the average annual precipitation.

Groundwater flow into the Washakie Basin is very sluggish, if it even occurs at all. Based on that information, it follows that there are no natural drains within the interior portion of the basin. The only natural drains to the system occur near the contact between the Mesaverde Group and the overlying Lewis Shale as springs. These contact springs were simulated in the model as drains inserted into the top layer. The only other drains within the model area are flowing wells completed in the Almond Formation. The flowing wells are discharging from the same coal seams that are proposed to be produced; therefore, they were inserted into layer 3. The locations and elevations of the springs and flowing wells were determined from U.S. Geological Survey mapping and Wyoming SEO records. Spring discharge rates were also determined from SEO records or assumed to be similar to that of nearby measured spring flows.

Limitations of the Model

Many of the assumptions and limitations within the modeling software are the result of the inaccuracies inherent in modeling a natural system and are generally similar for all modeling software. Limitations and assumptions specific to this modeling effort are primarily due to the paucity of physical and hydraulic characteristics of the aquifers and confining units in the regional model area, as described in detail in the Atlantic Rim groundwater model Technical Report (WWC 2005).

Simulation of the Projected Effects

The simulation portion of the model replicates the proposed development within the ARPA. Presently, the most severe development scenario projects that a maximum of 1,800 CBNG wells would be completed within the ARPA. Current production predictions estimate that the wells would produce water for 20 to 30 years, so the average life of water production for each well was 25 years and each drain simulating a well was left active for 25 years within the model. The development scenario assumes that wells within the interior portion of each unit would be developed first, with wells expanding concentrically from the center of the unit out to the edges of the ARPA boundary. After a drain was turned on, it was left on for 25 years. The modeled simulation period extends in five-year increments from 2005 to 2050, with the last production well being turned off in 2050. Drawdown contours from the projections within the five modeled layers at the end of each five-year period are shown in figures included in the Atlantic Rim groundwater model Technical Report (WWC 2005).

The results of the simulation show that the drawdowns within the coal package (layer 3) are relatively severe as compared to the drawdowns projected within the overlying and underlying sandstone packages (layers 1 and 5, respectively). The maximum drawdown and areal extent of drawdown within the Almond Formation coal (layer 3) is projected to occur in 2030. Drawdown contours projected to occur for layers 3 (coal package), 1 (overlying sandstone package), and 5 (underlying sandstone package), respectively, in year 2030 are depicted in Appendix M. As shown, maximum cumulative drawdowns in the coal are greatest at the production well locations, although drawdowns do not propagate down dip to the west. In fact, no drawdowns in the produced coal are expected to occur beyond the western boundary of the ARPA. Coal drawdowns are projected to propagate somewhat more in the up dip direction toward the Almond Formation's outcrop, although are not expected to actually reach the outcrop.

While the drawdowns within the coal package are relatively severe immediately around the production well locations, the water discharge rate from each well does not decline over time as severely as expected. Table 4-6 presents the average per well discharge rate at the end of each five-year period between 2010 and 2050. Table 4-7 depicts the modeled impacts to the various existing flowing wells within the ARPA, and as shown, impacts to the flowing wells are predicted to be minimal. Impacts to the contact springs are also predicted to be minimal. In year 2005, the modeled spring discharge was approximately 88,800 cubic feet per day for the entire model area. In year 2050, the modeled spring discharge was approximately 85,200 cubic feet per day for the entire model area.

Table 4-6. Average Per Well Discharge Rates Each Five Years During the Simulation Period.

Year	Number of Wells in Production	Average Discharge Per Well (gpm)
2005	48	30.1
2010	989	32.4
2015	1368	34.2
2020	1651	33.7
2025	1720	32.9
2030	1682	32.9
2035	904	34.4
2040	422	33
2045	105	22.9
2050	8	7.8

Table 4-7. Impacts to Flowing Wells in Year 2050.

Latitude	Longitude	Row	Column	Year 2000 Modeled Flow Rate (gpm)	Year 2050 Modeled Flow Rate (gpm)
41.0894	107.4968	114	190	30	27.9
41.0725	107.5053	115	188	28	26
41.0887	107.4782	114	195	2	1.4
41.1985	107.5103	95	186	15	12.9
41.2613	107.5798	84	167	2	1.6
41.6022	107.4658	22	199	3	2.2
41.2263	107.5572	90	173	21	20.4
41.1946	107.5880	96	165	5	3.5
41.1902	107.5675	97	171	5	4.0
41.3024	107.6040	76	161	21	19
41.3240	107.6160	73	157	9	8
41.3493	107.6245	68	155	24	21.4
41.3495	107.5956	68	163	8	7.2
41.3815	107.5660	62	171	9	0*

* A production well was placed in the same cell as the flowing well.

Recovery

After water production starts to decline, recovery of water levels in the coal would become apparent. Based on the projected development of wells, all production is expected to end by 2050. In order to simulate recovery, all drains except for the ones simulating the contact springs were shut off by 2050. The model was then run for an additional 2,950 years to model the long-term effects of groundwater withdrawals. Recovery predictions for years 2100, 2500, and 3000 are included in the Atlantic Rim groundwater model Technical Report (WWC 2005). The model predicts that recovery in the coal would be slow; however, most of the recovery would have occurred by the year 3000.

The model also predicts that it takes a relatively long time for groundwater adjustments within the coal to have an effect on groundwater levels within the Almond sands and Pine Ridge Sandstone. The timing of the maximum impacts to the Almond/Lewis Shale contact springs demonstrates this phenomenon. The most severe impacts to the springs were modeled in the year 3000, at which time the discharge rates start to increase. This recovery scenario assumes a constant recharge based on the recharge rates arrived at empirically during the steady-state calibration. This recharge rate, while arguably the best assumption that can be made, is nevertheless based on limited calibration experience and research information available at this time.

4.4.3.2 Proposed Action Impacts

4.4.3.2.1 Proposed Action Impacts to Surface Waters

As described in Chapter 2, total construction phase surface disturbance resulting from the Proposed Action would be about 17,600 acres (5.7% of the ARPA). The construction disturbance would not be uniformly distributed across the project area, but rather, project facilities would be located where the efficiency and feasibility of extracting the natural gas would be the highest. Combined with the estimated existing disturbance of 600 acres, cumulative disturbance would be about 18,200 acres (5.9% of the ARPA). Impacts to surface water are not directly related to surface disturbance, as described in impacts common to all action alternatives roads and pads can impact surface hydrology beyond their initial disturbance.

The primary roads utilized to access the ARPA are U.S. Interstate Highway 80, State Highway (WY) 789, WY 70 and WY 71. A number of Carbon County and 2-track roads provide access to and within ARPA. Currently, there are approximately 1,000 miles of existing primary, secondary and 2-track roads within the ARPA (about 2.5 mi/mi^2).

With successful reclamation, during the life of the project (30-50 years), total disturbances would be reduced to about 6,200 acres (about 2.0% of the ARPA). As describe earlier most of the ARPA would be difficult to reclaim. Reclamation success in this case would mean an area free of weeds with grass/forb regeneration. Where sagebrush, juniper or other vegetation was disturbed the location would not return to pre-disturbance hydrologic function until 30-50 years after the end of the project in some locations as described in the impacts common to all section.

The construction disturbance associated with the Proposed Action can also be distributed by watershed. As discussed in Chapter 3, the entire ARPA is contained within three major drainage basins. One leg of the Continental Divide runs east and west across the upper portion of the project area. Drainage south of this divide flows south and west to the Little Snake River (Hydrologic Unit Code [HUC] 14050003) in the Colorado River basin. A second leg runs north and divides the northwest and northeast portions of the project area. Drainage west of this divide flows north to Separation Lake in the closed Great Divide Basin (HUC 14040200). Drainage east of the divide flows northeast to the North Platte River (HUC 10180002) in the Missouri River basin. The major drainage basins are depicted on Appendix M: Watershed Basins. The Little Snake River flows east to west just south of the ARPA. Approximately three-quarters of the ARPA drains into the Little Snake River via Muddy Creek. Muddy Creek (HUC 14050004) originates in the Sierra Madre Range, east of the ARPA, and flows west and south to its confluence with the Little Snake River near Baggs. The primary Muddy Creek tributaries in the ARPA include, from upstream to downstream, McKinney Creek, Dry Cow Creek, Cow Creek, Wild Cow Creek, Cherokee Creek, and Deep Creek.

Increasing sediment delivery to watersheds above the 303d section of Muddy Creek (Section 3.4) would lead to habitat degradation in pools and riffles and increase salinity of these waters, resulting in significant effects. The primary watershed contributing to this segment is the Muddy Creek/Alamosa Gulch watershed (Appendix M: HUC Boundaries). The proposed action with 8 wells/section in this watershed would lead to increases in surface runoff and sedimentation into this watershed and would result in significant impacts.

According Chapter 3 the Soils section there are many topsoils that are saline or sodic in the ARPA, these soils when eroded as a result of project activities can make this salt available to surface waters. This would contribute to the non-point source of salt in the Colorado River Basin and can be expected to be a significant impact to this system since these rates would be above background conditions.

Many of the drainage channels in the ARPA are classified as Waters of the United States. Crossings of these channels and any associated wetlands may require authorization from the COE through the CWA Section 404 permitting process. None of the drainages in the Great Divide Basin are considered Waters of the United States and therefore would not need COE permitting. Since, road and pipeline construction across established channels could adversely modify flow hydraulics; required BMPs would protect these channels from long-term changes in hydrologic function (Appendix H). Channel crossings specification in the required BMPs say that crossings would minimize changes in channel geometry and subsequent changes in flow hydraulics and these BMPs require designing channel crossings for a minimum of the 25-year runoff events, or otherwise specified by the BLM. Guidance for designing crossings is given in Appendix J: BMPs for Non-Point Source Pollution, these would be required for drainages with the potential to support fish populations.

As described in Appendix K, water would be required in most aspects of project construction including road construction, drill site construction, well drilling, and pipeline testing. Water for use in the project construction could be as high as 1,000 gallons per acre of disturbance, which would equate to a total of approximately 54 ac-ft of water (for 17,710 acres of disturbance). Water used in the well-drilling process could be as high as 125,400 gallons, or about 0.4 ac-ft of water per well, for a total of approximately 693 ac-ft (for 1,800 wells). Water used in the deeper, conventional well-drilling process averages 462,000 gallons (1.4 ac-ft) per well for a total of approximately 280 ac-ft (for 200 wells). The operators intend to use freshwater-based mud for the majority of their drilling operations. Water would also be used for hydrostatic testing of pipelines. Assuming one set of pipelines per well pad (single or multiple wells), and all pipelines associated with 2,000 well pads (7,920,000 feet of pipeline) would be hydrostatically tested at once and therefore water would not be re-used, approximately 64 ac-ft of water (at 2.6 gal/ft) would be required for hydrostatic testing of pipelines. Therefore, total water demand with hydrostatic testing for the Proposed Action would be approximately 1,100 ac-ft. This total quantity of water would not be withdrawn all at one time; rather, this amount would be distributed over the construction phase that could extend over several years as discussed in Appendix K.

Water used for construction and drilling may not come from CBNG wells, and therefore could possibly come from sources connected to surface waters in the Colorado River Basin. This volume of water is conservatively estimated as 10.3 acre-ft/year for the life of the project. The potential depletions were part of the consultation process with the Fish and Wildlife Service and have been considered in regard with native fish recovery programs in the Colorado River Basin (see Section 4.8 and Appendix G)

Water would be obtained from SEO-approved local surface water sources and/or water wells completed in the coal seams of the Mesaverde Group. As described in Chapter 3, there are presently 90 active permitted groundwater rights filed in the project area, one of which is for a water well that supplies water for drilling deep oil and gas wells. Of the 90 active permitted groundwater rights in the project area, 55 are designated for livestock use. There are approximately 195 surface water right permits within the project area; 165 of the 195 are associated with livestock water facilities. The permitted amounts associated with these water rights total about 43,000 ac-ft per year (42,730 ac-ft are associated with Big Bend Reservoir #1). Roughly 14 percent of the 195 permits are adjudicated. Historically, water wells have been the primary source of supply for oil and gas drilling in this arid area; it is likely that water wells would supply the proposed project drilling needs. The total water demand identified above would not likely adversely affect the existing surface water or groundwater rights in the project area provided full coordination is implemented with the SEO and the BLM. Again, the total water demand of 1,100 ac-ft by the project would be spread out over several years and would not cause significant adverse impacts on the surface water or groundwater resources within the ARPA.

Reclamation would occur on the barrow ditches for roads, portions of well pads, and pipeline ROWs as described in Appendix B: Reclamation Plan. Even after successful reclamation these areas would form distinct vegetation boundaries that may or may not be better for reducing rainsplash erosion or decreasing surface runoff. They also may experience unauthorized travel from off-road vehicles leading to further erosional problems.

Discharge and use of hydrostatic test water, would need to be accomplished in a manner that does not adversely affect soils, stream channels, and surface water and groundwater quality. After testing operations are completed, the water would be pumped into water-hauling trucks and transported to drilling locations within the project area to be used in conjunction with drilling operations or re-used for other aspects of the construction and/or production process. However, if such water is not re-used it must be disposed of in a manner where soil scouring and water quality impairment would not result. Hydrostatic test water is expected to be of relatively good quality; however, it should be evaluated for compliance with State water quality standards. No test water should be discharged unless such water meets these standards. Test water not needed for drilling operations that meets water quality standards would be disposed of onto undisturbed land having vegetative cover or into an established drainage channel in a manner as not to cause accelerated erosion. Further, use and disposal of hydrostatic test water must comply with the mandatory ROW stipulation for hydrostatic testing as well as the POD, the CWA and the WYPDES permit that would be required for the proposed project.

4.4.3.2.2 Proposed Action Impacts to Groundwater

The proposed CBNG development in the ARPA is targeted principally at coal beds contained in the Almond Formation member of the late Cretaceous Mesaverde Group. Drilling depths for the Mesaverde coals would range from approximately 1,200 to 6,000 feet. Groundwater would be removed from the coal seam aquifers. There is no current practical use for water in these coal seams due to drilling and management costs, the high level of TDS concentrations, and the availability of higher quality water from shallower aquifers. The targeted coal seam aquifers that would be dewatered are classified as confined to semi-confined aquifers because they are bound by confining sedimentary layers of shale, siltstone, and claystone that are impervious to semi-pervious. Furthermore, the targeted coal seam aquifers are stratigraphically lower and hydraulically isolated from shallow groundwater sources that are typically developed.

Effects from development of CBNG to groundwater resources within and near the ARPA have been evaluated in the South Baggs Area Natural Gas Development EIS (USDI-BLM 2000), Sun Dog POD EA (USDI-BLM 2001), Blue Sky POD EA (USDI-BLM 2002a), Cow Creek POD EA (USDI-BLM 2002b), Brown Cow POD EA (USDI-BLM 2003a), Doty Mountain POD EA (USDI-BLM 2003b), Red Rim POD EA (USDI-BLM 2003c), Jolly Roger POD EA (USDI-BLM 2004a), and the Rawlins Draft RMP (USDI-BLM 2004b).

Reserve pits would be utilized to contain drilling fluids, cuttings, and wastewater produced from the well drilling operations. In some cases the reserve pit would be lined with an impermeable liner to prevent seepage and possible contamination of surface and groundwater. Leakage of pit fluids would be minimal from lined reserve pits unless the liners were installed incorrectly or the liners were damaged during drilling operations. Thus, adverse impacts from leaks in lined reserve pits would likely not occur.

4.4.3.3 Alternative A – No Action

For both ground and surface waters, impacts would continue as described in the EAs developed for each POD during the interim drilling policy. It can be expected that as interim reclamation success improves that impacts to surface water resources would decrease. Final reclamation would disturb areas again initially, but long term reclamation would reduce impacts to background levels within 5 years after final reclamation.

4.4.3.4 Alternative B

4.4.3.4.1 Surface Waters Impacts for Alternative B

The most beneficial feature of this alternative is that it would give more definition to the development periods. Due to the temporal development, there would be feedback in the form of monitoring to better plan future development in subsequent phases. Individual watersheds would receive more initial disturbance for construction under this alterative, but would also improve the success of interim reclamation. Interim reclamation would be more successful due to economies of scale in terms of planting, treating for weeds, travel planning and other tasks. When these activities occur in only a portion of the project area at a time and we can assume these economies of scale would be realized.

4.4.3.4.2 Groundwater Impacts for Alternative B

The groundwater model results included within the draft EIS assume that development within the ARPA occurs in the northern (phase 1), middle (phase 2) and southern (phase 3) portions of the project area simultaneously. However, it should be noted that within the existing groundwater model, development in the middle portion of the project area generally occurs first followed by development in the northern section and the southern portion of the project area, respectively. The original development scenario assumed that additional development was centered on existing units and propagated concentrically from each unit. The largest units, and most of the existing development, were within the central portion of the ARPA. Therefore, at the beginning of the groundwater flow simulation the bulk of the development was within the central portion and the northern and southern reaches were reached later on within the simulation. Discussions with Anadarko personnel indicated that development within the southern portion of the ARPA would occur last, so development within the southern portion of the project area was limited to development within the existing units until near the end of the simulation period.

Changing the temporal distribution of the development (as proposed in Alternative B) would not result in long-term changes to the groundwater model results (i.e., recovery period and affected contact spring discharge rates.) It would only change the timing of the short-term drawdowns and the drawdowns during production. Changing the spatial distribution of the wells has the potential to change both the shape of the drawdowns and the long-term results. For example, depending on the placement of the wells, the recovery period may be longer or shorter, and the timing and magnitude of the maximum effects on the contact spring may vary. Overall, the model is not appreciably sensitive to spatial and temporal distributions of the wells. It is however, more sensitive to hydraulic conductivity, drain conductance, and the storage coefficient of the aquifers. It would also be very sensitive to the length of time it takes to fully develop each well, which at this time is based on existing production within the ARPA.

4.4.3.5 Alternative C

4.4.3.5.1 Surface Waters Impacts for Alternative C

There are a number of development protection measures that have been developed to reduce impacts to resources for alternative C. These development protection measures are designed to reduce sediment loads to channels and changes in peak flows from surface runoff and intercepted groundwater by reducing disturbance, improve reclamation success, and reduce impacts to visual resources, vegetation and wildlife. The following development protection measures would be implemented under this altenative:

1. Pump reserve pit and do earth work for reclamation right after drilling, put in top soil and plant first good season, interim reclamation would be completed one year after spud date.
   - o Reduces erosion from pad sited since it severely cuts the amount of time the pad is unvegetated, and therefore more susceptible to erosion.
   - o Reduces erosion from spoils and topsoil piles.
   - o Improves infiltration on the site by reducing the amount of compaction from vehicles in the interim reclamation portions of the pad.
   - o Improves the success of interim reclamation since the topsoil would still be biologically active.
   - o Reduces the likelihood of contamination of shallow groundwater by reducing unauthorized dumping in the pit and also the use of the reserve pit for flow back of fracing fluids, since the pit would be open less of the time.

2. No pad, compressor or water transfer sites can be located in these areas. – This would not allow well pad or other facility placement in these areas identified with special resource concern, but would still allow for utilities, roads and other linear features with engineering designs when the area cannot be avoided.

3. Road density criteria – For the most part this would limit collector and local roads to existing two-tracks and would likely be combined with item 7, low impact road designs and would require optimal road network designs.
   - o Where roads have been identified as the major impact of gas development, this impact would be reduced.

4. Specifying a maximum surface disturbance criterion.
   - o Reduce well pad density
   - o Allow for better placement of roads to reduce impacts to surface hydrology.

5. Pitless, shared pit and/or closed system drilling - Instead of using a reserve pit to flow back fluids during drilling, a tank would be used. A small pit would still be needed for the drilling cuttings and could be shared among wells, but the pit would be approximately ½ the size and would not need to be as deep.

- This would reduce the footprint of the pads on average to about ½ the size
- This would reduce the risk of groundwater contamination since most fluids would be contained in tanks instead of the reserve pit.

6. Low impact road design – This technique would use brush beating, the placement of matting, fabric or whatever is suitable and placement of at least 6 inches of engineered road base (i.e. mostly gravel/sand with minimal tackifier). This technique would not be used when a sideslope of greater than 3% is needed for the road design, conventional construction would be used in these areas (see Appendix J: BMPs for non-point source pollution). Any blading or the construction of ditches would be minimized and only occur when slope is greater than 8% or when needed for cross drainage. For some areas only resource roads (the portion of roads that go directly to an individual well pad) would require this and this technique would also be used for only the portion of the pad site that needs regular vehicular traffic for well maintenance. This method would require ditch witching for all utilities and placement in the travelway of the road when terrain would require the right of way to be bladed to install utilities.

- With the elevated roadway there would generally not be a need for drainage ditches
- Significantly reduces surface disturbance.
- Less need for intense interim reclamation with earthwork, native regeneration would be more than sufficient in areas that have been brush beat and have received temporary disturbance from tank placement, ditchwitching or limited vehicular travel.
- Reduce areas impacted by soil compaction, by leaving underlying soils intact. This would improve infiltration and reduce surface runoff.
- Would significantly improve success of brush regeneration, and native forb success. These would reduce erosion from rainsplash and improve surface roughness and hence reduce surface runoff, riling and other hillslope erosional processes.

7. On collector and local roads, new construction would require 95% compaction before gravel is added. All existing roads would need coordination with County and BLM to improve surface. All collector and local roads, would annually receive a non-chlorine based dust abatement chemical treatment to reduce dust.

8. Best management practices such as waddles at the input and output of culverts, erosion fabric/matting on steep cut and fill slope, placement of sediment fences during construction etc.

- All these activities would improve reclamation success and reduce impacts to surface hydrology.
- Overall implementation would reduce impacts when areas such as soils with high-runoff potential are identified ahead of time.

4.4.3.5.2 Groundwater Impacts for Alternative C

There should not be a significant difference between this alternative and the proposed action for groundwater resources.

4.4.4 Impacts Summary for all Alternatives

Impacts resulting from drill pad, access road, facility site, and pipeline ROW construction could include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss

of topsoil productivity, and increased susceptibility of the soil to wind and water erosion. These impacts could increase runoff, erosion, and off-site sedimentation.

Due to extremely low hydraulic conductivity of the confining layers, enhanced leakage from any aquifer stratigraphically above or below the dewatered coal seams would be minimal, and only after a period of time would drawdown effects in any overlying aquifer become apparent.

A predicted total project volume of produced water in the best success scenario for 2,000 well development would be 250,000 to 450,000 bbls/day for approximately 6 to 8 years. This produced water would be disposed of through 83 injection wells completed in the Hatfield, Cherokee or Deep Creek sands within the Mesaverde Group. The water would be injected into these wells for the life of the project. No cumulative impacts to the target members of the Mesaverde Group would occur during this project.

4.4.5 Mitigation Summary

The Required BMPs (Appendix H) and applicant committed measures (Appendix K) measures and procedures would be followed under all alternatives and are critical to reducing impacts to water resources.

The Required BMPs (Appendix H) would be followed on BLM lands or where a BLM approved action would impact BLM lands. A modification to a mitigation measure and/or design feature may be approved on a case-by-case basis when deemed appropriate by the BLM. An exception would be approved only after a thorough, site-specific analysis determined that the resource or land use for which the measure was put in place is not present or would not be significantly impacted. Many of the measures below are designed to reduce the impacts experienced during the interim drilling period as described in section 3.4.5.3 "Current POD Conditions". The benefits of each of these BMPs are briefly described below:

- Water management plan as part of the annual work plan submittal in April – This would provide detailed information on current water disposal needs and injection capacity.

- Surface disturbance on slopes >25% as identified from the 30 meter DEM data – The Digital Elevation Model (DEM) slope data is areas with steep topography in general, these areas should be avoided for construction activities.

- Drainage Crossings – These would be designed for at the minimum for the 25 year storm event and in such a way to not modify the drainage hydrology. These measures as well as the drainage design criteria for drainages with potential fish habitat in Appendix J would protect most crossings from direct impacts.

- Mitigation to Reduce Surface Runoff and Erosion – The annual Work Plan would describe the location and types of mitigation as described in Appendix H. This would allow for the evaluation during onsites and a final construction plan would then be submitted that would include locations of mitigation measures.

- Well Inventories and Water Developments Associated with Groundwater – Although the groundwater model predicted only reductions in wells used for water development, should wells be impacted by project actions a well agreement would be sought by the operator to mitigate impacts.

- o Interim Reclamation of Unused Areas – Proper reclamation of the interim surface disturbance is essential for minimizing impacts from erosion and weed propagation. The Reclamation Plan (Appendix B) would require the operators to submit annual reclamation plans that would include progress. This accountability should help improve current reclamation practices.

- o Water Used for Construction, Maintenance, and Drilling Activities – All waters, subject to approval by the Wyoming SEO, for these uses would come from the Colorado River or Great Divide Basins and most of the water would come from CBNG wells. This would remove the potential for impacts in the North Platte River System and reduce impacts to surface water uses.

Applicant committed measures would be applied on privately owned surface and State of Wyoming lands unless otherwise specified by the involved private and/or State surface owners. The Operators and the BLM, as discussed in Chapter 2 and Appendix K, would implement preconstruction planning and design measures described.

4.4.6 Residual Impacts

Significant impacts to surface hydrology would occur under the proposed alternative and Alternative B (Temporal Alternative). These impact including negatively impacting a waterbody (Muddy Creek West of 789) listed on the State 303d list, changing streamflow characteristics in stream channels, alteration of stream geometry and increasing sediment to the point of degrading a streams designated use (Muddy Creek, from the eastern project boundary to the confluence with the Little Snake. No significant impacts are expected to occur under Alternative A (No Action) or Alternative C (Spatial Alternative).

4.5 VEGETATION AND WETLANDS

4.5.1 Introduction

Direct impacts to existing native shrub/grassland communities in the ARPA resulting from project implementation include a short-term reduction of herbaceous vegetation and a long-term loss of shrub cover. Potential indirect impacts to the vegetation resource may occur as a result of damage to biological soil crusts, soil compaction, mixing of soil horizons, loss of topsoil productivity, increased soil surface exposure, soil loss due to wind and water erosion, increased potential for noxious/invasive weed invasion and establishment, shifts in use patterns or amounts by livestock and wildlife, and changes in visual aesthetics.

4.5.2 Impact Significance Criteria

Several criteria were used to determine the significance of impacts caused by the construction and operation of the proposed natural gas project on vegetation resources encompassed within the ARPA. These criteria were developed based on federal, state, and local agency rules, regulations, and management guidelines.

The impact on vegetation would be considered potentially significant if the following were to occur:

- non-attainment of short- or long-term reclamation standards and goals for disturbed sites specified by the Reclamation Plan (Appendix B) or the BLM resulting in a loss/decrease of plant species density, diversity, and abundance, or where reclaimed areas do not attain adequate vegetation groundcover and species composition to stabilize the site within five years from disturbance;

- an event or action that would remove a community's unique attributes or ability to support other resource values within the life of the project;

- introduction or spread of noxious or invasive weeds that contributes to unsuccessful revegetation, the introduction of weeds into areas considered weed free, or an increase in noxious or invasive species where they already exist.

- Wyoming BLM Standards for Healthy Rangelands are not met.

4.5.3 Direct and Indirect Impacts

4.5.3.1 Direct and Indirect Impacts Common to All Alternatives

Direct impacts include the removal of native vegetation and topsoil during the construction phase and installation of permanent structures (e.g., compressor sites, roads, and well pads). Future climatic patterns, land use, and compliance with the Reclamation Plan and weed control efforts would be primary factors for successful LOP reclamation. Monitoring sites for documenting long-term trend of vegetation cover types would be avoided so that disturbance from permitted commercial activities would not occur.

Potential indirect impacts to the vegetation resource may occur as a result of soil compaction, mixing of soil horizons, loss of topsoil productivity, increased soil surface exposure causing increased soil loss due to wind and water erosion, and increased potential for noxious/invasive plant establishment. Additional indirect impacts occur as a result of altered runoff hydrology due to roads, pads and other facilities, particularly on moderate to steep slopes. Slopes greater than eight percent require special engineering and are found on 35 percent of the project area. Facilities located in these areas reduce natural runoff to downslope locations and increase channelization of flows and gullying, which results in desertification effects including lower productivity, cover and species composition downslope. Another indirect effect is dust from roads, which settles on nearby vegetation and results in reduced photosynthetic activity and plant growth.

All alternatives would disturb Wyoming big sagebrush and alkali sagebrush plant communities. Due to the very long to unknown recovery rates for these two shrub species on dry, harsh sites, reclamation would primarily result in herbaceous plant recovery, replacing shrublands with grassland-type cover and structure.

The saltbush steppe vegetation cover type would have very low acreage affected by the proposed action. Badlands have sparse vegetation, occur on moderate to steep slopes, and are common in other areas. Therefore, impacts from disturbance to these vegetation cover types would not affect their overall abundance, health or diversity across the region.

Thirty-one percent of the aspen, juniper woodland, serviceberry, and true mountain mahogany cover types occur on private and state lands. These sites would not be protected from

disturbance by any development. Loss of these communities would increase wildlife use on remaining areas within these cover types and exacerbate current declining health conditions.

Due to the scarcity of wetland/riparian sites in the ARPA and BMPs/COAs to protect them, the probability of well pads, roads, pipelines, and ancillary facilities being placed in these areas is very low. The RMP specifies that a 500-foot (minimum) buffer around riparian and other water resources and a 100-foot buffer from ephemeral drainages be maintained. This restriction not only protects wetland/riparian sites, but basin big sagebrush sites which are generally found adjacent to drainages. Additionally, permits under Section 404 of the Clean Water Act would be required for any activities in wetlands or waters of the United States. The Operators would be required to demonstrate to the COE that there are no "practical alternatives" to placement of a well location in a wetland. The probability of removing wetland vegetation or disturbing any waters of the U.S. is low following compliance with mitigation procedures. Existing water sources that dry up or have reduced flows due to water draw-down associated with gas field development would be mitigated to maintain wetlands/riparian site characteristics and vegetation.

Although most natural gas would be collected as water is removed from the coal aquifers, some gases would move upslope through the formation and escape through the soil surface. Where this occurs the vegetation would die back, resulting in dominance of herbaceous species and increased bare ground. These locations would generally be small and scattered along the outcrops of the coal formations, probably affecting less than ten acres altogether.

Vegetation treatments would become more complex and costly as the density of field development increases. The opportunities to utilize prescribed burns as a management tool would become more limited, requiring increased use of chemical and mechanical forms of manipulation. These methods decrease the ratio of shrub versus herbaceous species, but primarily influence species already present, compared to fire which creates openings for early succession species (especially forbs). Therefore, in areas where the objective is to increase forb composition and there are currently few forb species present in the community, it would be difficult and more expensive to reach this objective using chemical or mechanical forms of treatment.

Direct and indirect impacts to the vegetation resource would be reduced with implementation of and compliance with Required Best Management Practices stated in Appendix H, Applicant Voluntarily Committed Measures (Appendix K), the Reclamation Plan (Appendix B), and the RMP. However, no measures currently address spreading concentrated runoff back over the land. Therefore, channelization and gullying leading to desertification would occur. Achieving final reclamation goals is dependant upon disturbed soil properties, developing seed sources for native forbs and shrubs, short- and long-term monitoring, future climatic conditions and land-use patterns, and most importantly, operator commitment. In addition, non-native species used in reclamation on State and private lands could expand onto adjacent public lands, requiring some form of both monitoring and control.

The lack of adequate weed control efforts in the first few years of development under the Interim Drilling Plan has already increased weeds and seed banks that would have to be controlled for several years at a minimum. Halogeton has been observed spreading outside areas of disturbance from CBNG development on all land ownerships. There are no applicant voluntarily committed measures to control weeds; therefore the current trend of weed spread is likely to continue on private and state lands. These populations would continue to pose a threat of expansion onto public lands that would require long-term treatments.

Reinjecting all water produced from CBNG development has both positive and negative impacts upon riparian/wetland plant communities, depending on water quality and how and where water releases occurred. Obviously, if produced water was higher in salts or other contaminants than natural background levels, reinjection would be a benefit to these communities by not increasing salt loading that would shift composition to more salt tolerant species and would result in fewer species, less cover, and lower palatability for grazers and browsers. Water would not be released down ephemeral draws. This would remove the potential for headcutting and increased sedimentation downstream into existing riparian plant communities. Water would also not be released down perennial stream channels at high rates year around which would result in widening or blowing out the vegetation and channel characteristics. Water releases down perennial channels that mimicked natural flow patterns (high in spring or other short peaks in runoff and reduced the rest of the year) would not be allowed. However, there would not be benefits to riparian/wetland habitats from artificially maintaining moisture levels during dry years if water produced was equal to or of better quality than natural runoff. Species requiring higher moisture levels like sedges, bulrushes and willows would not be supported during dry years. This results in existing natural conditions of lower productivity, lower bank cover, and transition to drier tolerant species with lower bank holding capability, greater erosion, and reduced structural diversity being maintained. The opportunity to artificially maintain or enhance riparian habitat along streams in general would not occur; including maintaining sufficient flows down Separation Creek to maintain the 800 acres of riparian/wetland habitat in Mahoney Lakes, resulting in the continued loss of this habitat until climate patterns change.

4.5.3.2 Proposed Action

The proposed action assumes drilling of approximately 2,000 new natural gas wells and construction of required ancillary facilities over the next 20 years. This would directly reduce the extent of existing vegetation cover types. Over the estimated 20-year development phase, the Proposed Action is projected to initially disturb an estimated total of 15,800 surface acres which represents about 6% of the total land surface of the project area (270,000 acres). Also, half of this disturbance would occur within the first six years. During the projected 30-50 year life-of-project (LOP), the disturbed acres would be reduced to about 6,200 acres depending upon time required for successful reclamation, future land uses and climatic conditions. This would hold true for reclamation of herbaceous species, but not for shrubs habitats to be returned to pre-existing conditions. Indirect impacts due to dust from roads is expected to affect vegetation adjacent to roads, resulting in an additional 15 to 30% of the development area and 5-10% of the natural gas development area (based on estimate of 300 feet width impacted along roads).

Direct and indirect impacts to vegetation would affect specific plant communities to varying degrees depending on general abundance, browse use, topography, and difficulty of reclamation. The majority of development would occur in mountain and Wyoming big sagebrush vegetation cover types, since they occupy about 85 percent of the ARPA. However, long-term impacts to Wyoming big sagebrush would be much higher than to mountain big sagebrush.

Wyoming big sagebrush plant communities occur on sites with lower precipitation and poorer soils, which increases the difficulty in reclamation and the likelihood that only initial shrub reestablishment may occupy disturbed sites during the estimated 30-50 year LOP. This loss of shrub habitat from direct disturbance, coupled with dust drifting off roads making nearby vegetation less usable, would equate to a 20 to 35 percent reduction in available Wyoming big sagebrush habitat. Even though the majority of disturbance would not be in antelope and mule deer CWR, it would be in adjacent transition range. With average browse rates on crucial winter

range (CWR) and adjacent transition range already at moderate levels (40 to 60 percent) during average winters and higher during severe winters; this reduction in usable habitat would lead to increased browse use levels that would result in plant mortality.

For the most part, impacts described in this and sections below are primarily about CBNG wells, since the actual number and location of deep natural gas wells is speculative at this point. However, development of deep natural gas wells in the Wyoming big sagebrush plant community would have the greatest negative impacts (versus other plant communities), because they would be compounding the negative impacts already described for CBNG development. In addition, approximately eight percent of this cover type occurs on moderate to steep slopes that would be affected by increased gully erosion and desertification due to the influence of roads on overland hydrology.

In allotments where grazing reductions or suspension of use is made by the livestock permittee due to the rate and scale of field development, there would be affects to the vegetative resource. Plant material previously removed or trampled by livestock would be left largely ungrazed, resulting in increased litter, soil protection, and reduced runoff and erosion. Plant vigor may improve in some areas, but most allotments with rotational grazing already have good vigor of desired species. Reclamation efforts would benefit without being grazed by livestock. However, grasses would eventually out-compete forbs and shrubs in the absence of livestock grazing. In Wyoming big sagebrush transition and crucial winter range, increased grass cover and vigor may, in combination with increased shrub browsing, reduce establishment of shrub seedlings. This would skew the age-class ratio and contribute to the long-term decline in Wyoming big sagebrush cover and density. Therefore, impacts from disturbance to this vegetation cover type would affect its abundance, health and diversity across the region, exceeding the significance criteria.

Mountain big sagebrush sites occur in areas with higher precipitation and better soils, and should reclaim more easily than Wyoming big sagebrush sites. Whether these sites would return to pre-existing levels of sagebrush cover during the 30-50 year LOP is unknown. Following prescribed burns in this area, mountain big sagebrush has been documented recovering to original cover levels in 40 to 50 years. In field development, soil profiles and structure is altered, which would likely lengthen time needed for recovery of shrubs. The elevation this species occurs at also precludes it from receiving more than light browsing by big game species before it is protected by winter snow. Approximately one-fourth of this type occurs on moderate to steep slopes, particularly in the vicinity of the Muddy Creek drainage, Muddy Mountain, and the Deep Gulch/Wild Cow area. These sites would be affected by increased gully erosion and desertification due to the influence of roads on overland hydrology. Therefore, impacts from disturbance to this vegetation cover type would affect its health and diversity on locations with moderate to steep slopes, exceeding the significance criteria in these areas. However, acreage loss from disturbance would not affect its' overall abundance, health or diversity across the project area.

Alkali sagebrush is the third most common vegetation cover type within the ARPA, but is not common within this region or even within the State of Wyoming. The high clay content in the soils it grows upon has high runoff and severe water erosion potential once the protection of vegetation cover is removed, and increases the difficulty of reclamation. Dust would also be an issue from these sites due to the fine soil particles that would settle on plants and further reduce the availability of usable forage. Although this species receives some browse use by wildlife and sheep, the use levels do not approach those documented for Wyoming big sagebrush. However, with 20 to 35 percent of usable forage lost to disturbance or unavailable due to dust,

the use levels may increase to become a concern. Therefore, impacts from disturbance to this vegetation cover type would reduce its' overall abundance, and may affect its' health and diversity across the region, exceeding the significance criteria.

Mountain big sagebrush/mountain shrub mix vegetation cover types occur on sandier sites around the sandhills and on steeper, north and east slopes where snow drifts and provides higher precipitation levels. The steeper slope sites would be avoided, so loss from project disturbance should be minimal. Sites around the sandhills contain high amounts of bitterbrush which is important to mule deer during the fall and winter and is not abundant elsewhere in the ARPA. Bitterbrush should be able to be reestablished on these sites, but not within the LOP; therefore, impacts from disturbance to this vegetation cover type would affect its health and diversity in localized areas. However, acreage loss from disturbance would not affect its' overall abundance, health or diversity across the project area.

Juniper woodland and true mountain mahogany vegetation cover types occur on gentle to steep slopes, often on poorer, shallower soils over rock substrate. The aspen and serviceberry cover types are found on good soils and higher elevation sites that drift in with snow. These types are not abundant within the ARPA, but are much more common in other areas of the RFO. Since these habitat types failed Rangeland Health Standard #3 –Upland Plant Health in the Upper Colorado River Basin watershed assessment (2002), additional disturbance of these habitats would be counter to ongoing efforts to improve their health. Although sites on moderate to steep slopes would likely be avoided due to increased construction difficulty, there currently are no protective measures for these communities. Therefore there could be a negative effect on the local abundance, health and diversity, exceeding the significance criteria, although not on a regional basis.

The silver sagebrush/bitterbrush vegetation cover type occupies sand dunes in what is known as the "sandhills". The uniqueness of this vegetation/soils complex within the entire State of Wyoming led to the designation of "Area of Critical Environmental Concern" (ACEC). The actual ACEC is mostly excluded from the ARPA, but the north end of this unique plant community is in the checkerboard land pattern and a portion is included in the ARPA. The sand dunes, whether stabilized or not, are usually avoided due to the difficulties they pose for development and reclamation. The potential to increase wind erosion and destabilize the loose sand is very high. Therefore, impacts from disturbance to this vegetation cover type may affect its' overall abundance, health and diversity within the region, exceeding the significance criteria.

The ability to reestablish native vegetation on sensitive soil types (i.e., clayey, sands, saline-sodic) is not well documented in this area, but may be in other locations. Although current technology exists to stabilize these areas and minimize soil erosion as revegetation is being carried out, there is currently a lack of local seed sources for native forb and shrub species, and the recovery rate to restore native shrubs (particularly Wyoming big sagebrush and alkali sagebrush) to their pre-existing condition is unknown. This would likely lead to a two-phased reclamation, initially grasses with weed control and 3-5 years later interseed grasses with forbs and shrubs when native seed is available. Many of the potential impacts to the vegetation resource would be reduced assuming construction, maintenance and operation of well pad sites and associated disturbances are in accordance with Chapter 2 of this EIS, the Reclamation Plan, the BMP/COA appendix, and RMP stipulations.

Surface disturbing activities would increase the potential for new infestation and spread of existing invasive plant species populations. Invasive weed species usually thrive on newly disturbed surfaces and out-compete more desirable native plant species. On the other hand,

prompt and successful reclamation would reduce the potential for these species to establish and spread. Assuming that existing weed populations on public lands would receive adequate treatments in the future, potential weed expansion onto public lands would not occur; therefore weeds would not exceed the significance criteria.

4.5.3.3 Alternative A - No Action

Under the No Action Alternative, direct and indirect vegetation impacts would continue under the interim drilling plan. The lack of adequate weed control efforts in the first few years of development under the Interim Drilling Plan has already increased seed sources for weeds that would have to be controlled for several years at a minimum. Halogeton has been observed spreading outside areas of disturbance from CBNG development. If the current trend is continued, there would be an introduction of weeds into areas considered weed free, and an increase in noxious or invasive species where they already exist, which would exceed the significance criteria.

4.5.3.4 Alternative B

Alternative B is the same as the Proposed Action in terms of number of wells drilled, acres disturbed both short-term and long-term. The principle difference is that the majority of disturbance would occur in phases, still with half the disturbance/development occurring within the first six years. In terms of impacts to vegetation cover types, they would essentially remain the same as described under the Proposed Action.

There may be some benefits to vegetation related to the concentrated development. This method of developing all wells, roads, pipelines and facilities at the same time may result in better planning and reduced acreage of disturbance to vegetation. It would also provide additional time to: develop native plant seed sources, determine successful reclamation techniques for clay soils with alkali sagebrush, and complete drilling and knowledge learned from the Interim Drilling Plan that may reduce impacts to juniper woodland and true mountain mahogany/mountain shrub communities in the southern portion of the ARPA.

This alternative would increase the likelihood of suspension of all grazing use by the livestock permittee due to the rate and scale of field development, with affects to the vegetative resource similar to the proposed action. The principle difference would be in reclamation, as there would be no need for fencing of pads and other facilities to protect them from grazing until vegetation was sufficiently reestablished. Livestock grazing would not hinder reclamation success which would further reduce the potential for weed establishment. Weeds would not exceed the significance criteria.

4.5.3.5 Alternative C

Alternative C would proceed with development similar to the Proposed Action, but would limit the acres of disturbance or recommend avoidance to protect sensitive values. Examples of sensitive values are areas with steep slopes, soils with high runoff potential, big game crucial winter range, and juniper/mountain shrub plant communities. Since about 95 percent of the ARPA is affected by one or more restrictions for sensitive values (Appendix M: Alternative C--Resources with limited surface disturbance mitigation measures), the total acres disturbed would be reduced by about 64%, with impacts in different plant communities affected to varying degrees.

For instance, alkali sagebrush grows on clay soils with a high runoff potential, so this community would have less than half the disturbance than a comparable site supporting Wyoming big sagebrush. However, sagebrush sites within two miles of active leks that qualify as nesting habitat would also have limited disturbance. In addition, locations on moderate to steep slopes would have reduced surface disturbance compared to sites on gentle slopes; this would further reduce desertification impacts caused by alterations to runoff hydrology from roads. These benefits would affect all plant communities on moderate to steep slopes. Juniper woodland, aspen, serviceberry and true mountain mahogany communities would be avoided, which would maintain the current acreage of these types on public land in the ARPA.

The additional mitigation measures would result in less acreage being disturbed, but some shrub species (Wyoming big sagebrush, Alkali sagebrush, silver sagebrush/bitterbrush) still would not be replaced, removing the community's unique attributes or ability to support other resource values within the LOP, thereby exceeding the significance criteria.

This alternative would continue the likelihood of suspension of all grazing use by the livestock permittee due to the rate and scale of field development, but on a pasture or regional scale within allotments. Within these smaller development areas, the principle difference would be in reclamation success, as there would be no need for fencing of pads and other facilities to protect them from grazing until vegetation was sufficiently reestablished. Livestock grazing would not hinder reclamation success which would further reduce the potential for weed establishment. Weeds would not exceed the significance criteria.

4.5.4 Impacts Summary

Impacts from the Proposed Action would include direct removal of acreage of vegetation communities, and indirect loss of usability from dust, thus decreasing abundance and redistributing use of these native species throughout the LOP (or longer). Disturbance in aspen, juniper woodland, mountain shrub, and Wyoming big sagebrush communities within mule deer and antelope transitional and crucial winter range, would also require long-term recovery and may exacerbate existing management issues that led to the failure of Rangeland Health Standards #3 (Upland Vegetation) and #4 (Wildlife Habitat). Sites located in the mountain big sagebrush cover type would recover with reclamation. In addition, the desertification of rangelands due to changes in overland hydrology on moderate and steep slopes would negatively affect more than one-third of the ARPA. Project implementation would potentially reduce the amount and functions of wetlands, special aquatic sites, and other waters of the U.S due to accelerated erosion and sedimentation from adjacent moderate and steep slopes. Development of additional seed sources for native forbs and shrubs to use in reclamation would not be required; therefore only limited or region-specific seed sources would be available for reclamation. Disturbance to most vegetation cover types would exceed the significance criteria and weed presence would not exceed significance criteria.

Impacts for Alternative A would include disturbed land and associated loss of vegetation as described in the Interim Drilling Plan and associated POD EAs, which would not exceed the significance criteria for vegetation in general. However, the increase in presence and spread of weeds does exceed the significance criteria.

Impacts for Alternative B would be the same as the Proposed Action, with disturbance of most vegetation communities and weed expansion exceeding the significance criteria. If livestock use is suspended, there would be improved reclamation as there would be no need for fencing of disturbed areas to protect them from livestock grazing until vegetation was sufficiently

reestablished. Disturbance to most vegetation cover types would still exceed the significance criteria and weed presence would not exceed significance criteria.

Impacts for Alternative C would promote developing seed sources for native forbs and shrubs to be used in reclamation which would aid in achieving long-term objectives. Avoidance of disturbance in aspen, juniper woodland, true mountain mahogany, and serviceberry communities would protect 69% of these cover types, however disturbance could still occur on private and state lands, contributing to their continuing decline in health. The additional mitigation measures would result in less acreage being disturbed, but some shrub species (Wyoming big sagebrush, Alkali sagebrush, silver sagebrush/bitterbrush) still would not be replaced, removing the community's unique attributes or ability to support other resource values within the LOP, thereby exceeding the significance criteria. Weed presence would not exceed the significance criteria.

4.5.5 Additional Mitigation Measures

There would be no additional mitigation measures for the Proposed Action, Alternative A, or Alternative B.

Additional mitigation measures for Alternative C:

- Restricting surface disturbance to less than 20 acres and four pad locations per section on slopes over 8%
- Avoid surface disturbance within juniper woodland, aspen, true mountain mahogany, and serviceberry communities.
- Promote development of commercial seed sources for native forbs and shrubs

4.5.6 Residual Impacts

Residual impacts would be the same as those described under the impact summary for the Proposed Action, Alternative A, and Alternative B.

Residual impacts from Alternative C include reduced acreage affected by dust, sand blowouts, desertification and accelerated erosion. Long-term loss of Wyoming big sagebrush habitat may not occur with application of mitigation measures. Collection of seeds of native forbs and shrubs to assist federal plant material centers or private producers to develop commercial seeds sources for use in reclamation would help meet long-term objectives of restoring diverse native plant communities following disturbance from permitted activities.

4.6 RANGELAND RESOURCES

4.6.1 Introduction

Impacts to rangeland resources would result with implementation of the Project. Potential impacts would occur throughout the life of the project, from: vegetation and soil disturbance associated with construction activities, reclamation, weed control, road construction and use (i.e. dust and animal collisions), rangeland improvements function, water management, and increased recreational use by the public.

4.6.2 Impact Significance Criteria

Impacts to rangeland resources would be potentially significant if;

- Resource management actions result in >10% permanent reduction in AUMs available for livestock grazing in a given allotment.
- Resource management actions reduce or eliminate the opportunity to run the livestock of choice.
- Wyoming BLM Standards for Healthy Rangelands are not met.
- Vegetation significance criteria are not met.

4.6.3 Direct and Indirect Impacts

4.6.3.1 Direct and Indirect Impacts Common to All Alternatives

The ARPA includes lands that are located within 31 grazing allotments (Chapter 3). In many cases, the boundaries of these allotments extend beyond the boundaries of the ARPA; therefore, discussion of impacts would focus on the 20 allotments primarily affected. The remaining 11 allotments would have similar impacts, but very minor in scale. Under the Proposed Action and all alternatives, cattle and sheep grazing would continue throughout the duration of the project.

Livestock management concerns include reclamation, rangeland improvement functionality, dust from roads, and livestock losses. Adequate reclamation and weed control has been slow in being implemented. Control of halogeton in 2004 was inadequate, forcing one operation trailing sheep to go miles out of their normal trail route to avoid this poisonous plant. Weed control and prompt reclamation occurred on some locations during 2005.

The primary impact to grazing resources would be short-term loss of available forage as a result of construction and production-related disturbance. Available forage would be reduced during drilling and field development and reclaimed as soon as feasible under direction of the Reclamation Plan (Appendix B) and BLM. A long term loss of forage would occur by construction of roads, drill pads, and ancillary facilities that remain permanent during the LOP. Additional forage would not be usable due to dust from roads settling on adjacent vegetation reducing the palatability. The Project would result in increased traffic and increased speeds on the improved roads within the ARPA, particularly during the drilling and field development phase. The potential exists for increased death loss of young livestock due to vehicle collisions following construction of new and higher speed roads. Speed limits should be established and posted as the county has already done on the twenty-mile road south of Rawlins. This would result in decreased potential for livestock/vehicle collisions. There is also the potential for reduced water yield from artesian wells used by livestock as water draw-down in the coalbeds occurs. If this does occur, mitigation would consist of either coalbed methane water of similar quality being substituted to replace the same volume of water no longer flowing, or creating an alternate water source.

The graveled roads reduce dust in the short term, but the scoria commonly used breaks down quicker than other gravels and, in the long term, fugitive scoria dust covers the vegetation resulting in lower palatability and shifting of grazing to other locations. This may reduce usable forage by 15 to 30%, leading to more concentrated use in dust-free locations, leading to lower plant productivity and cover. Increased dust may also affect animal health. These impacts

could include reduced weight gains or require lowering stocking rates in affected allotments. Roads on moderate to steep slopes that result in long-term changes in overland hydrology and desertification impacts below these locations would also lead to lower weight gains or require reduced stocking rates. New and improved access roads would improve livestock operations by improving access for viewing the allotment, facilities and animals; to doctor sick animals; and for trucking animals in or out of an allotment.

The potential exists for disruptions to livestock management actions. There is also potential for damage range improvements from the movement of heavy trucks, drilling equipment, and heavy construction equipment. The mineral companies should promote a policy to report and correct damage to range improvements and livestock facilities as quickly as possible, including contacting the permittee or the BLM. Traffic along roads that pass through shipping pastures or by corrals when in use may interrupt or complicate this work, extending the time and increasing the cost to complete it. Herding of animals through areas being developed or moving around them would increase the complexity and time to accomplish these tasks. In some allotments, management flexibility may be sacrificed to avoid or to minimize these types of impacts. Cattleguards and gates are often damaged by drill rigs that are too wide/heavy, leading to added maintenance and unwanted mixing of livestock. On the west side of Highway 789, there have been numerous instances of gates being left open or fences cut for pipelines that have not been closed or repaired adequately. This has led to mixing of livestock and additional time for herding. In large allotments, this may involve up to a week of additional time.

Disturbance of soils and increased vehicle activity would increase the potential for introduction, establishment, and spread of undesirable non-native/noxious weedy species. This can reduce forage availability and animal weight gains, in addition to affecting trail routes and animal health, particularly increasing death loss of sheep. Recently observed expansion of halogeton from disturbed sites into adjacent native rangelands must also be monitored and treated. Prompt reclamation of disturbed sites and treatment of weeds would minimize the impact of weeds upon livestock operations.

Water resources could be both positively and negatively affected by the proposed action. New water locations may be established in self-contained systems, similar to two water troughs and tanks already authorized on lands of Weber Ranch in the Doty Mountain allotment. These help improve distribution of use and provide water otherwise not available in dry years. Storage tanks and pipelines may be supplemented with water from CBNG development that may save in pumping costs during the LOP. Existing water sources that dry up or have reduced flows due to water draw-down associated with gas field development may affect livestock operations.

4.6.3.2 Proposed Action

The Proposed Action would result in an estimated initial disturbance of about 15,800 acres. This represents about 3% of the total land area of the 31 grazing allotments used by fourteen livestock operators. Initial reclamation would replace forage removed from short-term disturbances. Reclamation efforts would be focused on site stability, with reclaimed vegetation consisting of herbaceous (grass and forb) species. Cattle AUMs total 91% of livestock AUMs. During the LOP, this disturbance would be reduced to about 6,240 acres, or about 1% of the combined land area of the allotments. The amount of forage removed as a result of the proposed action is less than normal variations in forage available from year to year. Therefore, the loss of forage, would be minimal in the short-term and may actually increase available forage in the long-term, and therefore benefit livestock operations.

Impacts would not exceed the significance criteria.

4.6.3.3 Alternative A - No Action

As explained in Chapter 2, the No Action Alternative would allow the Operators to only complete development of wells (200 maximum) already approved under the Interim Drilling Plan. This affects the Doty Mountain, Cherokee, Fillmore and Sixteen Mile allotments, listed in order by the number of wells in each (high to low). Due to this low number of wells, spread across four allotments in excess of 272,000 acres, there would be minimal forage lost or reduced in usability due to dust. This impact should be replaced by forage returning due to reclamation of short-term disturbances, as long as adherences to reclamation and weed control stipulations occur.

Impacts of greater concern are those relating to death loss from vehicle collisions or poisonous plants and disruption of livestock management actions such as vehicular traffic through shipping pastures or altering sheep trailing routes to avoid facilities and halogeton. At this scale of development, these impacts should be negligible if coordination with permittees, field personnel awareness, and weed control measures occur. Whether existing water sources would be impacted due to water draw-down pumping is unknown. The potential for damage to livestock control structures would be minimal due to the level of development. Benefits to livestock operations from existing or new water sources and road infrastructure as a result of CBNG development would continue or be improved.

Impacts would not exceed the significance criteria.

4.6.3.4 Alternative B

The Temporal Development alternative is the same as the Proposed Action in terms of number of wells drilled and acres disturbed both short-term and long-term. The principle difference with the Temporal Development alternative is that the majority of disturbance would occur in phases, with the middle area first, followed by the north and/or south portion in subsequent order. The impacts to livestock operations, would remain the same in the long-term as described under the Proposed Action. However, the short-term impact of the length of time and intensity that impacts occur would vary by region.

Allotments in the middle section, comprising of Adams Ranch, Deep Gulch, Doty Mountain, East Muddy, Headquarters Ranch, JO Pastures, and South Muddy would be affected initially until all build out was completed. This affects four livestock operations. The north section would involve three allotments, Bull Canyon, Fillmore and Sixteen Mile, and two livestock operations. The southern section would involve nine livestock operations and twelve allotments: Airheart Pasture, Baggs Subunit, Brimmer Pastures, Cherokee, Cottonwood Creek, Deep Creek Pasture, Morgan Ranch, Smiley Draw, South Pasture, West Loco, West Wild Cow and Wild Cow.

Differences in impacts to livestock operations relate to the concentrated development on a regional basis. This method of developing all wells, roads, pipelines and facilities would result in a shorter time span of disturbance, and may result in better planning and reduced conflicts if consultation and coordination with livestock operators occurs. Intensity of development would therefore be greater when it did happen, so negative impacts would be amplified. It would also provide additional time to: determine successful reclamation and weed control techniques, and complete drilling and knowledge learned from the Interim Drilling Plan that may reduce impacts to other allotments and livestock operations that are developed later.

Impacts would not exceed the significance criteria.

4.6.3.5 Alternative C

The Spatial Development alternative would proceed with development across the ARPA similar to the Proposed Action alternative, but would have limited acres of disturbance on sensitive sites and/or to protect specific resource values. Examples of some of these sites are steep slopes, soils with high runoff or erosion potential, big game crucial winter range, greater sage-grouse nesting habitat, and aspen/juniper/mountain mahogany plant communities. This would reduce the total surface disturbance by approximately 10,000 acres, or 64 percent less than the proposed action, and long-term disturbance would be reduced by approximately 3,600 acres, or 77 percent less than the proposed action. This would reduce impacts to livestock operations and allotments to varying degrees.

In general, allotments with critical wildlife habitat and high runoff potential soils would have reduced surface disturbance which would result in reduced forage lost or made unusable by dust. Allotments with sensitive soils would have methods employed to reduce erosion or speed up reclamation that would also lower impacts to livestock operations. Posted and enforced speed limits would reduce the young livestock loss to vehicle collisions. Annual coordination with livestock operators would further reduce conflicts with livestock management operations. The reduction in surface disturbance, combined with dust abatement control techniques would reduce the indirect forage loss from dust.

4.6.4 Impacts Summary

Proposed Action. Impacts would include surface disturbance and the associated loss of forage (about 2,026 AUMs). During the LOP, these AUMs are estimated to be replaced and probably increased assuming reclamation efforts are successful. There would be increased death loss, unusable forage due to dust, declining rangeland health and forage productivity, and disruptions to livestock management actions, and the potential for damage to livestock control facilities; however, impacts would not exceed the significance criteria.

Alternative A. Impacts would include surface disturbance and the associated loss of forage as described in the Interim Drilling Plan and associated POD EAs. This would amount to less than ten percent of the forage loss described under the Proposed Action, or between 150 to 200 AUMs. Since this impact is spread across four large allotments, the short-term impact should be minimal. During the LOP, this total is estimated to be replaced or exceeded assuming reclamation efforts are successful. Due to the small scale of development in this alternative, there would be minimal impacts in terms of increased death loss, unusable forage due to dust, declining rangeland health and forage productivity, potential for damage to livestock control structures, and disruptions to livestock management actions.

Alternative B. Impacts would include surface disturbance and the associated loss of forage same as the Proposed Action, but occurring in zones.

Alternative C. Impacts would include reduced surface disturbance (by 64%) and the associated loss of forage. Implementation of the additional mitigation measures would further reduce the direct and indirect loss of AUMs and enhance reclamation of disturbed areas. During the LOP, this total would be replaced or exceeded assuming reclamation efforts are successful. Impacts would be the same in type, but reduced in magnitude and would not exceed the significance criteria.

4.6.5 Additional Mitigation Measures

There are no proposed additional mitigation measures under the proposed action, Alternative A or Alternative B.

Additional mitigation measures for Alternative C:

- The BLM would require that the Operators establish speed limits in the project area, and erect signs in lambing/calving areas, shipping pastures, or adjacent to working corrals to warn vehicle operators.

- The Operators would coordinate annually or more often when necessary with affected livestock operators to minimize disruption during livestock operations, and to discuss/resolve impacts to livestock management facilities.

- Minimize dust from collector roads by maintaining a 95 percent compaction ratio during construction, gravel, and annual treatments of dust abatement product.

4.6.6 Residual Impacts

The Proposed Action would result in residual impacts from death loss, unusable forage due to dust, declining rangeland health and forage productivity, and disruptions to livestock management actions.

The No Action Alternative would result in the same residual impacts, but much reduced.

Alternative B would have the same residual impacts as the proposed action, but concentrated in zones and on fewer operators in a given time period.

Alternative C would result in reduced residual impacts to livestock operations due to reduced death loss, reduced unusable forage due to dust, and fewer disruptions to livestock management activities. Additional mitigation measures in this section and proposed by other resources would significantly reduce, but not eliminate, the potential impacts from gas field development to livestock operations.

4.7 WILDLIFE

4.7.1 Introduction

The principal wildlife impacts likely to be associated with the Proposed Action or action alternatives include: (1) direct and indirect loss of wildlife habitats, (2) displacement of some wildlife species, (3) an increase in the potential for collisions between wildlife and motor vehicles, and (4) an increase in stress to wildlife.

In addition, an analysis of potential wildlife concerns within each section of the ARPA was conducted so that Operators could take the locations of these potential concerns into account when planning and selecting eventual well locations. Mitigation measures that correspond to the respective types of wildlife impacts within any given section would be implemented.

The primary wildlife resource concerns known to be present within the ARPA include: big game crucial winter/transitional ranges; big game migration routes; overlapping big game crucial winter range (multiple species); leks, nesting habitat, and severe winter relief habitat of greater sage-grouse; leks and nesting habitat of Columbian sharp-tailed grouse; and raptor nests.

The wildlife map (Appendix M: Overlapping Wildlife Concerns) represents the currently known locations of wildlife resource concerns within the ARPA. As more field data are gathered, additional areas that include wildlife resource concerns may be identified and mapped. If development occurs in areas of overlapping wildlife resource concerns, mitigation measures for each individual resource would be implemented. This approach provides the Operators with information that can be utilized when developing gas well placement plans. Planned placement of disturbances may avoid individual wildlife resource concerns, or overlapping concerns present within a section.

4.7.2 Impact Significance Criteria

The following criteria were considered in the assessment of impacts associated with the Proposed Action and Alternatives and are the same as those contained in the Draft Rawlins Resource Management Plan (BLM 2004b):

- Substantial loss of habitat function or disruption of life history requirements of a species or population segment that would make them eligible for listing under the Endangered Species Act (ESA).

- Decreased viability or increased mortality of threatened and endangered (T&E), proposed, and/or candidate species or adverse alteration of their critical habitats.

- Management actions that result in substantial disruption or irreplaceable loss of vital and high value habitats as defined in the Wyoming Game and Fish Department Mitigation Policy (WGFD 2004c).

- Substantial loss of habitat function or disruption of life history requirements of Special Status Species that would preclude improvement of their status.

4.7.3 Direct and Indirect Impacts

4.7.3.1 Direct and Indirect Impacts - Common to All Alternatives

Applicant Voluntarily Committed Measures listed in Appendix K, and the BMP appendix would be implemented.

The Wildlife Monitoring/Protection Plan (Appendix E) would be followed to prevent, reduce, and detect impacts to wildlife and fish species throughout the LOP. This plan serves two purposes. One is to describe the protocols to monitor wildlife responses, habitats, behavioral shifts, etc. The other is to provide protocols to protect wildlife species and track the effectiveness of the monitoring plan. BMP's implemented for other resource concerns may provide indirect protection for a variety of wildlife species.

Potential direct and indirect impacts to wildlife species, common to all alternatives are discussed below. Wildlife habitats directly affected by the proposed project include areas that are physically disturbed by the construction of pads, roads, pipelines, and production facilities;

wildlife habitats indirectly disturbed include areas surrounding directly impacted habitats. Disturbance during construction and production such as human presence, dust, and noise may displace or preclude wildlife use of disturbed areas. Wildlife sensitivity to these impacts varies considerably with each animal species.

Prohibiting construction, drilling, and other activities potentially disruptive to wildlife during sensitive time periods (i.e. winter, brood-rearing), would minimize the probability of displacement, nest abandonment, or reproductive failure during these critical times of the year. To reduce human presence, remote monitoring of project facilities, gating of roads, and noise reduction techniques should be utilized to the greatest extent possible during the production phase. However, habitat loss would still occur outside of this time period, as development would be allowed. Additionally, it does not address the displacement of animals/loss of critical habitat due to the presence and operation of wells, facilities and roads after construction is complete.

Displacement is unavoidable in the short term under all action alternatives, and this displacement has the potential to have the most significant effect on wildlife. Avoidance of disturbed areas would result in wildlife displacement from an area larger than the actual disturbed sites. The extent of displacement would be related to the duration, magnitude, and the visual prominence of the activity, as well as the extent of construction and operational noise levels above existing background levels. Visual prominence of facilities is dependent upon surrounding topography.

Displacement would result in local reductions in wildlife populations if adjacent, undisturbed habitats are at carrying capacity. In this situation animals are either forced into less optimal habitats or they compete with other animals that already occupy unaffected habitats. Possible consequences of such displacement are lower survival, lower reproductive success, lower recruitment, and ultimately lower carrying capacity and reduced populations (Oil and Gas Mitigation Working Group 2004).

Reaction of animals to noise and human presence varies depending on the intensity of the noise source and whether it is continuous or intermittent. Transient loud noises would provoke alarm responses; however, many animals learn to ignore more constant, lower level noise sources that are not associated with negative experiences such as being chased or hunted (Busnel 1978).

The extent of wildlife displacement is impossible to predict for most species since the response severity varies from species to species and can even vary between different individuals of the same species. After initial avoidance, some wildlife species (usually certain birds and rodents and to a lesser extent deer and pronghorn) may acclimate to the activity and begin to reinvade areas previous avoided. This acclimation and reoccupation would be expected to occur following construction and drilling when the project moves into the production phases where less noise and human activity would take place. Acclimation to activity may increase predation on some species.

Construction and drilling noise have the potential of affecting wildlife species at the project site as well as areas surrounding disturbance sites. Man-made construction such as well pads and roads can reduce use of surrounding habitat by wildlife. These impacted sites reduce foraging due to the direct loss of native vegetation from ground disturbance. In addition, there is an area surrounding these sites that tends not to be utilized due to the increased human activity. This “zone” can extend up to a half mile from the developed area. Consequently, development

impacts to wildlife can extend further offsite than the actual amount of disturbed area. Although some individual animals can habituate to the increased infrastructure, it is generally assumed that, over all, the increased human footprint on a previously lightly developed area is detrimental to big game species. In addition to the avoidance response, increased human presence intensifies the potential for wildlife-human interactions ranging from the harassment of wildlife to poaching and increased legal hunting pressure. Also, increased traffic levels on new and existing roads could increase the potential for wildlife-vehicle collisions. Following drilling and well completion operations, noise levels would be reduced because well pumps would be powered by muffled generators. As a result, species might acclimate to the well pad production facilities and utilize habitats immediately adjacent to such sites. This has been observed at other natural gas production sites in Wyoming.

Direct habitat loss from construction would equal approximately 6% of the project area. In addition, dust would directly and indirectly impact 15 – 30% more acreage. These impacts would include habitat avoidance. Indirectly, this may increase inter- and intra-species competition for forage and thermal cover; in areas already fully occupied, density dependant species would be further displaced, possibly outside of the project area. This may force animals to utilize lower quality habitats, which may lead to a reduction in reproduction rates or an increase in predation. The long-term loss/reduced usability of shrub habitat would lead to an increase in use on remaining shrub habitats. This increase of use would then lead to a long-term reduction of shrub habitats outside the immediate project disturbances. A further reduction of shrub habitat from die off caused by overuse would further reduce the habitat quantity and quality available in the long term, resulting in a significant impact.

Habitat fragmentation and isolation are difficult to determine and probably vary species to species but they could occur as a result of gas field developments, which are typically configured as point and linear disturbances scattered throughout broader areas. Although these types of disturbances do not usually create physical barriers to wildlife movement, the effective use of adjacent undisturbed habitats could diminish as densities of well pads, ancillary facilities, and roads increase.

Reclamation of disturbed areas along pipeline and road ROWs, and unused portions of well pads, would result in re-establishment of vegetation in these areas over a relatively short time period. Re-vegetation would continue with the subsequent reclamation of abandoned well sites. Grasses and forbs are expected to become established within the first several years following reclamation; however shrub re-establishment to pre-disturbance levels would not be achieved during the life of this project. Consequently, the total acres disturbed would constitute a long-term loss of shrubs and would not be usable by species dependant upon the shrub component for forage or shelter.

To protect breeding grounds and raptor nest sites, the BLM places a buffer around leks and nests where controlled surface use (CSU) is stipulated (USDI-BLM 1990). The buffer around the leks located within the project area covers 8440 acres or 3.1% of the ARPA. The buffer around nests covers 17,846 acres or 6.6% of the project area. Therefore, most these areas would remain undisturbed for the LOP.

4.7.3.1.1 General Wildlife (Species other than described in Sections below)

The disturbance of wildlife habitat would reduce habitat availability for a variety of small birds and mammals. The temporary disturbances that occur during the 20-year construction period would tend to favor early succession wildlife species such as ground squirrels and horned larks

and would have more impact on mid-to-late-succession species such as sage sparrows, sage thrashers, and voles. The long-term disturbance acres would have a minor effect on wildlife species not dependant upon shrubs. In addition to the direct disturbance acreage, dust would directly and indirectly impact 15 to 30% more acreage. These impacts would include habitat avoidance by birds, mammals, and insects. Indirectly, this may increase inter- and intra-species competition for nesting and foraging areas; in areas already fully occupied, density dependant species would be further displaced, possibly outside of the project area. This may force animals to utilize lower quality habitats, which may lead to a reduction in reproduction rates or an increase in predation.

The primary songbirds (common and BLM sensitive species) that may be displaced by the reduction in habitat are: vesper sparrow, green-tailed towhee, lark sparrow, sage sparrow, sage thrasher, loggerhead shrike, and Brewer's sparrow. Although there is no way to accurately quantify these changes, the displacement would be long term. Birds are highly mobile and would disperse into surrounding areas and utilize suitable habitats to the extent that they are available. The long-term loss/reduced usability of shrub habitat would lead to an increase in use by all species, including big game (see big game section below), on remaining shrub habitats. This increase of use would then lead to a long-term reduction of shrub habitats outside the immediate project disturbances. A further reduction of shrub habitat from die off caused by overuse would further reduce the habitat quantity and quality available for shrub-dependant birds. Standard mitigation measures would indirectly help songbirds during critical time periods, however, impacts on nesting and foraging habitats would be significant. The magnitude of habitat loss, and continued human presence during the production phase of the project, would exceed the significance criteria.

The primary small mammals found on the project area include, but are not limited to, cottontail rabbits, deer mice, various vole species, pocket gophers, white-tailed jackrabbits, Richardson's ground squirrels, and white-tailed prairie dogs. The initial phases of surface disturbance would result in some direct mortality and displacement of small mammals from construction sites. Quantifying these changes is not possible because population data are lacking. However, the impact is likely to be minor, and the high reproductive potential of these small mammals would enable populations to quickly repopulate the area following interim reclamation. Most of these species would benefit from an increase in grass-dominated vegetation from reclamation.

Development of the project may result in some direct mortality of small birds and small mammals from vehicle collisions; however, this mortality is expected to be negligible and is not likely to significantly reduce populations within the ARPA.

4.7.3.1.2 Big Game

Impacts to big game species may include: (1) the removal and modification of habitat, (2) displacement due to increased human activities, (3) increased potential for vehicular collisions due to increased traffic levels on existing highways, and (4) increased potential harvest success due to easier access. The magnitude of disturbance to big game species would depend upon the season the area is used by each species, the ability of a species to habituate to disturbance, the corresponding drilling schedule, and the density of well field development.

The WGFD classifies big game crucial winter range (CWR) as vital habitats and recommends that habitat function be maintained so that the location, essential features, and species supported by the habitat are unchanged (WGFD 2004c). The application of BLM seasonal

restrictions to prevent drilling on CWR between November 15 and April 30 reduces the displacement of big game during the most critical season.

Timely reclamation of well pads, pipelines, and ROWs would provide grass and forb forage within a few years, while sagebrush and other important shrub species would require longer for re-establishment to pre-disturbance levels. With average browse rates on CWR and adjacent transition range already at moderate levels (40-60 percent) during average winters and higher during severe winters; this reduction in usable habitat would lead to increased browse use levels that would result in plant mortality. A ten-year clipping trial study conducted by Colorado State University indicated that repeated plant removal above 60 percent resulted in increased plant mortality of big sagebrush. Displacement of animals, due to project related activities, onto either of these ranges for a longer time period would increase overall browse use levels on both transition and CWR above 60 percent, which would result in plant mortality, lower vigor and declining cover of remaining Wyoming big sagebrush plants. For the most part, impacts described in this and sections below are primarily about CBNG wells, since the actual number and location of deep natural gas wells is speculative at this point.

Pronghorn Antelope

The 43,720 acres of pronghorn crucial winter/yearlong range are located along the western edge of the ARPA (Appendix M: Seasonal pronghorn ranges and migration routes). Approximately 43.5% of the crucial winter/yearlong range in the Baggs pronghorn herd unit is within the ARPA. The remainder of the ARPA is classified as winter/yearlong or spring/summer/fall range.

Prohibiting construction, drilling, and other activities potentially disruptive to pronghorn within CWR from November 15 to April 30, would reduce the probability of displacement during this critical time of the year. During the production phase, there is no equivalent mitigation and animals may be displaced up to 0.25 miles from the source (RFO RMP DEIS 2004b). This would lead to increased stress/decreased condition or reproductive rates of the animals as they travel further and may have to use lower quality range. To reduce human presence, remote monitoring of project facilities would be utilized to the greatest extent possible during the production phase.

Several general pronghorn migration routes transverse the ARPA; it is not known how critical these routes are. This project could alter or block pronghorn movements along existing migration routes.

In addition to the direct removal of habitat due to the development of pads and associated ancillary facilities, disturbances from drilling activities and traffic would affect utilization of the habitat adjacent to these areas. However, pronghorn have been found to habituate to increased traffic volumes and heavy machinery as long as the machines move in a predictable manner (Reeve 1984). Pronghorn have also been found to habituate to and inhabit surface mining sites in Wyoming (Segerstrom 1982, Deblinger 1988). Well development operations and deviation from ordinary activities may cause antelope displacement of up to 0.5 miles (Segerstrom 1982, Easterly et al. 1991), but they would likely habituate to activities along roads and continue using habitats in those areas (Reeve 1984). The magnitude of displacement would decrease over time as: (1) the animals have more time to adjust to the circumstance, and (2) the extent of the most intensive activities such as drilling and road building diminishes and more wells are put into production. By the time the field is under full production, construction activities would have ceased, and traffic and human activities would be reduced. Minimizing human presence at well

sites after they have been put into production and timely reclamation of well pads, pipelines, and ROWs would help reduce displacement of pronghorn from the well field. However, fences along Highway 789 create a migration barrier not allowing pronghorn to move from east to west across the highway. Pronghorn found east of this highway are restricted to crucial winter habitat found along Muddy Creek and against Highway 789, creating a trap to animal movement.

Mule Deer

The 74,492 acres of mule deer crucial winter and crucial winter/yearlong range are located within the ARPA (Appendix M: Seasonal mule deer ranges and migration routes). Approximately 27% of the crucial winter and crucial winter/yearlong range in the Baggs mule deer herd unit is within the ARPA. Forty percent of this CWR is on private and state land and is afforded no protection. Therefore, loss of this CWR is likely during the LOP, leading to increased use on public land CWR. Construction activities remove CWR vegetation and increase noise and human activity levels which displaces animals. The critical shrub component within CWR removed would not be replaced (with potentially the exception of mountain sagebrush) to pre-development levels during the life of the project.

Prohibiting construction, drilling, and other activities potentially disruptive to pronghorn within CWR from November 15 to April 30, would reduce the probability of displacement during this critical time of the year. During the production phase, there is no equivalent mitigation and animals may be displaced up 0.75 miles from the source (Rawlins Draft RMP 2004c). This would lead to increased stress/decreased condition or reproductive rates of the animals as they travel further and may have to use lower quality range. To reduce human presence, remote monitoring of project facilities would be utilized to the greatest extent possible during the production phase.

Several mule deer migration routes transverse the ARPA. A research project initiated by the BLM and WYGFD in February of 2005, funded by two of the operators, should help delineate the migration routes utilized by mule deer on the ARPA. When information is available from this research, additional mitigation would be placed on development for the protection of mule deer migration corridors. Meanwhile, this project could alter or block mule deer movements along existing migration routes.

In addition to the direct removal of habitat due to the development of pads and associated ancillary facilities, disturbances from drilling activities and traffic would affect utilization of the habitat immediately adjacent to these areas. Mule deer, however, are adaptable and may adjust to non-threatening, predictable human activity (Irby et al. 1988, Gusey 1986). However, the Sublette mule Deer Study, using GPS collars, found that winter mule deer habitat selection and distribution patterns have been affected by development, specifically road networks and well pads. Sawyer found no evidence of acclimation behavior. During three years of study, mule deer had higher probability of use in areas farther away from well pads as development progressed. Predictive maps also suggest that some habitats considered “high probability of use” areas prior to development, changed to “low probability of use” areas as development progressed, and visa versa. Indirect habitat loss can be substantially greater than the direct loss of habitat to roads and well pad construction and that reduction in winter range size and quality of available habitat may decrease the carrying capacity of the overall winter range (Sawyer 2004). This suggests that within the ARPA, indirect impacts such as displacement from activities, dust from roads, and competition for forage within the already poor condition CWR habitat may lead to reduced mule deer numbers and die offs from animals going onto CWR in poorer health with reduced body reserves.

Elk

Approximately 41,000 acres or 20% of the crucial winter/yearlong range in the Sierra Madre elk herd unit is within the ARPA (Appendix M: Seasonal Elk Ranges and Migration Routes). Several elk migration routes transverse the ARPA; it is not known how critical these routes are. This project could alter or block elk movement along existing migration routes.

Construction activities remove CWR vegetation and increase noise and human activity levels which displace animals. However, much of the CWR is on steeper south and west facing slopes that would be avoided during development. The amount of vegetation disturbed is not as important as the noise and activity levels that would still occur and result in displacement of elk. In addition to the direct removal of habitat due to the development of pads and associated transportation facilities, disturbances from drilling activities and traffic would affect utilization of the habitat adjacent to these areas (Powell 2003). Elk are more sensitive to human activities than pronghorn or mule deer, and they may be displaced from construction areas by 0.75 - 2 miles (Brekke 1988, Gusey 1986, Hiatt and Baker 1981). Displacement would be reduced in areas with topographic barriers (Edge and Marcum 1991). Elk would likely habituate to the physical presence of gas wells (Ward et al. 1973, Ward 1976, Hiatt and Baker 1981, Perry and Overly 1976). However, elk rarely adjust to continued human presence required during the production phase of the project (Thomas and Toweill 1982). With the increase in roads and potential recreational access to the area, displacement of elk is extremely likely during all phases of development. During the production phase, there is no equivalent mitigation and animals may be displaced up one mile from the source (Rawlins Draft RMP 2004). This would lead to increased stress/decreased condition or reproductive rates of the animals as they travel farther and may have to use lower quality range. To reduce human presence, remote monitoring of project facilities would be utilized to the greatest extent possible during the production phase.

Overlapping Big Game Crucial Winter Range

Areas of overlapping big game CWR are of greater importance because they provide crucial habitat for more than one species of big game. There are several areas of overlapping big game CWR located in the ARPA (Appendix M: Overlapping Crucial Winter Ranges). The combinations of overlapping big game CWR include the following: elk/mule deer 3,038 acres; mule deer/antelope 22,637 acres. Forty percent is on private and state lands where there are no protections against disturbance of animals during critical time periods.

Indirectly, this may increase inter- and intra-species competition for forage and thermal cover; in areas already at carrying capacity, density dependant species would be further displaced. This may force animals to utilize lower quality habitats, which may lead to a reduction in reproductive rates or an increase in predation.

4.7.3.1.3 Upland Game Birds

Greater Sage-grouse.

Greater sage-grouse are abundant within the ARPA, due to the high amount and diversity of suitable habitat, lack of habitat fragmentation, and the close proximity of upland and riparian habitats. In addition, all habitats needed to fulfill the life history requirements of this species are found adjacent to one another. Potential impacts to greater sage-grouse include: loss of nesting or early brood-rearing habitat; decreased population productivity caused by loss of nesting or

early brood-rearing habitat; reduced utilization of suitable habitats due to indirect disturbance; loss of winter habitat; and displacement of birds into lower quality habitats.

Potential sources of direct impacts to greater sage-grouse include excessive noise levels proximal to occupied leks; disruptive human activities that occur during the daily time period in which courtship and breeding, nesting, brood-rearing, and foraging activities take place; and habitat loss from construction of project facilities. Noise levels interfere with bird communication during mating periods resulting in lower bird attendance at leks. Disruptive human activities alter normal bird behavior, increases nest abandonment, and may displace birds into less desirable habitats. Construction of facilities and roads creates a long-term loss of greater sage-grouse habitat and increases fragmentation of remaining habitat. All of these impacts lead to lower productivity and long-term decline in the population of this species.

Of greater concern is the indirect loss of habitat resulting in bird displacement and fragmentation of nesting and early brood-rearing habitat. Sources of indirect impact primarily relate to dust settling on vegetation and loss of sagebrush habitat due to over-browsing by antelope and mule deer. Dust reduces the palatability and production of forbs and shrubs used by grouse. Over-browsing by big game on ranges shared with grouse would reduce quality and/or abundance of nesting, brood-rearing, and winter habitats, and forage.

Potential greater sage-grouse nesting habitat covers 92% of the ARPA. In the long-term, recovery of shrubs to pre-disturbance levels would not occur during the life of the project. Therefore, there would be a long term loss of nesting habitat.

Sage grouse may repopulate an area following energy development but may not attain population levels that occurred prior to development (Braun 1998). Most nests abandoned are directly or indirectly related to human activity. Likelihood of abandonment is higher when nests are disturbed early in incubation period (Remington and Braun 1991).

Columbian Sharp-tailed Grouse.

Six occupied Columbian sharp-tailed grouse lek locations have been documented on or within one mile of the ARPA, which comprise 27% of the leks within the Rawlins Field Office (Appendix M: Columbian sharp-tailed grouse lek locations). Potential Columbian sharp-tailed grouse nesting habitat (habitat located within one mile of an occupied lek) covers approximately 4,900 acres or 1.8% of the ARPA. Leks are not located on BLM lands, however 785 acres of nesting and brood-rearing habitat are. Wintering habitat for sharp-tailed grouse (serviceberry/mixed mountain shrub habitat) totals 287 acres, of which 278 acres are on BLM.

Potential sources of impact to sharp-tailed grouse include excessive noise levels proximal to occupied leks, and disruptive human activities that occur during the daily time period in which courtship and breeding activities take place. As no leks are located on BLM managed lands, the potential for disturbance during courtship and breeding periods is likely as there are no timing restrictions for surface disturbing or other disruptive activities. Also, in the long-term, recovery of shrubs to pre-disturbance levels would not occur during the life of the project for sharp-tailed grouse nesting and brood-rearing habitat.

The application of avoidance and mitigation measures on BLM lands would help to reduce stress to sharp-tailed grouse during nesting and brood-rearing periods. There are no measures to protect the habitat from being removed by project activities outside this spring period on BLM lands or at any time on private and state lands.

Wintering Areas for Grouse.

Wintering areas (as they are mapped) would be protected from surface disturbing activities from November 15 to March 14. Approximately 200 acres of sever winter relief areas (SWR), of which 174 acres are on BLM, have been identified and mapped so far. Mapped wintering habitat for sharp-tailed grouse (serviceberry/mixed mountain shrub habitat) totals 287 acres, of which 278 acres are on BLM. Activities would be allowed outside this timing period and habitat would be removed. This would result in habitat loss as well as potential displacement of wintering birds.

4.7.3.1.4 Raptors

The potential impacts that the project could have on raptors include: nest abandonment and/or reproductive failure due to project activities or increased public access, reductions in prey populations, mortality from vehicle collisions, loss of nesting habitat, decreased population recruitment, and reduced utilization of suitable habitats.

There are 357 raptor nests located within the ARPA, with an additional 185 raptor nests within one mile of the ARPA boundary (one mile seasonal protection) totaling 542 nests. The total acreage around nests, buffered by one mile of seasonal protection, totals 173,483 acres or 64 % of the ARPA.

The development of the project would disturb habitat for several prey species. The amount of short-term change in prey base populations created by construction is expected to be minimal in comparison to the overall level of small mammal populations. While prey populations on the project area would likely sustain some reduction during the development phase of the project, most prey species would be expected to rebound to pre-disturbance levels following initial reclamation. Once reclaimed, these areas would likely promote an increased density and biomass of small mammals that is comparable to those of undisturbed areas (Hingtgen and Clark 1984). For these reasons, no measurable long-term reductions are anticipated to the prey base. However, prey populations may be displaced due to dust and habitat loss. In turn, those raptors (i.e. prairie falcon and burrowing owl) dependant on small birds and insects may be indirectly affected.

Some raptors feed on carrion on and along the roads, while others (owls) may attempt to capture small rodents and insects that are illuminated in headlights. These raptor behaviors put them in the path of oncoming vehicles where they are in danger of being struck and killed. The potential for such collisions can be reduced by requiring that drivers undergo training that describes the circumstances under which vehicular collisions are likely to occur and the measures that can be taken to minimize them.

4.7.3.1.5 Fish

Refer to Special Status Species for impacts to Sensitive Fish Species.

4.7.3.2 Proposed Action

Development would alter or remove approximately 15,800 acres of wildlife habitat over the next twenty years. However, reclamation of disturbed habitats would commence immediately and continue throughout the 20-year construction period, resulting in a short-term recovery of grass-dominated habitat. This reclamation would reduce the area disturbed by 60 percent, to 6,240

acres. Long-term recovery of shrubs to pre-disturbance levels would not occur during the life of the project. There would be 54 acres of pre- and 22 acres of post- reclamation disturbance with the maximum eight pad locations per section.

Impacts are the same as identified in "Common to All" above, unless discussed below.

4.7.3.2.1 General Wildlife (Species other than described in Sections below)

The long-term disturbance would have a minor effect on wildlife species not dependant upon shrubs. Impacts to songbirds that are dependant upon shrub habitats for nesting and foraging would be significant. The magnitude of habitat loss, and continued human presence during the production phase of the project, would exceed the significance criteria.

4.7.3.2.2 Big Game

Pronghorn Antelope

The acreage disturbance and the actual number of pads per section would fall under a high impact post-reclamation. The direct loss/reduced usability of Wyoming big sagebrush would increase use on remaining shrubs, resulting in shrub health decline outside the immediate project disturbances. This would have the greatest impact to antelope due to their extreme reliance upon sagebrush (96% of their diet) during winter. This level of development within pronghorn CWR, compounded by the current condition of the crucial winter habitat would exceed the significance criteria.

Mule Deer

The acreage disturbance and the actual number of pads per section would fall under a high impact post-reclamation. This level of development within mule deer transitional range and CWR, compounded by the current poor condition of the crucial winter habitat would exceed the significance criteria.

Elk

Although actual acreage disturbance would fall under a "high" impact post-reclamation, there would be an "extreme" impact to elk based on the actual number of pads (8 pads per section). With this level of development, impacts to elk CWR would exceed the significance criteria.

4.7.3.2.3 Upland Game Birds

Greater Sage-grouse.

The proposed action habitat disturbances would equate to a maximum direct loss of 9% of the available nesting habitat (eight locations per section with associated roads and facilities). However, the acreage disturbed by this alternative would fall into the high impact category.

Of greater concern is the indirect loss of habitat resulting in bird displacement and fragmentation of nesting and early brood-rearing habitat. At eight locations per section impact zones surrounding each well pad, facility and road corridor begin to overlap, thereby reducing habitat effectiveness over much larger, contiguous areas. Human, equipment and vehicular activity and noise impacts are also more frequent and intensive (WGFD 2004).

The application of avoidance and mitigation measures would help reduce the loss of habitat and stress to greater sage-grouse in proximity to leks on public lands. Based on research conducted in Wyoming, only 45% of nests would be afforded seasonal protection as they are within the two-mile buffer of leks. Of the suitable nesting habitat, 21% is outside the two-mile buffer and would be afforded no seasonal protection. Habitat loss would continue outside the ¼ mile protected buffer around leks. However, the long term loss of shrubs combined with the indirect impacts on the habitat, such as dust, noise, and continued human presence during the drilling and production phase would result in habitat loss and disturbance levels exceeding the significance criteria.

Columbian Sharp-tailed Grouse.

The application of avoidance and mitigation measures in this alternative would help to reduce stress to nesting and brood-rearing and wintering sharp-tailed grouse. However, because of the magnitude of habitat loss and continued human presence during the production phase of the project, impacts would exceed the significance criteria.

Wintering Areas.

The timing stipulation prevents winter disturbance to grouse, but does not prevent the direct loss of wintering areas outside of this time period. Loss of this habitat would lead to lower productivity and long-term decline in the population of these species.

4.7.3.2.4 Raptors

With the application of avoidance and mitigation measures, impacts are not expected to exceed the significance criteria.

4.7.3.2.5 Fish

Refer to Special Status Species for impacts to Sensitive Fish Species.

4.7.3.3 Alternative A – No Action

Under Alternative A, drilling would continue under the interim drilling plan. The remainder of the area would remain undeveloped.

4.7.3.4 Alternative B

The temporal development involves the same number, rate and spacing of wells to be drilled as in the proposed action. However, the principle difference would be that the majority of development would occur in three phases with the center portion of the project area (Doty Mountain Pod, Sundog/Cow Creek POD and Blue Sky Pod) being developed first over a five to six year period. The initial phase would involve approximately 950 CBNG well locations. There would be continued drilling, of approximately 100 additional wells, within previously analyzed PODs, concurrently with development of the initial phase. Development would then be shifted to the second phase in the northern portion and the third phase in the southern portion of the project area. The entire project area would still be developed over a twenty year period, with approximately 95% of the CBNG wells and 75% of the conventional wells being drilled within 15 years. In terms of disturbance to wildlife and their habitats, this phased approach would

potentially provide “safe-haven” areas in two thirds of the project area during the development phases of the ARPA. However, this does not take into account that those areas would be already occupied, may be of lower quality or not be suitable, or may not be available due to migration distances or potential barriers. They may not provide enough habitat for the areas lost. Lessons learned during the earlier phases may change how the next phase of development proceeds (adaptive management through monitoring).

4.7.3.4.1 General Wildlife (Species other than described in Sections below)

This alternative would benefit some wildlife species more than others, depending on their mobility and adaptability. Mobile and less tolerant species such as sagebrush dependant birds could potentially move to adjacent areas to avoid direct and indirect impacts. Impacts would be the same as those described in the proposed action however, they would occur mainly on one third of the project area, at any one time.

4.7.3.4.2 Big Game

Most pronghorn CWR is located along the western edge of the project. The transition range is located through the middle of the project north to south. Therefore, development would disturb one third of the CWR and transition range over the first five to six years. Even though two thirds of these ranges would remain intact, development would occur in the middle, fragmenting both. The increase in use on undisturbed ranges would lead to a long-term decline in health of the ranges.

Mule deer CWR lies within the southern and northern portions of the project. Therefore, the first phase of development would have the least amount of disturbance to mule deer CWR; however disruption of animal movements would occur within transition habitat and migration corridors. Two of the project proponents have funded a study to better understand and identify mule deer use and movement within the project area. This alternative may provide the study more time to better understand mule deer movements and allow for protection of migration corridors.

Elk CWR occurs within all phases of the project. During the first phase of development, impacts to CWR habitat would be the greatest. The first phase of development would effectively fragment the CWR.

Similar to the proposed action, with the same number of pad locations and spacing, this level of development within transitional ranges and CWR, compounded by the current poor condition of the crucial winter habitat would exceed the significance criteria.

4.7.3.4.3 Upland Game Birds

Greater sage-grouse are found throughout the project area. Therefore, impacts from this alternative would be the same within each portion of the phased alternative. This alternative would benefit greater sage-grouse in the short-term by concentrating development within one third of the project area over the first five to six years. Suspension of grazing use would leave more residual grass cover and forbs on grouse habitat, which in turn would benefit grouse nesting and brood-rearing. In the long-term, however, the decline in health of CWR and transitional ranges for big game would further reduce habitat quality and quantity for grouse, potentially leading to a decline in population numbers.

Columbian sharp-tailed grouse are found within the southern phase of development. Within the first phase of development Columbian sharp-tailed grouse are found outside the eastern edge within the Sand Hills ACEC. This alternative would ultimately disturb Columbian sharp-tailed grouse habitat during the southern phase of development and grouse could be displaced from the project area.

Similar to the proposed action, with the same number of pad locations and spacing, this level of development within grouse habitat, would exceed the significance criteria.

4.7.3.4.4 Raptors

With the application of avoidance and mitigation measures, impacts are not expected to exceed the significance criteria.

4.7.3.5 Alternative C

The Spatial Development alternative would proceed with development across the ARPA similar to the Proposed Action alternative, but would be constrained by critical/sensitive resource concerns. These sites would have additional protective measures beyond what is already provided by applying standard mitigation stipulations (Appendix E) and BMPs. Examples of these sensitive sites are: steep slopes, soils with high runoff potential, big game CWR, greater sage-grouse nesting and brood-rearing habitat, and juniper/true mountain mahogany/serviceberry plant communities. Because of these sensitive issues, there would be less surface disturbance allowed per section on BLM lands. This would reduce the total surface disturbance by approximately 64 percent less than the proposed action. Long-term disturbance would be reduced by approximately 77 percent less than the proposed action. There would be less than 20 acres of pre-reclamation and 5 acres of post-reclamation surface disturbance with a maximum of 4 pads per section in grouse nesting and brood-rearing habitat and CWR on BLM lands. This would reduce impacts on different wildlife species to varying degrees.

For instance, juniper/true mountain mahogany/serviceberry plant communities would be avoided across the project area and no disturbance would be allowed in these communities within SMA boundaries. This would aid in efforts to restore them to a more healthy condition to meet Rangeland Health Standard #3. These vegetation communities provide important habitat components for big game and grouse.

The overall reduction in acres initially disturbed would reduce habitat fragmentation and indirectly increase potential recruitment of native species re-establishing disturbed sites. This would decrease the overall habitat loss and displacement effects to wildlife species, as well as reduce impediments within movement corridors. A reduction in disturbance of wildlife habitat by 64% would benefit all species and reduce the time required, long term, to return the functionality of the habitat in the project area. These benefits would be realized to the greatest extent in the central and southern portions where there is a preponderance of BLM lands. The extreme southern portion and the northern half would realize some benefit of these additional mitigations, but their effectiveness would be reduced due the lack of equivalent mitigation on private and state lands.

4.7.3.5.1 General Wildlife (Species other than described in Sections below)

Under this alternative, addition mitigation would be applied to minimize impacts to important CWR, important winter habitat for grouse, greater sage-grouse nesting and brood-rearing

habitats. This mitigation to reduce total acres of disturbance would directly and indirectly benefit small birds and mammals. This would reduce disturbance in essential habitats during critical time periods for a diversity of wildlife species. This can include, but is not limited to nesting, brood-rearing, thermal cover and transitional habitat use for a diversity of small birds, mammals. Due to these factors, impacts would not exceed the significance criteria for small mammals and songbirds.

4.7.3.5.2 Big Game

Although the exact locations are not known, the placement of pads, roads, and other facilities within the ARPA would be focused on areas that are on and adjacent to the existing pods. As build out occurs from the pods big game CWR would be impacted. Below are the calculation of the percentage of CWR to be impacted (by species of big game) within the ARPA and what percent of the project area would be affected by the additional mitigation. This does not take in to account the impacts to transitional range or migration corridors.

The following acreage figures are for direct habitat loss: (conversion of habitat to pads, roads, compressor stations, etc.). There would be less than 20 acres of pre-reclamation and 5 acres of post- reclamation with the maximum 4 pads per section (resource roads and pads, not collector roads) within CWR.

The pronghorn herd units to be affected by the ARPA are the Bitter Creek and Baggs units. Out of 99,574 acres of CWR habitat found within the Bitter Creek unit, 1,402 acres would be disturbed or 0.5%. Out of 95,557 acres of CWR habitat found within the Baggs unit, 41,501 acres would be disturbed or 43%. Twenty-four percent of the CWR is on private and state lands; additional mitigation would not be applied to those lands. Additional mitigation would occur on approximately 12% of the ARPA. Reduced impacts to transition range would help maintain the health of CWR.

The mule deer herd unit to be affected by the ARPA is the Baggs unit. Out of 270,893 acres of CWR habitat found within the unit, 73,472 acres would be disturbed or 27%. Forty-two percent of the CWR is on private and state lands; additional mitigation would not be applied to those lands. Additional mitigation would occur on approximately 16% of the ARPA. Reduced impacts to transition range would help maintain the health of CWR.

The elk herd units to be affected by the ARPA are the Petition and Sierra Madre units. No CWR for the Petition unit is found within the ARPA. Out of 178,697 acres of CWR habitat found within the Sierra Madre unit, 40,840 acres would be directly disturbed or 23%. Elk CWR additional mitigation would be applied to approximately 15% of the ARPA. Seventeen percent of the CWR is on private and state lands; additional mitigation would not be applied to those lands. Additional mitigation would occur on approximately 10% of the ARPA.

Under this alternative, the reduced direct acreage disturbance and number of pads would reduce impacts to the moderate category for pronghorn and mule deer CWR. Direct and indirect impacts to pronghorn CWR would be reduced so that impacts would not exceed the significance criteria. Direct impacts to mule deer CWR, combined with indirect impacts would still exceed the significance criteria. For elk CWR, impacts would be reduced to the high category, which would still exceed the significance criteria.

4.7.3.5.3 Upland Game Birds

There would be less than 20 acres of pre-reclamation and 5 acres of post- reclamation with the maximum 4 pads per section (resource roads and pads, not collector roads) within nesting and brood-rearing habitat.

Ninety-two percent of the project area contains brood-rearing and nesting habitat for greater sage-grouse. Direct disturbance would be reduced by 64% on public lands, reducing long-term loss of greater sage-grouse habitat to the moderate category. Short-term suspension of grazing use in some pastures would leave more residual grass cover and forbs on grouse habitat, which in turn would benefit those grouse nesting and brood-rearing in these localized areas. However, the indirect impacts (displacement from construction and drilling noise, traffic, increased human activity) would still exceed the significance criteria.

Although winter conditions generally have little effect on greater sage-grouse populations (Call and Maser 1985, Beck and Braun 1978), the protection of those habitats utilized during the most severe winters would greatly facilitate the survival of greater sage-grouse during extreme winters. The avoidance of SWR habitat would eliminate the loss of these critical areas.

Columbian sharp-tailed grouse are found within the southern half of the ARPA. Surface disturbing activities would be prohibited in serviceberry/mixed mountain shrub habitat within the SMA boundaries which would also protect wintering habitat for sharp-tailed grouse on 278 acres (97%). Soil mitigation, restricting surface disturbance on high runoff potential soils, would also indirectly protect nesting and brood-rearing habitat. Direct disturbance would be reduced by 64% on 785 acres (16%), reducing direct impacts to the moderate category. Disturbance would not be reduced on the other 84% on private and state land, maintaining impacts in the high category. This combined, with other indirect impacts would still exceed the significance criteria.

4.7.3.5.4 Raptors

Under this alternative, impacts would be reduced by minimizing the amount of surface disturbance within sensitive/critical resource areas. With the application of avoidance and mitigation measures, impacts are not expected to exceed the significance criteria.

4.7.4 Impacts Summary

4.7.4.1 Proposed Action

Standard mitigation measures would indirectly help songbirds during critical time periods, however, impacts on nesting and foraging habitats would be significant. The magnitude of habitat loss, and continued human presence during the production phase of the project, would exceed the significance criteria.

The impact to small mammals is likely to be minor, and the high reproductive potential of these small mammals would enable populations to quickly repopulate the area following interim reclamation. Most of these species would benefit from an increase in grass-dominated vegetation from reclamation.

This level of development within big game CWR and transition range, compounded by the current condition of these ranges would exceed the significance criteria.

The application of the winter timing stipulation would only protect grouse during this critical time period. This does not prevent the direct loss of wintering areas for grouse outside of this time period. The long term loss of shrubs combined with the indirect impacts on the habitat, such as dust, noise, and continued human presence during the drilling and production phases would result in the proposed action activities exceeding the significance criteria for greater sage-grouse and Columbian sharp-tailed grouse.

With the application of avoidance and mitigation measures, impacts are not expected to exceed the significance criteria for raptors.

4.7.4.2 Alternative B

Similar to the proposed action, the magnitude of habitat loss, and continued human presence during the production phase of the project, would exceed the significance criteria for songbirds.

Similar to the proposed action, with the same number of pad locations and spacing, this level of development within transitional ranges and CWR, compounded by the current poor condition of the crucial winter habitat would exceed the significance criteria.

Similar to the proposed action, with the same number of pad locations and spacing, this level of development within grouse habitat, would still exceed the significance criteria.

With the application of avoidance and mitigation measures, impacts are not expected to exceed the significance criteria for raptors.

4.7.4.3 Alternative C

Impacts would not exceed the significance criteria for small mammals and songbirds.

Direct and indirect impacts to pronghorn CWR would be reduced so that impacts would not exceed the significance criteria. Direct impacts to mule deer CWR, combined with indirect impacts would still exceed the significance criteria. For elk CWR, impacts would be reduced to the high category, which would still exceed the significance criteria.

Long-term loss of habitat to greater sage-grouse and Columbian sharp-tailed grouse, combined with indirect impacts (see Common to All section above) would still exceed the significance criteria.

With the application of avoidance and mitigation measures, impacts are not expected to exceed the significance criteria for raptors.

4.7.5 Additional Mitigation Measures

4.7.5.1 Proposed Action

There are no additional measures proposed.

4.7.5.2 Alternative A

There are no additional measures proposed.

4.7.5.3 Alternative B

There are no additional measures proposed.

4.7.5.4 Alternative C

Additional mitigation measures implemented for other resource concerns may provide indirect protection for a variety of wildlife species. In addition to the requirements in Appendices E, B, H, and J, the following mitigation measures (Appendix L) are recommended to reduce potential impacts to wildlife:

- Low impact road design for resource roads (roads into individual pads) on slopes < 5%, if road can be built with no side slopes. This would include ditch-witching utilities within the ROW, brush beating, some type of fabric or matting and gravel.
- Improve road surface on newly constructed or improved local and collector roads with 95% compaction on the road base and non-chlorine dust abatement product or suitable alternative treatment each year
- Reduce pad density to 4 locations per section and the associated infrastructure and limit initial disturbance (i.e. short-term) total to < 20 acres per section in CWR, grouse nesting and brood-rearing habitat, soils with high runoff potential, vegetation communities on >8% slopes
- Avoid surface disturbances within aspen, juniper woodland, True mountain mahogany, and serviceberry communities
- Limit surface disturbances within the silver sagebrush/bitterbrush vegetation community
- No surface disturbance within identified severe winter relief habitat for greater sage-grouse
- No surface disturbance within identified winter habitat for Columbian sharp-tailed grouse
- Road density would be targeted for less than 3 miles/mile^2, transportation and well access roads would utilize existing road paths where feasible, no new road crossings of Muddy Creek, use only non-chlorine deicing and dust control agents, convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement, and no surface disturbances within aspen, juniper-woodland, true mountain mahogany, and serviceberry communities within the Muddy Creek SMA
- Road density would be targeted for less than 3 miles/mile^2, convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement, and no surface disturbances within aspen, true mountain mahogany, and serviceberry communities within the Cow Butte/Wild Cow SMA
- Net reduction in road density to less than 3 miles/mile^2, transportation and well access roads would utilize existing road paths where feasible, use only non-chlorine deicing and dust control agents, convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement, no surface disturbance within the 18 acres surrounding JO Ranch Headquarters, and limit surface disturbances within the silver sagebrush/bitterbrush community to < 20 acres/mi^2 within the Sand Hills SMA.

4.7.6 Residual Impacts

4.7.6.1 Proposed Action

Standard mitigation measures would not completely alleviate the magnitude of habitat loss and continued human presence during the production phase of the project on nesting and foraging habitats for songbirds.

Standard mitigation measures would not completely alleviate the long term loss of shrubs, nor the indirect impacts on habitat, such as dust, noise, and continued human presence during the drilling and production phase within big game transition and CWR, and grouse habitat.

4.7.6.2 Alternative A - No Action

There would be no residual impacts.

4.7.6.3 Alternative B

Similar to the proposed action, with the same number of pad locations and spacing, standard mitigation measures would not completely alleviate the magnitude of habitat loss and continued human presence during the production phase of the project on nesting and foraging habitats for songbirds.

Similar to the proposed action, with the same number of pad locations and spacing, standard mitigation measures would not completely alleviate the long term loss of shrubs, nor the indirect impacts on habitat, such as dust, noise, and continued human presence during the drilling and production phase within big game transition and CWR, and grouse habitat.

4.7.6.4 Alternative C

Although the additional mitigation would reduce the long term loss of shrubs, the indirect impacts on habitat, such as dust, noise, and continued human presence during the drilling and production phase, disturbance to mule deer and elk transition and CWR, and grouse habitat would occur.

4.8 SPECIAL STATUS PLANT, WILDLIFE, AND FISH SPECIES

4.8.1 Introduction: Threatened, Endangered, Proposed, Candidate or Sensitive Species of Plants, Wildlife, and Fish

The FWS has determined that nine species, which are listed under the ESA as either threatened or endangered or as proposed or candidate species are potentially present within the Rawlins BLM Field Office area (USDI-FWS 2004a; Table 3-32). Additionally, ten species found downstream of the Rawlins Field Office area in the Platte and Colorado River systems may potentially be impacted if water depletions occur. More detailed information on threatened, endangered, and proposed species is presented in the BA for the Atlantic Rim Project (Appendix G). A total of 36 species (7 plants, 6 mammals, 16 birds, 3 amphibians, and 4 fish) occur on the BLM Sensitive Species List in the RFO and may occur on or near the ARPA.

4.8.2 Impact Significance Criteria

The following criteria were considered in the assessment of impacts associated with the Proposed Action and All Alternatives and are the same as those contained in the Draft Rawlins RMP (BLM 2004). Impacts to species of special concern including threatened, endangered, proposed, candidate and sensitive species would be considered significant if any of the following was to occur:

- Substantial loss of habitat function or disruption of life history requirements of a species or population segment that would make them eligible for listing under the Endangered Species Act (ESA).

- Decreased viability or increased mortality of threatened and endangered (T&E), proposed, and/or candidate species or adverse alteration of their Critical habitats.

- Management actions that result in substantial disruption or irreplaceable loss of vital and high value habitats as defined in the Wyoming Game and Fish Department Mitigation Policy (WGFD 2004).

- Substantial loss of habitat function or disruption of life history requirements of Special Status Species that would preclude improvement of their status.

- Actions preclude attainment of conservation goals as stated in conservation plans and strategies for special status species

4.8.3 Direct and Indirect Impacts

4.8.3.1 Direct and Indirect Impacts Common to All Alternatives

The Wildlife Monitoring/Protection Plan (Appendix E) would be followed to prevent, reduce, and detect impacts to threatened, endangered, proposed, and candidate wildlife and fish species throughout the LOP. This plan serves two purposes. One is to describe the protocols to monitor wildlife responses, habitats, behavioral shifts, etc. The other is to provide protocols to protect wildlife species and track the effectiveness of these protections.

Wildlife habitats directly affected by the proposed project include areas that are physically disturbed by the construction of wells, roads, pipelines, and production facilities. Wildlife habitats indirectly impacted might not be physically disturbed, but the suitability of these habitats is affected by direct disturbances in nearby areas. Disturbance during construction and production phases of development such as human presence, dust, and noise may displace or preclude wildlife use of disturbed areas. Wildlife sensitivity to these impacts varies considerably with each animal species.

4.8.3.2 Proposed Action

As described in detail in Chapter 2, a total of 1,800 new coal bed natural gas wells and 200 conventional natural gas wells would be drilled and developed under this alternative during the next 20 years with an expected LOP of 30-50 years. Well placement within the ARPA is not known at this time, however, development would occur across the analysis area and within and near existing PODs that were developed under the Interim Drilling Policy (Appendix A).

The following T&E, Proposed, or Candadate species are not known to occur in the ARPA and would not be impacted by the project: blowout penstemon, Colorado butterfly plant, Ute Ladies'-tresses, Canada lynx, Preble's meadow jumping mouse, yellow-billed cuckoo, whooping crane, interior least tern, piping plover, and Eskimo curlew, and Wyoming toad. Additionally, there would be no water depletions in the North Platte Drainage so there would be no impacts to the western prairie fringed orchid. Species which may be affected, as well as fish species are discussed below.

Black-Footed Ferret. Development of the Proposed Action would likely result in direct disturbance of some portions of prairie dog colonies. Surveys for black-footed ferrets would be required prior to ground disturbing activities within prairie dog colonies located in the Dad Complex. The remaining white-tailed prairie dog colonies within the ARPA are in the "block clearance" area, where surveys for black-footed ferrets are no longer warranted. Implementation of the proposed action may affect but is not likely to adversely affect the black-footed ferret.

Bald Eagle. Bald eagles have been observed on the project area primarily during December, January, and February (WGFD 2003). The majority of bald eagle sitings are in the southern portion of the ARPA, close to the Little Snake River. Bald eagles may utilize the project area for foraging during winter months because a large portion consists of winter range for antelope, mule deer, and elk.

The potential for vehicle-animal collisions would increase as a result of increased vehicular traffic associated with the project. Because bald eagles commonly feed on carrion, particularly during the winter months, the presence of road-killed wildlife on and adjacent to the access roads is an attractant. Eagles feeding on these carcasses are in danger of being struck by moving vehicles. Any increase in the death rate of bald eagles from vehicular collisions would constitute a significant impact. Because the potential for an increase in wildlife-vehicle-eagle encounters exists, the bald eagle may be affected, but is not likely to be adversely affected.

Threatened and Endangered Fish Species. Four federally endangered fish species may occur as downstream residents of the Colorado River system: Colorado pikeminnow (*Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*) (USDI-FWS 2003). One federally endangered fish species, the pallid sturgeon (*Scaphirhynchus albus*), may occur as a downstream resident of the Platte River system in Nebraska.

Though they currently exist only downstream of the ARPA, water draining from the ARPA affects the downstream habitat for these species. Under the *Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin* (RIP), "any water depletions from tributary waters within the Colorado River drainage are considered as jeopardizing the continued existence of these fish." Tributary water is defined as water that contributes to instream flow habitat. Depletion is defined as water which would contribute to the river flow if not intercepted and removed from the system. The BLM retains discretionary authority over individual projects within the area for the purpose of endangered species consultation. If the recovery program is unable to implement the RIP in a timely manner or make sufficient progress in recovery of these endangered species, re-initiation of Section 7 consultation may be required so that new reasonable and prudent alternatives can be developed. The FWS has determined that progress made under the RIP has been sufficient to merit a waiver of the mitigation fee for depletions of 100 acre-feet per year or less (Memorandum dated March 9, 1995 to Assistant Regional Director, Ecological Services, Region

6, from Regional Director 6, "Intra-Service Section 7 Consultation for Elimination of Fees for Water Depletions of 100 acre-feet or Less from the Upper Colorado River Basin"). The Proposed Action would deplete approximately 10.3 acre-feet of water per year, and thus a mitigation fee waiver would be applicable.

Under the Proposed Action, the primary source of potential risks to these fish species is increases in suspended sediments and sedimentation from land disturbance from project activities. No produced water from the ARPA would be discharged to the Little Snake River drainage; therefore, produced water discharges do not pose a risk to these species. Accidental releases of produced waters or other materials could occur. However, these materials would become highly diluted before they would reach any downstream waters where these species occur; consequently, the potential risks from such occurrences are negligible.

Colorado Pikeminnow. Suitable habitat for the Colorado pikeminnow does not exist on the ARPA. Suitable habitat does exist downstream of the ARPA in the Yampa and Green Rivers; however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water resources and soils outlined in this document are implemented.

Bonytail. Suitable habitat for adult bonytail is absent from the ARPA. Suitable habitat does exist downstream of the ARPA in the Yampa and Green Rivers; however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water resources and soils outlined in this document are implemented.

Humpback Chub. Suitable habitat for adult humpback chub is absent from the ARPA. Suitable habitat does exist downstream of the ARPA in the Yampa and Green Rivers; however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water resources and soils outlined in this document are implemented.

Razorback Sucker. Suitable habitat for this species is not available on the ARPA. Suitable habitat does exist downstream of the ARPA in the Yampa and Green Rivers; however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water resources and soils outlined in this document are implemented.

Pallid Sturgeon. Suitable habitat for this species is not available on the ARPA. The pallid sturgeon is present in the Platte River, a tributary to the Missouri River, located downstream from a portion of the ARPA; however, the Proposed Action is not expected to affect this habitat provided that mitigation measures for water resources and soils outlined in this document are implemented.

The following sensitive species have the potential to occur on the project area, however, the species have not been found within the ARPA. If populations are found, mitigation would be applied to avoid disruption of habitat function or of life history requirements. These species should not be impacted by the project: Nelson's milkvetch, Gibben's beardtongue, pale blue-eyed grass, Cedar Rim thistle, long-eared myotis, fringed myotis, spotted bat, Townsend's big-eared bat, pygmy rabbit, swift fox, trumpeter swan, Yellow-billed cuckoo (east of continental divide) Species which may be affected, as well as fish species are discussed below.

White-tailed Prairie Dog. There are currently 295 white-tailed prairie dog colonies, covering 6300 acres, mapped within the ARPA. The BLM requires that development avoid prairie dog colonies whenever possible. The intensity of development associated with implementation of the Proposed Action would likely result in direct disturbance of some portions of these prairie

dog colonies. Direct impacts to prairie dogs, in the form of lost burrows and foraging habitat, would be avoided and are not expected to exceed the impact significance criteria.

Wyoming Pocket Gopher. Based on the known distribution of the species and the availability of suitable habitat, Wyoming pocket-gophers likely occur in the ARPA. If populations are found, mitigation would be developed to protect them. Therefore, impacts are not expected to exceed the impact significance criteria.

White-faced Ibis. White-faced ibis colonies are always associated with shallow water habitats (Erwin 1983). The Proposed Action is not expected to exceed the significance criteria because development would not occur within 500 feet of riparian and wetland habitats.

Northern Goshawk. In Wyoming, goshawks are found in lodgepole pine and aspen habitat (WGFD 1999). Northern goshawks are known to occur adjacent to the ARPA (WGFD 2003a). Two active goshawk nests were documented outside the eastern edge of the ARPA in the mid to late 1980s. With the implementation of mitigation measures for raptor nests (Appendix E); implementation of the Proposed Action would not significantly impact the northern goshawk.

Ferruginous Hawk. Ferruginous hawks are known to occur and nest on the ARPA. The primary potential impact to ferruginous hawks from project activities is disturbance during nesting, which could result in reproductive failure. This potential impact would be mitigated by implementing measures in Appendix E. Development of the Proposed Action would not significantly impact the ferruginous hawk.

Peregrine Falcon. An available prey base of shorebirds, waterfowl, and/or small-to-medium sized terrestrial birds usually occurs within ten miles of the nest site. Peregrine falcons may migrate through the project area and have been observed on the ARPA (WGFD 2003a), but nesting on or near the project area is unlikely due to the lack of cliffs high enough to provide suitable nesting habitat. If nesting peregrine falcons are found on the ARPA, then all appropriate mitigation measures for raptors would be implemented to prevent or minimize impacts.

Greater Sage-grouse. See Section 4.7.3.1.3.

Columbian Sharp-tailed Grouse. See Section 4.7.3.1.3.

Mountain Plover. A portion of the potential mountain plover nesting habitat may be disturbed with implementation of the Proposed Action. Impacts to mountain plovers would be minimized by avoiding construction activities in suitable plover nesting habitat during the nesting period from April 10-July 10. Mountain plover tend to use the same nesting areas from year to year, but the exact nest locations change. Mountain plovers often nest near roads, feed on or near roads, and use roads as travel corridors (USDI-FWS 1999), all of which make the species susceptible to being killed by vehicles. Thus, the Operators would be required to inform employees about the potential for roadside and roadway use by this species. The BLM may also identify mountain plover “occupied habitat areas”. If these areas were proposed for disturbance, additional mitigation measure(s) would be required to reduce impacts. Given the implementation of mitigation measures in Appendix E, mountain plovers are not expected to be significantly impacted.

Long-billed Curlew. In Wyoming, it is an uncommon summer resident but may be locally common in suitable habitat (WGFD 1999). The long-billed curlew is a BLM sensitive species

throughout all of Wyoming. There have been three recorded observations of this species approximately two miles northeast of the ARPA and one recorded observation in the east-central portion of the ARPA (WGFD 2003a). The long-billed curlew is not expected to nest on the project area due to lack of habitat, and no significant impacts to this species are expected with implementation of the Proposed Action.

Burrowing Owl. Burrowing owls are known to occur on the ARPA (WGFD 2003a). One active burrowing owl nest was located on the ARPA in 2002. Surveys for this species should be conducted prior to construction in prairie dog colonies during the owl breeding/nesting season. If nesting owls are found, the same measures used for other raptor species (Appendix E) would be applied. Given these precautionary measures, no significant impacts to this species are expected to result from the implementation of the Proposed Action.

Sagebrush obligate song birds. The sage thrasher, loggerhead shrike, Brewer's sparrow, sage sparrow, and the Baird's sparrow are found in the ARPA (WGFD 2003a). The Proposed Action activities may displace birds to lower quality habitats, which may lead to a reduction in reproduction rates or an increase in predation. The magnitude of direct and indirect habitat loss (Section 4.7.3), and continued human presence would exceed the significance criteria.

Northern Leopard Frog. Sightings have been documented in all counties of Wyoming and this species has a high probability of occurring in areas of the ARPA having perennial water (WYNDD 2003). Provided that measures are taken to avoid disturbance and/or contamination of perennial water sources (see water and soil sections of this document), no significant impacts to this species are expected from implementation of the Proposed Action.

Sensitive Fish Species

Research conducted during the summer and fall of 2003 and 2004 within the upper Muddy Creek watershed, including the ARPA, found the two most consistent habitat associations among sub-adult and adult roundtail chubs, bluehead suckers, and flannelmouth suckers to be positive associations with both rock substrates and deep pools (Figures 4-1 and 4-2; Bower 2005). Under the Proposed Action, the primary impacts to these two habitat features are (1) sedimentation from new construction and project-related land disturbance resulting in decreased availability of rock substrates, and (2) alteration of local hydrologic conditions by new road construction that could lead to sedimentation and channel adjustments resulting in a loss of deep pool habitats. Additionally, fragmentation of aquatic habitats, if any project-related road crossings of Muddy Creek are constructed, could limit access to required habitats or block fish migration. Also, though no discharges of produced water to the Little Snake River drainage are planned for the project, because of their limited distribution in Wyoming and range-wide, accidental releases of produced waters or other toxic materials to Muddy Creek would pose a potential risk to sensitive fish populations.

The impact of new roads and other facilities on fish habitats can be divided into three categories: construction, presence, and urbanization (Angermeyer et al. 2004). During the construction phase, prior to interim reclamation, erosion of soils exposed during earth-moving activities accelerates fine-sediment loading in stream channels. Though the biological effects of sedimentation include a variety of ecological interactions (Waters 1995), sedimentation can act to shift habitat structure such as channel depth, pool-to-riffle ratio, percent fines in substrates, and cover availability (Angermeyer et al. 2004). This sediment can extend miles downstream of the construction site and persist in stream channels for years (Angermeyer et al. 2004).

During the presence phase, impacts are primarily associated with the interception of shallow groundwater flow paths by roads. Water is frequently diverted along the roadway and routed to surface-water drainage networks at drainage crossings. This can, in turn, alter the timing, routing, and magnitude of runoff, triggering geomorphic adjustments through erosion by channel incision, new gully or channel head formation, or slumping and debris flows (Figure 4-3; see review in Trombulak and Frissel 2000). Channel incision occurs when the base elevation of the stream channel adjusts to account for an alteration of geomorphic parameters such as sediment supply, flow volume, or channel roughness (e.g., riparian vegetation). Channel incision has been shown to simplify channel geometry and result in the loss of pool habitats (Shields et al. 1994).

In the case of the proposed action, the effects of urbanization can be thought to include the detrimental effects of exotic species introductions and increased human presence within the ARPA. Roads provide dispersal mechanisms for a variety of exotic upland and riparian plant species. Of particular concern is the spread of tamarisk (*Tamarix* spp., also known as salt cedar) within the upper Muddy Creek watershed. This exotic species has been shown to displace native riparian vegetation while consuming a greater volume of water, resulting in reduced water tables and suitability of aquatic habitats (Graf 1978). Tamarisk is currently known to exist in portions of the ARPA and its spread is likely as a result of dispersal via new road construction and utilization. Increased human uses of the area are also likely to increase the probability of unsanctioned, illegal, and unintentional introductions of exotic fishes and other aquatic organisms. These introductions have been cited as one of the major threats to freshwater biodiversity (Allen and Flecker 1993) and warrant careful consideration given the detrimental effects of exotic fishes on native Colorado River Basin fishes present within the upper Muddy Creek watershed.

Stream fishes require habitats for spawning, feeding, rearing, and refuge. The spatial heterogeneity and connectivity of the stream system can necessitate the movement of fishes among these habitats in order to complete their life cycles (Schlosser 1995). Interruption of movement among required habitats by road crossings can have demographic effects, decreasing population viability (Trombulak and Frissel 2000; Gibson et al. 2005). The distributions of the three target species during the summer and fall of 2003 suggest several potential implications of habitat fragmentation in regards to access to refuge habitats and subsequent ability to recolonize adjacent reaches (Bower 2005). Additionally, movements of the three species observed during 2005 suggests that required habitats exist in spatially distinct portions of the watershed, thus requiring movement of individuals in order to complete their life history requirements (Bobby Compton, University of Wyoming, personal communication).

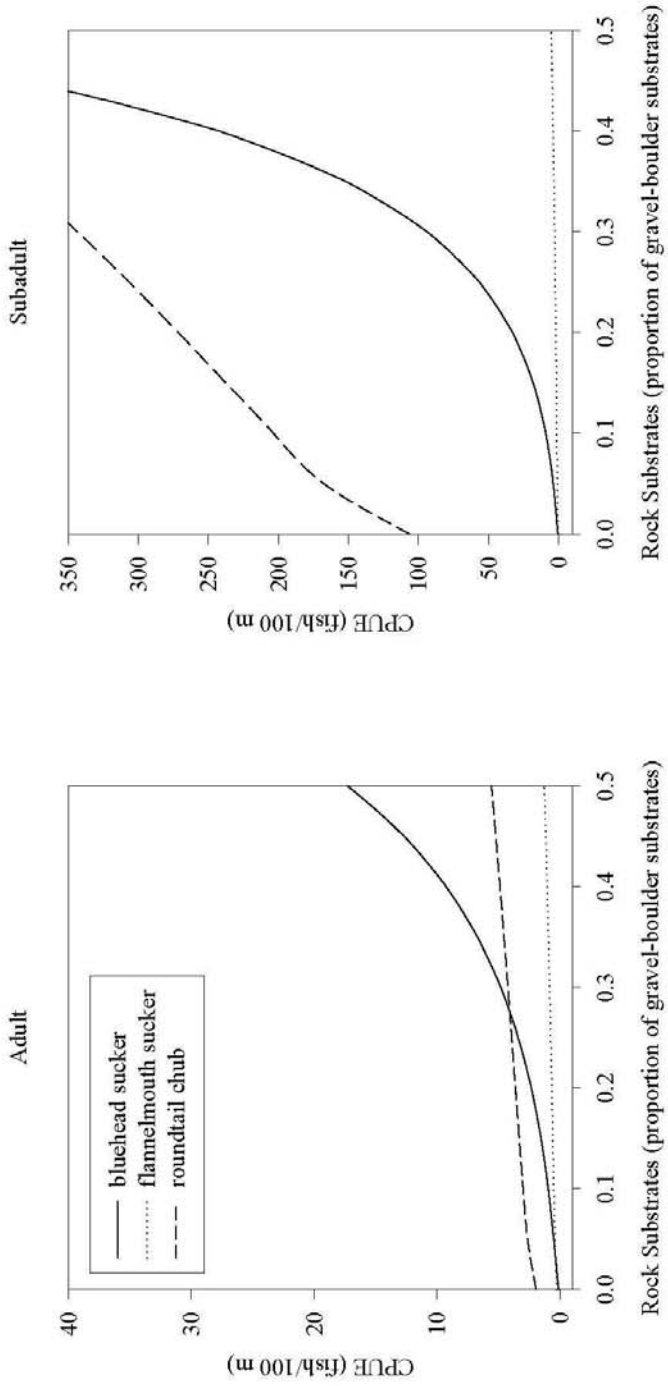


Figure 4-1. Relative abundance of two length groups of three species within the upper Muddy Creek watershed as a function of the prevalence of rock substrates at the reach scale from Bower (2005). Plots were generated using the averaged multi-model linear-regression function for both length groups of the three species.

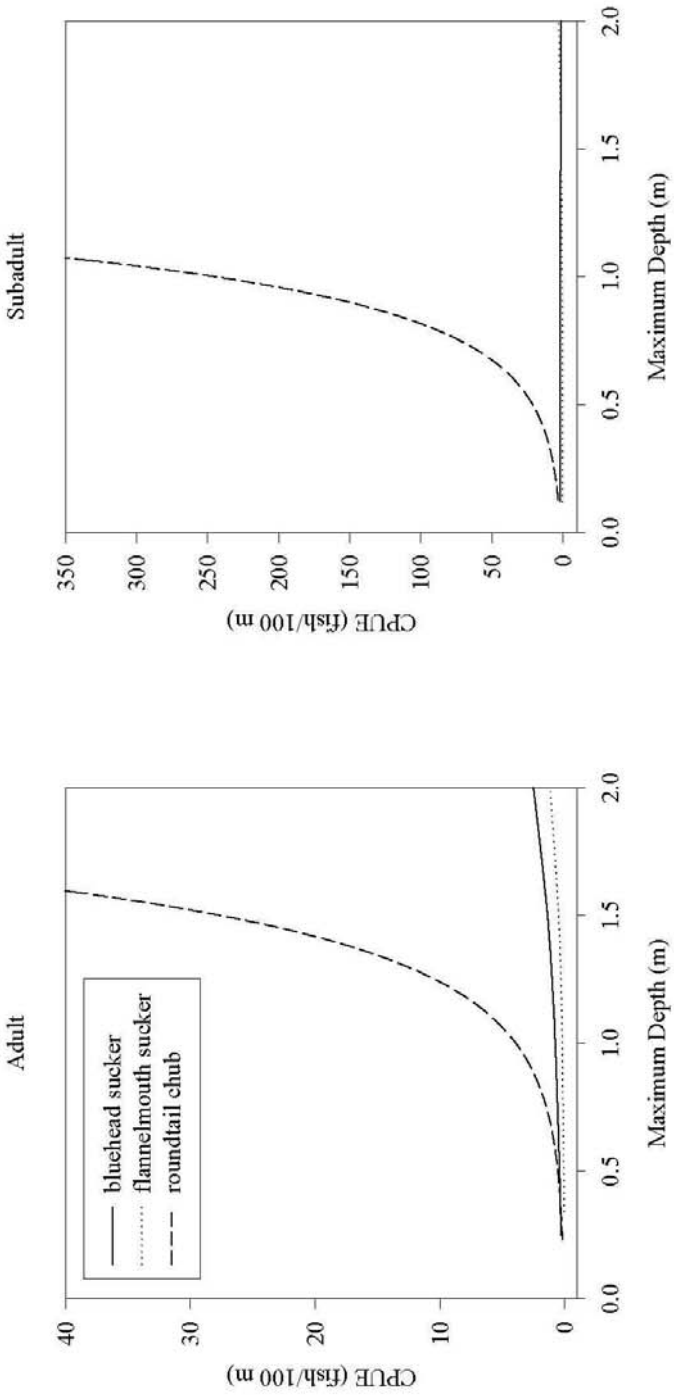


Figure 4-2. Relative abundance of two length groups of three species within the upper Muddy Creek watershed as a function of maximum channel unit depth from Bower (2005). Plots were generated using the averaged multi-model linear-regression function for both length groups of the three species above minimum depth thresholds.

Figure 4-3. Example of erosion resulting from concentration of surface runoff at drainage crossings.

Eighty-acre spacing of coalbed methane well locations under the proposed action would result in a road density of 7.1 mi/mi^2 within the Upper Muddy Creek/Grizzly Special Management Area. This includes new road construction (0.5 mi/well location) as well as 100 miles of existing road. Additionally, crossings of Muddy Creek are anticipated as a result of the proposed action, though the number and specific location of these crossings has not yet been determined.

Research within the Little Robbers Gulch drainage (bordering the ARPA on its western edge) has demonstrated the effects of roads, natural gas drillpads, and pipelines on sediment production and runoff (Wollmer 1994). This work examined the effect of road densities of 2 mi/mi^2, including associated well pad and pipeline facilities, on local sediment production and runoff. A net increase of 1% in local sediment production and 0.3% in local runoff was found when compared to unaltered rangeland sites. Though this work helps to identify the potentially limited extent of local erosion caused by roads, the study did not address the effects of flow interception which can lead to altered runoff timing, routes, and magnitudes. It is these hydrologic alterations that are most likely to result in geomorphic adjustments through erosion, causing sedimentation or loss of habitat features such as deep pools.

Roundtail Chub. Based on the impacts of new roads and other facilities on the habitat features found to be important to roundtail chubs within the upper Muddy Creek watershed as well as the effects of habitat fragmentation on the ability of roundtail chubs to access required habitats, the proposed action would significantly impact the habitat of this species within the ARPA, and may preclude improvement of their status as prescribed in the *Range-wide Conservation Agreement for Bluehead Suckers, Flannelmouth Suckers, and Roundtail Chubs*.

Bluehead Sucker. Based on the impacts of new roads and other facilities on the habitat features found to be important to bluehead suckers within the upper Muddy Creek watershed as well as the effects of habitat fragmentation on the ability of bluehead suckers to access required habitats, the proposed action would significantly impact the habitat of this species within the ARPA, and may preclude improvement of their status as prescribed in the *Range-wide Conservation Agreement for Bluehead Suckers, Flannelmouth Suckers, and Roundtail Chubs*.

Flannelmouth Sucker. Based on the impacts of new roads and other facilities on the habitat features found to be important to flannelmouth suckers within the upper Muddy Creek watershed as well as the effects of habitat fragmentation on the ability of flannelmouth suckers to access required habitats, the proposed action would significantly impact the habitat of this species within the ARPA, and may preclude improvement of their status as prescribed in the *Range-wide Conservation Agreement for Bluehead Suckers, Flannelmouth Suckers, and Roundtail Chubs*.

Colorado River Cutthroat Trout. Given the absence of Colorado River cutthroat trout from the ARPA and portions of Muddy Creek downstream of the ARPA, the proposed action is not likely to significantly impact the habitat of this species.

4.8.3.3 Alternative A - No Action

There would be no additional disturbance as a result of this alternative.

4.8.3.4 Alternative B

The temporal development involves the same number and spacing of wells to be drilled as in the proposed action. However, the principle difference would be that the majority of development would occur in three phases with the center portion of the project area (Doty Mountain Pod, Sundog/Cow Creek POD and Blue Sky Pod) being developed first over a 5 to 6 year period. The entire project area would still be developed over a twenty year period. The initial phase would involve up to half of the total wells proposed. Development would then be shifted to the second phase in the northern portion and the third phase in the southern portion of the project area. There would be continued drilling within previously analyzed PODs under the existing interim drilling plan concurrently with development of the initial phase. However, this drilling and facility development would be limited. In terms of disturbance to wildlife and their habitats, this phased approach would be beneficial by temporarily delaying fragmentation of habitat, providing “safe-haven” areas in two thirds of the project area during the development phases. This would be more beneficial to those species requiring large blocks of undisturbed habitat.

Under this alterative all impacts on the species would remain the same as the Proposed Action unless addressed below.

Wildlife Species

Impacts to wildlife species under this alternative would be same as the proposed action, however, species may benefit temporarily as the development is phased in over the LOP. The impacts from the production phase once construction is completed would be the same as the proposed action.

Fish

Similar to the proposed action, eighty-acre spacing of coalbed methane well locations under the proposed action would result in a road density of 7.1 mi/mi^2 within the Upper Muddy Creek/Grizzly Special Management Area. This includes new road construction (0.5 mi/well location) as well as 100 miles of existing road. Resulting impacts to the habitats of sensitive fishes would be similar to those disclosed within the proposed action.

Muddy Creek represents a boundary between the first and second phases of development under Alternative B. Given this boundary, there may be a decreased desire to construct crossings of Muddy Creek as development proceeds within each of the phases. The avoidance of road crossings of Muddy Creek would eliminate resulting fish habitat fragmentation and reduce the likelihood of exotic species introductions.

Roundtail Chub. Based on the impacts of new roads and other facilities on the habitat features found to be important to roundtail chubs within the upper Muddy Creek watershed, Alternative B would significantly impact the habitat of this species within the ARPA. The avoidance of road crossings of Muddy Creek would eliminate resulting fish habitat fragmentation and reduce the likelihood of exotic species introductions.

Bluehead Sucker. Based on the impacts of new roads and other facilities on the habitat features found to be important to bluehead suckers within the upper Muddy Creek watershed, Alternative B would significantly impact the habitat of this species within the ARPA. The avoidance of road crossings of Muddy Creek would eliminate resulting fish habitat fragmentation and reduce the likelihood of exotic species introductions.

Flannelmouth Sucker. Based on the impacts of new roads and other facilities on the habitat features found to be important to flannelmouth suckers within the upper Muddy Creek watershed, Alternative B would significantly impact the habitat of this species within the ARPA. The avoidance of road crossings of Muddy Creek would eliminate resulting fish habitat fragmentation and reduce the likelihood of exotic species introductions.

Colorado River Cutthroat Trout. Given the absence of Colorado River cutthroat trout from the ARPA and portions of Muddy Creek downstream of the ARPA, Alternative B is not likely to significantly impact the habitat of this species.

4.8.3.5 Alternative C

The Spatial Development alternative would proceed with development across the ARPA similar to the Proposed Action, but surface disturbance would be reduced in areas with critical/sensitive resource concerns. These areas would have additional protective measures (Appendix L) beyond what is already required (See Appendix E and mitigation measures from other resources). Examples of some of these sensitive sites are steep slopes, soils with high runoff potential, big game crucial winter range, greater sage-grouse nesting and brood rearing habitat,

class III visual areas, and juniper/true mountain mahogany plant communities. Because of these sensitive issues, there would be fewer pad locations per section on public lands. This would reduce the total acres disturbed to 64 percent less than the proposed action. Long-term disturbance would be reduced by approximately 77 percent less than the proposed action. There would be less than 20 acres of pre-reclamation and 5 acres of post-reclamation surface disturbance with a maximum of 4 pads per section in grouse nesting and brood rearing habitat. This would directly reduce habitat fragmentation and human presence for other associated sagebrush obligate species. Soil mitigation, restricting surface disturbance on high runoff potential soils, would also indirectly protect over half of the saltbush steppe habitat within the ARPA. This would benefit species such as white-tailed prairie dog, mountain plover, and burrowing owl. Direct disturbance would be reduced by 64%, reducing impacts to all BLM sensitive species. Impacts would not exceed the significance criteria for sagebrush obligate species under this alternative.

Fish

Development protection measures within the Upper Muddy Creek Watershed/Grizzly SMA would benefit sensitive fishes by limiting the alteration of local hydrologic conditions that create and maintain habitat features of importance to sensitive fishes. Two of these habitat features, rock substrates and deep pool habitats, have been shown to be of importance to sensitive fishes (Bower 2005) and are though to be susceptible to loss or decreased suitability as a result of hydrologic alteration from road construction. Maintenance of existing road densities, through the utilization of existing road paths, as well as incorporation of appropriate road designs, such as low-impact road designs on slopes of less than 8 percent, would result in a net decrease in erosion from the existing road network. Particularly problematic road paths that are causing accelerated erosion would be identified within transportation planning efforts. By reclaiming these problematic road paths, additional road lengths would be available for new road construction when lease holdings could not be accessed along existing paths, without resulting in a net increase in road density or erosion.

Additional special protective measures within the Upper Muddy Creek Watershed/Grizzly SMA would preclude the fragmentation of fish habitats by road crossings, thus ensuring that access among the diverse habitats required by sensitive fishes is maintained. These measures would also limit the potential spread of exotic species that often have detrimental direct or indirect impacts on sensitive fishes and their habitats.

Roundtail Chub. Given the implementation of special protective measures identified for the Upper Muddy Creek Watershed/Grizzly SMA, the Alternative C would not significantly impact the habitat of this species within the ARPA.

Bluehead Sucker. Given the implementation of special protective measures identified for the Upper Muddy Creek Watershed/Grizzly SMA, Alternative C would not significantly impact the habitat of this species within the ARPA.

Flannelmouth Sucker. Given the implementation of special protective measures identified for the Upper Muddy Creek Watershed/Grizzly SMA, Alternative C would not significantly impact the habitat of this species within the ARPA.

Colorado River Cutthroat Trout. Given the absence of Colorado River cutthroat trout from the ARPA and portions of Muddy Creek downstream of the ARPA, the Alternative C is not likely to significantly impact the habitat of this species.

4.8.4 Impact Summary

4.8.4.1 Proposed Action

T&E

Implementation of the Proposed Action would result in direct loss of habitat from surface disturbance associated with the construction of well sites, related facilities, access roads, and pipelines. In addition, some wildlife species would be indirectly impacted by displacement from habitats in the vicinity of the project area due to the presence of human activities associated with the construction and operation of wells. Small portions of potential black-footed ferret habitat may be disturbed. The potential for collisions between bald eagles and motor vehicles would also increase due to the construction of new roads and increased traffic levels on existing roads. The primary source of potential risks to the fish species is increase in suspended sediments and sedimentation from land disturbance from project activities. The intensity of these impacts may decrease with the completion of the construction phase and with the onset of reclamation efforts on disturbed areas.

None of the threatened and endangered species found downstream of the ARPA within the Colorado River system are known to occur in the ARPA, therefore there would be no direct impacts to these species. However, water depletion as a result of project development, even though minimal, could indirectly impact these species. Implementation of all mitigation measures for water and soils would help reduce other potential impacts. No produced water from the ARPA would be discharged to the Little Snake River drainage; therefore, produced water discharges do not pose a risk to these species. Accidental releases of produced waters or other materials could occur. However, these materials would become highly diluted before they would reach any downstream waters where these species occur; consequently, the potential risks from such occurrences are negligible. Any water depletion within the Colorado River system results in a “may affect, likely to adversely affect” determination for threatened and endangered species found in and along this river. Therefore, BLM would initiate formal consultation with FWS for those species. If any threatened or endangered fish species are identified within the ARPA, the BLM would consult with the FWS and develop a protection plan for the fish.

Sensitive Species

With the implementation of the Proposed Action, direct loss of habitat would result from surface disturbance associated with the construction of well sites and related access roads and pipelines. Small portions of potential habitat for several sensitive species may be disturbed. The intensity of these impacts would decrease with the completion of the construction phase and with the onset of reclamation efforts on many of the disturbed areas. The application of prescribed avoidance, monitoring (Wildlife Monitoring/Protection Plan, Appendix E) and mitigation measures would reduce the impact potential. Impacts would still exceed the significance criteria for sagebrush obligate species. Alteration of fish habitat suitability would result in significant impacts to sensitive fishes.

4.8.4.2 Alternative B

The impacts to T&E species would be the same as under the Proposed Action.

Overall impacts to BLM sensitive species would be very similar to the proposed action. In terms of disturbance to wildlife and their habitats, this phased approach would be beneficial by temporarily delaying fragmentation of habitat, providing "safe-haven" areas in two thirds of the project area during the development phases. This would be more beneficial to those species requiring large blocks of undisturbed habitat. Impacts would still exceed the significance criteria for sagebrush obligate species. Alteration of fish habitat suitability would result in significant impacts to sensitive fishes.

4.8.4.3 Alternative C

Overall impacts to special status species would be very similar to the proposed action. Direct disturbance would be reduced by 64%, reducing potential impacts to all special status species. Impacts would not exceed the significance criteria for sagebrush obligate species under this alternative. Development protection measures applied to the Upper Muddy Creek Watershed/Grizzly SMA would help to maintain the suitability of habitats for sensitive fishes.

4.8.5 Additional Mitigation Measures

4.8.5.1 Proposed Action

There are no additional mitigation measures identified for T&E species or BLM sensitive species except if identified mountain plover "occupied habitat areas" are proposed to be disturbed:

- Surface disturbance would occur outside identified occupied habitat for mountain plovers where feasible.
- Within ½ mile of the identified mountain plover occupied habitat area; speed limits would be posted at 25 mph on resource roads and 35 mph on local roads during the brood rearing period (June 1 - July 10).
- The access road would be realigned to avoid the identified mountain plover occupied habitat area.
- To protect mountain plover in occupied habitat, traffic would be minimized from June 1 - July 10 by car-pooling and organizing work activities to minimize trips on roads through the mountain plover occupied habitat area.
- To protect mountain plover in occupied habitat, fences, storage tanks, and other elevated structures would be either constructed as low as possible and/or would incorporate perch-inhibitors into their design.
- To minimize destruction of nests and disturbance to breeding mountain plovers, no ground-disturbing activities would occur from April 10 - July 10 unless surveys consistent with the Plover Guidelines or other FWS approved method find that no plovers are nesting in the area.

• A plugged and abandoned well within ½ mile of the identified mountain plover occupied habitat area would be identified with a marker 4 feet tall with a perch inhibitor on the top of the marker.

4.8.5.2 Alternative B

There are no additional mitigation measures identified.

4.8.5.3 Alternative C

Additional mitigation proposed:

- Low impact road design for resource roads (roads into individual pads) on slopes < 5%, if road can be built with no side slopes. This would include ditch-witching utilities within the ROW, brush beating, some type of fabric or matting and gravel.
- Improve road surface on newly constructed or improved local and collector roads with 95% compaction on the road base and non-chlorine dust abatement product or suitable alternative treatment each year
- Reduce pad density to 4 locations per section and the associated infrastructure and limit initial disturbance (i.e. short-term) total to < 20 acres per section in CWR, grouse nesting and brood-rearing habitat, soils with high runoff potential, vegetation communities on >8% slopes
- Avoid surface disturbances within aspen, juniper woodland, True mountain mahogany, and serviceberry communities
- Limit surface disturbances within the silver sagebrush/bitterbrush vegetation community
- No surface disturbance within identified severe winter relief habitat for greater sage-grouse
- No surface disturbance within identified winter habitat for Columbian sharp-tailed grouse
- Road density would be targeted for less than 3 miles/mile^2, transportation and well access roads would utilize existing road paths where feasible, no new road crossings of Muddy Creek, use only non-chlorine deicing and dust control agents, convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement, and no surface disturbances within aspen, juniper-woodland, true mountain mahogany, and serviceberry communities within the Muddy Creek SMA
- Road density would be targeted for less than 3 miles/mile^2, convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement, and no surface disturbances within aspen, true mountain mahogany, and serviceberry communities within the Cow Butte/Wild Cow SMA
- Net reduction in road density to less than 3 miles/mile^2, transportation and well access roads would utilize existing road paths where feasible, use only non-chlorine deicing and dust control agents, convert fences to BLM standards or designs (e.g., rail top fence) to facilitate big game movement, no surface disturbance within the 18 acres surrounding JO Ranch Headquarters, and limit surface disturbances within the silver sagebrush/bitterbrush community to < 20 acres/mi^2 within the Sand Hills SMA

4.8.6 Residual Impacts

4.8.6.1 Proposed Action

Standard mitigation measures would not completely alleviate the magnitude of habitat loss and continued human presence during the production phase of the project on nesting and foraging habitats for sagebrush obligate species.

Standard mitigation measures would not completely alleviate the long term loss of shrubs, nor the indirect impacts on habitat, such as dust, noise, and continued human presence during the drilling and production phase in special status species' habitat.

4.8.6.2 Alternative B

Similar to the proposed action, with the same number of pad locations and spacing, standard mitigation measures would not completely alleviate the magnitude of habitat loss and continued human presence during the production phase of the project on nesting and foraging habitats for sagebrush obligate species.

Similar to the proposed action, with the same number of pad locations and spacing, standard mitigation measures would not completely alleviate the long term loss of shrubs, nor the indirect impacts on habitat, such as dust, noise, and continued human presence during the drilling and production phase in special status species' habitat.

4.8.6.3 Alternative C

Although the additional mitigation would reduce the long term loss of shrubs, the indirect impacts on habitat, such as dust, noise, and continued human presence during the drilling and production phase, disturbance to special status species' habitat would still occur.

4.9 RECREATION

4.9.1 Introduction

This section addresses the potential impacts of the Proposed Action and Alternatives to recreational resources in the ARPA. The analysis focuses on the principal form of recreation within the ARPA, which is big game hunting, and considers both direct and indirect impacts to recreation resources.

4.9.1.1 Analysis Approach

The ARPA contains no developed recreation sites. Off-highway vehicle (OHV) use is limited to existing roads and two-tracks. Dispersed recreation in the ARPA occurs primarily on BLM land and consists largely of hunting by residents and visitors from outside the region. Camping and OHV use within the ARPA occur most often in conjunction with hunting. There is some seasonal pleasure driving and snow machine use, which often incorporate wildlife viewing as a significant reason for visiting the area. The ARPA contains two ACECs – Sand Hills ACEC and Jep Canyon ACEC – which merit intensive management of surface-disturbing activities for wildlife habitat (USDI-BLM 1990, 2003).

The health and abundance of wildlife populations directly affect the quality of hunting in the ARPA. When wildlife populations fluctuate, so do wildlife-based recreational opportunities. To determine impacts to hunting, the recreation analysis relies on the analysis of impacts to big game wildlife in the ARPA. The narrative and maps presented in Section 3.7 (Wildlife) were evaluated for their potential effect on hunting because of a loss of carrying capacity or the displacement of game.

Impacts to visual resources in the ARPA, identified in Section 4.10, also were considered for effects on recreation. Visual resources influence the character of outdoor opportunities by affecting the recreation setting, as do other effects of gas development such as noise, dust and traffic on recreational access routes.

4.9.2 Impact Significance Criteria

The recreation analysis evaluates impacts according to the management objectives established for the Great Divide Resource Area RMP. BLM management objectives for recreation resources are to ensure continued availability of outdoor recreational opportunities, while meeting legal requirements for the health and safety of visitors and mitigating conflicts with other resources.

The main concern for the recreation analysis is displacement of existing recreational use by the Proposed Action and Alternatives. Impacts to recreation would be significant if the Proposed Action or Alternatives would cause displacement of hunting, wildlife viewing, and driving for pleasure from the ARPA when no other comparable area nearby could reasonably provide substitute opportunities.

4.9.3 Direct and Indirect Impacts

The Proposed Action and Alternatives would potentially have both direct and indirect impacts to recreation. Direct impacts to recreation resources occur because of the physical disturbance of vegetation from the construction of facilities, the visual impacts of facilities and activities, and from the noise, traffic and visual distraction of human activity.

Examples of direct impacts include the removal of wildlife habitat that may affect game populations and the intrusion of gas facilities on a natural appearing landscape. Indirect effects to recreation resources include changes to recreation use and experiences on lands near directly impacted recreation resources. Examples are disturbances of nearby recreation settings by traffic, noise and landscape changes associated with gas facilities and related activity that would intensify visitation at undeveloped areas nearby.

Most effects to recreation from the Proposed Action and Alternatives would be considered adverse because they tend to decrease recreation opportunities and the appeal of the setting for most recreation participants. New roads associated with development may be considered beneficial in that they provide increased access for activities such as hunting but adverse in that the associated increase in activity of development would displace wildlife. Hence new roads do not benefit hunting if game is displaced. Initial increases in access might increase success rates early in the life of the project, but as development progresses, and game is displaced, success rates would be expected to decline with the size of the herd remaining in the project area. The opportunity to pursue game on foot is diminished when an abundance of roads provide access to road hunters that could scare game from the area.

Indirect impacts to recreation also can occur from population growth associated with the project's workforce. This factor was considered but not pursued further in the analysis of the Proposed Action and Alternatives because the project is unlikely to cause significant population effects, as described in Section 4.12 (Socioeconomics). Impacts to recreation from potential residential development in the future also are described in Chapter 5 (Cumulative Impacts Analysis).

Impacts Analysis

The principal recreation impact likely to be associated with the Proposed Action and Alternatives is the change in big game hunting opportunities because of habitat loss and wildlife displacement. The underlying effects upon wildlife habitat and behavior are analyzed in Section 4.7 (Wildlife). Changes to the landscape, analyzed in Section 4.10 (Visual Resources), also may affect hunters who value a natural setting as part of their experience and pleasure drivers who visit the ARPA to view the scenery and watch wildlife. These impacts would occur as the direct and indirect results of a higher density and wider distribution of gas development within the ARPA compared to existing conditions.

4.9.3.1 Proposed Action

As described in detail in Chapter 2, a total of 2,000 new natural gas wells would be drilled and developed under this alternative during the next 20 years with an expected LOP of 30-50 years. Well placement within the ARPA is not known at this time, but it is assumed that development would likely be concentrated within or near existing pods, although some wells also would be drilled in outlying areas where development currently does not exist.

Impacts to Hunting

The big game species potentially affected by the Proposed Action are mule deer, elk and pronghorn antelope. The proposed level of development would disturb approximately 15,803 acres of wildlife habitat over 20 years, but the practice of beginning reclamation when an individual facility is completed, as intended by the operator, would mean that the total un-reclaimed area in the ARPA would always be less than 15,803 acres at any one time during the development phase. After the completion of development, successful interim reclamation would reduce long-term disturbance and direct loss of habitat to a total of 6,241 acres.

In addition to the direct loss of habitat due to construction of well pads and associated roads, pipelines and utilities, disturbance from human activity and traffic would lower the utilization of habitat immediately adjacent to developed areas and cause wildlife displacement from an area larger than the actual disturbed sites. As noted in Section 4.7 (Wildlife), this displacement effect has the potential to have a great impact on wildlife not only due to displacement, but also due to wildlife concentration beyond carrying capacity in alternative habitats.

The extent of wildlife displacement is impossible to predict for most species. After initial avoidance some species such as deer and pronghorn may acclimate to the activity and begin to re-occupy the disturbed areas. Acclimation and re-occupation would be expected to occur following construction and drilling when the project moves into the production phases where less noise and human activity would take place. Despite acclimation and re-occupation, it is generally assumed that overall the increased human footprint on a previously lightly developed area is detrimental to big game species.

To the extent that displacement of big game does occur in connection with the Proposed Action, adverse impacts to hunting would occur in the ARPA. The impact would be borne primarily by local and regional hunters, especially local hunters for whom the benefits of the ARPA would be diminished as a convenient and economical place to hunt for sport and for game meat for the table. The impact also would be borne by commercial outfitters permitted to use the ARPA (see table 3.39). Increased development in the ARPA—with its potential to displace big game and its effect on the recreation setting—would reduce the appeal of the project area for a commercial clientele whose values include a successful harvest in an attractive recreational setting.

Impacts to the Recreation Setting

For many hunters and other outdoor recreationists, a natural setting is critical to the quality of the recreation experience. In the ARPA, the Proposed Action and Action Alternatives would potentially affect the recreation setting because of visual impacts and because of traffic and noise impacts.

As would be seen in Section 4.10, Impacts to Visual Resources, concludes that the Proposed Action and Action Alternatives would have a high, adverse impact on the natural appearance of the landscape. This level of degradation of the scenery would potentially affect hunters and other recreation visitors to the ARPA.

Research has found that hunters participate in this activity for many reasons. Though hunting success is the predominant reason, enjoyment of the outdoors and the environment has a role for many hunters (Manning 1986). Therefore, the visual quality of the setting would likely be important to many hunters in the ARPA, and degradation of the scenery in the project area would potentially diminish their enjoyment and the satisfaction of the hunt.

For pleasure drivers and wildlife viewers, natural scenery and productive wildlife habitats are an essential part of the activity. Therefore, recreation visitors who visit the ARPA to drive for pleasure or view wildlife would likely be very sensitive to changes in visual quality, and for these visitors, adverse impacts to visual quality in the project area would likely diminish their enjoyment of the outdoor experience.

For hunters, wildlife viewers and pleasure drivers, industrial traffic on roads in the ARPA would potentially detract from the recreational character of the setting in the ARPA. The operator is committed to posting appropriate warning signs, implementing safety training for the operators of project vehicles and equipment, and requiring project vehicles to adhere to low speed limits (see Section 2.13). These project management practices would potentially limit conflicts between project activity and recreation use in the ARPA. However, some level of conflict with the expectations of recreationists is unavoidable, particularly during drilling and field development activities. The risk of traffic accidents is significantly increased by vehicles associated with development and production in the ARPA.

Noise levels associated with drilling, field development, and operations activities may temporarily exceed threshold EPA average noise levels at specific locations within the ARPA, as would be noted in Section 4.15, Noise. This would directly detract from the relative silence of undisturbed country customarily sought by recreational visitors engaged in hunting, wildlife observation, and sightseeing. Noise impacts due to drilling, field development, and traffic may be unavoidable, at least during the drilling and development phases, after which much of the noise would abate. However, noise associated with compression and individual well pumps would be long term in duration and would potentially displace recreation to other areas.

Impacts to hydrologic systems and soil stabilizing vegetation would impact the recreation experience by altering the undeveloped setting present in most of the ARPA. The proliferation of opportunistic weeds on disturbed soils would further alter the setting and inhibit the success of reclamation.

The duration of the effects would be for the life of the project—which may affect more than one generation of recreation users—but the intensity of the effects would be lower after drilling and construction ends. The Proposed Action would likely displace some dispersed recreation use from the ARPA to areas for hunting and wildlife viewing that are farther away and are themselves likely to be under increasing pressure for development.

As noted in Chapter 3, there are no recreational visitation counts for the ARPA, but overall use is believed to be low, except during and just prior to hunting season which occurs primarily in the fall (USDI-BLM 2000). Low visitation during the rest of the year is due to low population densities in proximity to the area and the historically seasonal nature of the road network. Snow drifts in winter and any rains the rest of the year have, in the past, made most of the roads intermittently impassable.

Visitation to the ARPA may increase in the future because of recent improvements in surfacing on BLM and county roads. New roads developed in the ARPA to support gas development may also encourage use by opening new areas to access. With increased use over time, the impact of the Proposed Action may be higher. Another factor expected to promote visitation to the area is the stabilization and interpretation of the JO Ranch that was recently acquired by BLM near the Sand Hills. The Continental Divide National Scenic Trail (CDNST) is not likely to increase visitation to the project area, despite its being within 3 miles of the northeastern boundary of the ARPA.

In conclusion, the adverse impacts to the predominant recreation activities in the ARPA—hunting, pleasure driving and wildlife viewing—would be significant. The Proposed Action would diminish the wildlife presence, degrade scenery, and introduce traffic and noise. These effects would likely make recreation in the project area less desirable.

4.9.3.2 Alternative A – No Action

Under the No Action Alternative, the Proposed Action would not be approved. The ARPA's recreation experience would continue to be affected by existing facilities and interim drilling, but no new impacts to recreation and hunting would be introduced by the No Action Alternative.

4.9.3.3 Alternative B

Under Alternative B (as under the Proposed Action) a total of 2,000 new gas wells would be drilled and developed during the next 20 years with an expected LOP of 30-50 years. However, development would potentially occur in three zones by developing only two or three adjacent pods at a time. Each zone would take 6 to 7 years to develop.

Short term impacts to recreation occurring under Alternative B would be qualitatively the same as under the Proposed Action. However, the zoned approach would reduce short-term impacts occurring simultaneously during the project's development phase. While one phase is being developed, the other zones would also see activity, but not to the same degree as the zone under development. How many wells would be drilled in the other zones concurrently has not

been determined, but it would still generate traffic on primary roads, dust, traffic hazards and noise in areas outside the zone of concentrated development.

Thus, even though development is concentrated in one zone at a time, some development and disturbance would still be occurring in the other zones, so the wildlife and recreation associated with it would still likely be displaced from areas under development, making the impact to hunting and wildlife viewing significant in the long term. However, the reduced level of simultaneous development in the other zones would temporarily leave some areas undisturbed, which would allow hunters and recreationists limited, but continued opportunities to use portions of the ARPA.

After a zone is completed and interim reclamation occurs, wildlife may return to the area to some degree, but continued production operations would likely prevent normal wildlife activity and concentrations until after effective final reclamation has restored vegetation.

Long-term impacts to recreation would be the same under Alternative B as under the Proposed Action. Development would still continue for approximately 20 years. However, instead of the area of maximum surface disturbance moving generally outward concentrically from all of the existing interim development pods, only two or three adjacent pods would experience simultaneous concentrated development in the form of a zone.

4.9.3.4 Alternative C

Under Alternative C, as under the Proposed Action, a total of 2,000 new natural gas wells would be drilled and developed under this alternative during the next 20 years with an expected LOP of 30-50 years. However, development would potentially be constrained in areas that have critical resource concerns, such as fisheries, hydrology, soils and wildlife.

Some of the development protection measures included in Alternative C would reduce impacts to recreation. Limitations on surface disturbance in slopes over 8%, vegetation communities with high wildlife values, rare vegetation communities, proximity to water or wetlands, big game crucial winter range, grouse brood rearing and nesting habitat, silver sagebrush/bitterbrush communities, and soils with high runoff potential would help retain the existing quality of recreation opportunities in the ARPA. Road density limitations for grouse brood rearing and nesting habitat and some SMAs along with requirements for prompt interim reclamation, low impact road designs, careful siting of well pads, roads and facilities, and dust abatement techniques would also contribute to preservation of the recreation setting.

Data from the Wyoming Game and Fish Department (WGFD) random surveys were used to identify the areas of concentration of deer and elk hunter success in the ARPA. These areas are illustrated in Appendix M: Locations of Successful Hunts. As the figure shows, the hunter success is concentrated in five general areas, all of which fall within the boundaries of WGFD game management unit (GMU) 82, one of the most heavily hunted areas in the state. The areas are generally known as The Sand Hills, Deep Gulch and Cow Creek, Wild Cow Creek, Cherokee Creek, and Wild Horse Creek. Development in or adjacent to these areas would be expected to displace big game, and thus big game hunting to other areas where development is not occurring.

Direct loss of habitat due to construction of well pads and associated roads and pipelines, would lead to some wildlife displacement in these areas. Displacement due to habitat loss can be minimized but not avoided. This type of displacement would have an adverse impact to hunting

in the ARPA. This impact would be disproportionate because of the importance of these areas to game herds and thus to hunting.

A second type of impact, the disturbance of individual game animals by human activity and traffic, also would potentially have adverse affects on hunting. The long-term displacement of game herds because of sustained activity and noise is addressed in Section 4.7, Wildlife. Very short-term displacement of individual animals or small groups also would occur as an immediate, direct response to traffic, noise, and human activity. This type of disturbance, which can cause game to avoid an area for the better part of a day or so, is disruptive to hunting. Repeated disturbance of this kind could potentially have an adverse impact on an entire hunting season.

Because hunter success in the ARPA is concentrated in the areas described above, short term disturbance of game by project activity occurring during hunting season would potentially have a disproportionate adverse impact on hunter success and the hunting experience. The adverse impact to the areas of concentrated hunter success would potentially reflect on the hunting experience in affected parts of the ARPA and, perhaps, in the GMU as a whole.

The Cow Butte/Wild Cow and Sand Hills SMAs include some of the most heavily hunted portions of the ARPA. Development protection measures for these SMAs would include limitations tosurface disturbance and road densities, and fence conversions to BLM standards for improved wildlife passage. These and other development protection measures particular to each SMA would help retain the quality of hunting, wildlife viewing and recreation experiences in the ARPA.

The potential for a 64% reduction in surface disturbance and other development protection measures associated with Alternative C would reduce the project's impacts on recreation, but the overall network of facilities associated with 2,000 wells would still have a significant impact on recreation in the ARPA by displacing wildlife, and therefore hunters, wildlife viewers and other recreationists.

4.9.4 Mitigation Measures

The recreation analysis assumes the implementation of mitigations adopted as a result of the analysis of impacts to recreation, wildlife resources and visual resources. There are no relevant operator-committed mitigation measures. The mitigations used may include habitat enhancements in nearby undeveloped areas to compensate for degradation of habitat in the ARPA, and other measures as discussed in Section 4.7 Wildlife, in addition to Best Management Practices (BMPs) applied at the EA level. Minimizing activity during hunting season would probably not be an effective mitigation due to the disturbance of wildlife that normally occurs as a part of hunting activities.

No additional mitigation measures are necessary to specifically address impacts to recreation resources.

4.9.5 Residual Impacts

Residual impacts to recreation resources would exist even after the implementation mitigation measures. The residual impacts to recreation resources are the same as those described above in Section 4.9.3. Impacts to Hunting—and, perhaps to a similar extent, wildlife observation—would occur because habitat would be replaced by well pads, roads, and pipelines.

Displacement also would occur because of human activity, traffic, dust and noise adjacent to developed areas. The effects of these changes on wildlife would lower the quality of hunting and wildlife observation in the ARPA, at least until well drilling ends, and to some extent until final reclamation is complete after the end of the life of the project. During operations, wildlife may adapt to the routine activities associated with a well-field in production. Therefore, some re-occupation of disturbed areas may occur and some of the hunting quality may be restored. However, it is likely that there would be some residual impact to hunting and wildlife observation for the life of the project, which is potentially up to 50 years.

Residual impacts to recreation also would occur because of the impact of a natural gas field on the recreation setting. The reduced visual quality of the area after well-field development would primarily affect recreational sightseeing, which is a sensitive use of the ARPA.

4.10 VISUAL RESOURCES

4.10.1 Introduction

The landscape within the ARPA contains broad areas of grasslands, sagebrush, and tree cover, with the type of vegetative cover depending on the elevation of the surface and on water availability. Existing disturbance from oil and gas development is about 604 acres. This disturbance, about 0.2% of the 270,000 total acres in the ARPA, comprises un-reclaimed area from prior development of well pads, compressor stations, and containment ponds. A small portion of the remainder of the ARPA has been modified by improved and unimproved roads, power lines, constructed ponds, and irrigated cropland.

The issues of concern for visual resources in the ARPA are: 1) whether changes to the landscape from gas development would exceed BLM visual resource management objectives, and 2) whether changes in the visual resources due to gas development would potentially affect other users of the ARPA. The objective of VRM Management Class III is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but ***should not dominate the view of the casual observer***. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The classification of ARPA lands by visual quality, as defined by the BLM in the RMP, was determined according to the visual resource inventory procedure that is prescribed in BLM's Visual Resource Inventory Manual 8410.

The BLM's visual resource considerations during the siting of oil and gas facilities seek to minimize impacts to the extent possible and to avoid impacts that exceed allowable thresholds under existing VRM classifications. During the siting of specific oil and gas facilities within the ARPA, opportunities would be sought to minimize the prominence of structures, minimize unavoidable open disturbance during operations, and align roads and other rights of way for reduced visibility and contrast with natural features.

The analysis assumes that in the long run, measures presented in the Reclamation Plan (Appendix B) would be implemented. Because of the large geographic area covered by the project and the fact that the specific location of project facilities is not known at this time, the reclamation measures were presented in the plan in a general, non-specific manner. The final

choice of measures to be applied at any given location would be identified by the BLM in coordination with the Operators.

In the Great Divide RMP, BLM classified 259,000 acres of the 270,000 acres in the ARPA (about 96 percent) as VRM Class III, placing it in the category that comprises about 75 percent of all land in Great Divide Resource Area. The rest of the land in the ARPA, in the vicinity of Dad, is classified as VRM Class IV.

The management objective for VRM Class III is to allow only a moderate level of contrast between project features and the existing landscape. Moderate contrast means that project features should be selected, located and designed so as to not become dominant in the landscape, though they may be evident to the viewer and may even attract the viewer's attention.

VRM Class IV allows a strong visual contrast with the landscape, meaning project features may dominate views and even be the focus of viewer attention, though even in Class IV BLM may encourage the use of topography and vegetation to screen project features and reduce visual contrast.

4.10.2 Impact Significance Criteria

In determining the level of visual contrast to be expected from the Alternatives, this analysis has followed guidance on visual contrast rating from the BLM Visual Contrast Rating Manual H-8431-1. The degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between the project and the existing landscape. Briefly, the visual contrast introduced to the landscape by features of the proposed project is rated as weak, moderate or strong based on a comparison of the development's form, line, color, and texture to the same elements in the characteristic landscape.

To arrive at an impact rating, the analysis compares the highest visual contrast that the project would cause with the management objective for VRM Class III, which, as noted, comprises 96 percent of the ARPA. The impact rating to be attributed to the Alternatives are assessed by applying criteria from Table 4-8.

As noted, the VRM objectives for the ARPA were established by the RMP through the classification of all field office lands. The classifications are the sole determinant of the allowable level of visual impact. However, the RMP also includes guidance for management decisions in a multiple use context, such as where visual and mineral resources co-exist. The RMP includes an overall objective for visual resource management in the resource area as a whole that calls for minimizing adverse effects to visual resources while maintaining the effectiveness of land-use allocations for activities based on other resources (USDI-BLM 1990). Similarly, the overall objective stated in the RMP for oil and gas resource management throughout the resource area calls for providing opportunities for development of mineral resources while protecting other resource values (USDI-BLM 1990).

The task of minimizing adverse effects on visual resources while maintaining the effectiveness of land-use allocations is undertaken by BLM as apart of site-specific analyses of specific project features. These analyses are required once a site-specific proposal and additional resource information have been submitted to the BLM for individual APD or ROW applications. The site-specific analyses would occur after approval of the project and issuance of the ROD by

BLM and before surface disturbance pursuant to an individual APD or ROW grant would be allowed to take place on federal surface or minerals.

Table 4-8. Criteria for Assigning Summary Assessment of Impacts to Visual Resources for the Development Alternatives of the Atlantic Rim Natural Gas Project.

Level of Impact	Criteria
High	Predicted visual contrast would be higher than the level of change to the characteristic landscape allowable by the visual resource management classification. For example, introduced facilities in VRM Class III that dominate the landscape by becoming the primary focus of and holding viewers' attention would be rated as a high impact.
Moderate	Predicted visual contrast would be equal to but not exceed the level of change to the characteristic landscape allowable by the visual resource management classification, For example, introduced facilities in VRM Class III that are evident in the landscape and attract attention without dominating the view of the casual observer would be rated as moderate impact.
Low	Predicted visual contrast would be lower than the level of change allowable by the visual resource management classification. For example introduced facilities in VRM Class III that are evident to viewers but otherwise conform to the landscape's natural lines, forms, colors, and textures would be rated as a low impact.

The ARPA is a large area and the Alternatives are general in describing how project features would be located within the ARPA. This analysis proceeds by considering the level of visual contrast that would result from seeing typical project features from selected roads within the ARPA. The selected roads considered by the analysis are the maintained roads that access the principal areas within the ARPA where gas development would occur and where other uses, such as recreation, occur as well.

4.10.3 Direct and Indirect Impacts

4.10.3.1 Proposed Action

During the development phase, the Proposed Action would disturb 16,000 acres to drill wells and build roads, pipelines, and ancillary facilities like compressor stations. Development would continue for approximately 20 years, and the area of maximum surface disturbance would move generally outward from the existing interim development. Therefore, although development activities would disturb a total of 16,000 acres, the amount of the un-reclaimed disturbance apparent at any one time would be less than the amount of total disturbance.

As development progresses, facilities painted Shale Green or Brush Brown (or other non-reflective color approved by the BLM VRM specialist) would be completed, sites cleaned up, and interim reclamation activities initiated. In general, interim reclamation would occur concurrently as sections of the project are completed. Interim reclamation would reduce surface disturbance to an amount of in excess of 6,000 acres that would remain disturbed throughout the production phase of the Proposed Action. The facilities and remaining surface disturbance would be in place for 30 to 50 years, the life of the project (LOP), after which facilities would be removed and final reclamation of the LOP disturbance would occur.

Features of the Proposed Action would include structures (wellheads, tanks, generator and compressor units, etc.), structure sites (reclaimed to production size), and roads with adjacent utility ROWs (reclaimed to the LOP travel surface). In addition, the acreage reclaimed as facilities are completed and put into production (interim reclamation) would be revegetated, potentially creating continued contrast with the existing landscape for several years. The period of time that this contrast would exist would be variable, since it depends on the success of the reclamation measures and on the time needed for primary succession to return disturbed areas to pre-disturbance vegetation conditions.

The Proposed Action would potentially increase the amount of oil and gas-related disturbance in the ARPA approximately ten fold (i.e., a potential maximum of 2,000 wells in place for the LOP, compared to the existing 210 wells). This would increase the likelihood of seeing a landscape in the ARPA that includes oil and gas structures, the bare soil of well pads and other facilities sites, and roads.

The appearance of gas development at 80-acre spacing would create unavoidable contrast with natural landscapes in the ARPA, especially in tracts of continuous vegetation. The highly contrasting and difficult to conceal elements of development that appear with greater frequency at the proposed density are the bare pads where well and other facilities are constructed and the network of access and service roads.

The greatest potential for seeing visual contrasts from the Proposed Action would be from the principal roads of the ARPA. These roads would likely be traveled by private property owners and recreation visitors, as well as by oil and gas-related personnel. Sensitivity to the level of visual contrast from oil and gas development would likely be highest among recreation users, who include hunters, sightseers, and wildlife observers.

Table 4-9 lists roads where users would potentially see foreground-middle ground views of oil and gas structures and related change. These are views where contrasting features would be less than three to five miles from the viewer, according to the Visual Resource Inventory Manual H-8410-1 definitions of distance zones for visual resources analysis. The roads in Table 4-9 either access the northern or the southern part of the ARPA.

Approximately 65 percent of the VRM Class III lands in the ARPA are visible from one or more of the State, County or BLM roads in or adjacent to the project area. Approximately 67% of the Class III federal lands are visible. Therefore seeing development with strong contrast to the natural landscape that dominates the view of sensitive observers is quite probable and most likely unavoidable under the Proposed Action. See Appendix M: Areas Visible from Main Roads in VRM Class III.

Users of County Roads 503 and 608, as well as BLM 3309, also would occasionally see panoramic views with the facilities, roads, and reclaimed areas of the Proposed Action in the background.

Table 4-9. Roads in the ARPA Where Users would Likely See Views of Oil and Gas Facilities Under the Proposed Action.

Northern Part of ARPA		Southern Part of ARPA	
Number	Common Name	Number	Common Name
CR 605	20 Mile Road Daley Road	CR 503	Dixon Road
		CR 608 (west end)	Dad Road
		CR 608 (east end)	Lone Butte Road
		BLM 3305	Willows Road
		BLM 3308	Cow Butte Road
		BLM 3309	Wild Horse Road
		BLM 3320	Muddy Mountain Road

Notes:
All roads would likely access foreground to middle ground views of facilities within three to five miles or less of the viewer.
The northern part of ARPA includes the Red Rim and Jolly Roger federal lease units.
The southern part of ARPA includes the Doty Mountain, Cow Creek, Sun Dog, Blue Sky, Brown Cow, Boulder Creek, and Burbank Draw federal lease units.

When final siting decisions are made, design and location strategies would be used to screen features from view in VRM Class III areas visible from State, County or BLM roads. Utilizing existing topography to screen roads, pipeline corridors, drill rigs, well heads and production facilities is included in agency requirements for visual resources.

Some portions of the roads identified in Table 4-9 already have views of wells developed under the ARPA Operators' interim drilling program. As these views indicate, gas development does contrast with the characteristic landscape, even when designed and sited specifically for the ARPA. Judging from these examples, the greatest level of visual contrast due to the Proposed Action would occur because of bare soils on well pads, production facilities and structures, and associated roads. Specifically, geometric lines associated with these activities would contrast strongly with the characteristic vegetation and topography of the ARPA.

The reclaimed surface disturbance introduced by the Proposed Action would contrast with the ARPA landscape to a lesser degree. Reclaimed areas would contrast with undisturbed cover for several years because vegetation is slow to recover in most of the ARPA.

The adverse effects of visual contrast introduced by the Proposed Action are somewhat moderated by the VRM Class III rating of the viewshed, which allows for development so long as it does not dominate the view of the casual observer. Among users of the ARPA, hunters, sightseers and wildlife observers would likely be sensitive to the visual impacts of development. Other users of ARPA roads that would potentially have a view of gas development would likely be the livestock operators with ranching operations in the area and the personnel involved in developing and operating the Proposed Action.

Impacts to hydrologic systems and loss of vegetation would alter the character of the visual setting present in the ARPA. The proliferation of opportunistic weeds on disturbed soils would further alter the setting and inhibit the success of reclamation.

In conclusion, the adverse visual contrast introduced to the ARPA by the Proposed Action would be high. This level of contrast exceeds the maximum allowable in VRM Class III (96 percent of the ARPA) and is less than the maximum allowable in VRM Class IV (only 4 percent of the ARPA). Therefore, based on the criteria presented in Table 4-8, the impact of the Proposed Action as a whole to visual resources of the ARPA would be high, and thus significant. Impacts to visual resources from the Proposed Action would be long term, beginning during development and lasting beyond the LOP. In addition, the Proposed Action would potentially leave weak residual impacts in place on the landscape even after final reclamation at the end of the LOP because of the time it takes for reclaimed areas to return to pre-disturbance vegetation conditions.

4.10.3.2 Alternative A – No Action

Under the No Action Alternative, the Proposed Action would not be approved. The ARPA's visual character would continue to be affected by existing facilities, but no new visual impacts would be introduced, nor would management objectives for VRM Class III be exceeded by the No Action Alternative. The level of contrast introduced by the No Action Alternative would be low.

4.10.3.3 Alternative B

Developing the project area in three phases by concentrating drilling in only one zone at a time would reduce the amount of simultaneous short-term impact that would occur during the project's development phase. Development would still continue for approximately 20 years. However, instead of the area of maximum surface disturbance moving generally outward concentrically from all of the existing exploratory development "pods", only one zone would undergo concerted development at a time.

The Proposed Action anticipated that development activities would disturb an estimated 16,000 acres, but with the un-reclaimed disturbance apparent at any one time being indefinite but clearly less than the amount of total disturbance. Under Alternative B the amount of un-reclaimed disturbance apparent at any one time would still be indefinite. However, it would clearly be about one-fourth to one-third the extent of the simultaneous short-term disturbance anticipated under the Proposed Action.

Despite reducing short term impacts by phasing the development of 3 zones, Alternative B would not reduce long-term visual impacts to the ARPA remaining after the build-out of the gas fields and their operations over the life of the project. Therefore, impacts to visual resources under Alternative B would be anticipated to be high—the same as the Proposed Action.

4.10.3.4 Alternative C

Some of the development protection measures included in Alternative C would reduce the visual impacts of development. Limitations on surface disturbance in slopes over 8%, vegetation communities with high wildlife values, rare vegetation communities, proximity to water or wetlands, big game crucial winter range, grouse brood rearing and nesting habitat, silver sagebrush/bitterbrush communities, and soils with high runoff potential would help retain the visual quality of the ARPA. Road density limitations for grouse brood rearing and nesting habitat and some SMAs along with requirements for prompt interim reclamation, low impact

road designs, careful siting of well pads, roads and facilities, and dust abatement techniques would also contribute to preservation of the visual setting. See Appendix L.

As noted in the introduction and in Section 4.10.1, Impact Significance Criteria, impacts to visual resources in the ARPA were determined by assessing the visual contrast that the project would create on the landscape of the VRM Class III rated lands which constitute 96 percent of the ARPA. In addition to the VRM classifications, a visibility analysis has been generated from points along I-80, Highway 789, County Roads and BLM roads in and adjacent to the ARPA to show what portions of the project area are visible within 5 miles of these roads.

Development protection measures for visual resources under Alternative C would further reduce the visual impact of the project. Low impact road designs would be used in visible VRM Class III areas with less than 5% slope (Appendix M: Areas Visible from Main Roads in VRM Class III with Slopes <5%) which comprise over 26% of the federal surface in the ARPA. Other measures to reduce surface disturbance, prevent facility intrusion above the skyline, do reclamation promptly, and maximize pad distance from main roads would also contribute to preservation of the visual character of the area.

Facilities and roads constructed and visible in VRM Class III under Alternative C are not expected to dominate the landscape by becoming the primary focus of and holding viewers' attention as seen from the State, County or BLM roads, and would thus be rated as having a moderate level of impact. With an anticipated reduction in short-term surface disturbance of 64% as compared to the Proposed Action, Alternative C is not expected to exceed VRM Class III Management Objectives, and impacts are not expected to be significant.

4.10.3.5 Effects Common to All Action Alternatives

Predicted change to the characteristic landscape for each Action Alternative is expected to be equal to or greater than the level acceptable under VRM Class III management objectives. The visual quality of the project area would be adversely affected until successful final reclamation and repopulation of mature native shrub communities. The project area would potentially retain numerous improved project roads which would create lasting linear features that detract from the existing character of the area.

Proper coloration helps reduce the visual impact of oil and gas facilities.

4.10.4 Monitoring and Mitigation Measures

No additional mitigation measures are necessary under the No Action Alternative.

Best Management Practices (BMPs) are warranted to reduce impacts to the level allowable on VRM Class III lands. In addition, they may reduce conflict in the long run between continued expansion of mineral development and the interests of other users of the ARPA. Shale green facility coloration would blend satisfactorily with the environment in most well locations (approximately 93% of the ARPA or 92% of the federal surface within the ARPA) as seen above. Areas that would instead require a brown coloration (approximately 7% of the ARPA or 8% of the federal surface within the ARPA) to blend with brown shrubbery and grasses are shown in Appendix M: Project Area Facility Coloration.

VRM Class III comprises 94% of the federal surface in the project area. The operator-committed mitigation measures would not be sufficient to prevent the Proposed Action or Alternative B from exceeding VRM Class III management objectives. Even BMPs would not be sufficient to keep development within Class III management objectives as prescribed in Figures 4-4 and 4-5.

Alternative C is anticipated to have a moderate impact on VRM Class III portions of the project area, assuming BMPs and additional protections afforded other programs prevent the project from dominating the viewshed and exceeding VRM Class III management objectives.

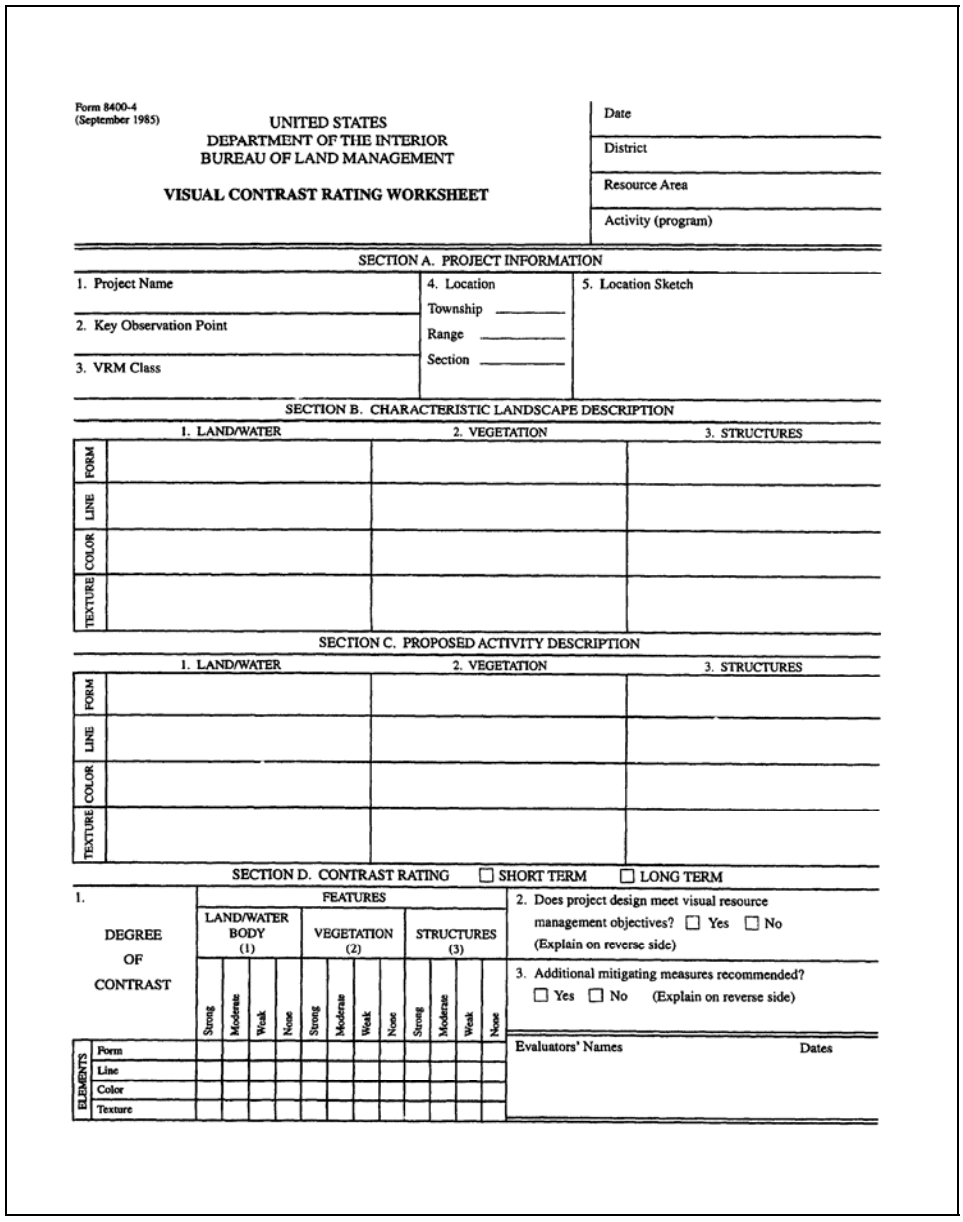
The need for more effective mitigation on all wells is an emerging issue in the GDRA. Although visual sensitivity is not the highest priority for many residents and visitors, a heightened awareness of scenic values and of the existing scenic quality is occurring for some residents and visitors as increasing numbers of sightseers and persons seeking various types of recreational opportunities pass through GDRA lands, including the ARPA.

Figure 4-4. Excerpt from Land Use Planning Handbook.

The Land Use Planning Handbook H-1601-1 (03/11/05) provides the following guidance:

I. Visual Resources

Implementation Decisions. Manage resource uses and management activities consistent with the VRM objectives established in the land use plan. Design all BLM resource uses, management activities, and other implementation decisions to meet VRM objectives established in the land use plan. Utilize visual resource management techniques and best management practices to mitigate the potential for short- and long-term impacts. Contrast ratings are required for all major projects proposed on public lands that fall within VRM Class I, II, and III areas which have high sensitivity levels (see Handbook H-8341-1 for contrast rating procedures).



Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date
District
Resource Area
Activity (program)

SECTION A. PROJECT INFORMATION

1. Project Name
2. Key Observation Point
3. VRM Class
4. Location
Township
Range
Section
5. Location Sketch

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM			
LINE			
COLOR			
TEXTURE			

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM			
LINE			
COLOR			
TEXTURE			

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	FEATURES: LAND/WATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form												
Line												
Color												
Texture												

2. Does project design meet visual resource management objectives? ☐ Yes ☐ No
(Explain on reverse side)

3. Additional mitigating measures recommended?
☐ Yes ☐ No (Explain on reverse side)

Evaluators' Names Dates

Figure 4-5 The Visual Contrast Rating Worksheet, Form 8400-4, for the project would be filled out after an alternative is selected.

4.10.5 Residual Effects

As noted, visual contrasts from wells, ancillary facilities and roads would be visible for the LOP, even with the use of BMPs, and the visual contrast from reclaimed land would have a residual effect for several years after the LOP until vegetative treatment begins to mature. The project area would potentially retain numerous improved project roads which would create lasting linear features that detract from the existing character of the area.

4.11 CULTURAL RESOURCES

4.11.1 Introduction

Cultural resources on public lands, including archaeological sites and historic properties, are protected by various laws and regulations, for example the National Historic Preservation Act of 1966 (NHPA) as amended, Governing Regulations, and 36 CFR 800. The specific directives can be found in "Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines" (Federal Register 1983). Laws and regulations concerning cultural resources stipulate that the Federal Government take into consideration the effects of an action on significant cultural resources. This requires that cultural resources within the proposed area of potential effect (APE) must be identified and evaluated. A determination of effect is made and measures are then formulated to mitigate or minimize any adverse effects to those historic properties included in, or eligible for, the NRHP.

The Atlantic Rim Project Area (ARPA) data base contains at least 425 cultural resource sites in a 270,080 acre (422 sections) project area. (recorded prior to 2003 as a result of inventory of 20% of the area). Site types include prehistoric camps including burial, habitation, ceramic/pottery, stone circles, rock shelters, petroglyphs, ground stone/milling activities, and quarries. The prehistoric lithic debris sites include debris scatters/procurements, ceramics, ground stone/milling activities, and quarries.

Historic sites include trails, stage stations, inscriptions, cairns, debris/trash, ranches, irrigation ditches, ranching/herding/corrals, and a post office. Historic trails include the Overland Trail, the Cherokee Trail, and the Rawlins to Baggs Road. The Washakie Station (listed on the NRHP) and the Sulphur Springs Stage Station were stops along the Overland Trail. The Sulphur Springs Station was also utilized by the Rawlins to Baggs Road. Other stations in the ARPA associated with the Rawlins to Baggs Road include Muddy Creek Station, Soldier Wells Station, Willow Station, and the 16 Mile Station. The JO Ranch is a prominent eligible property within the project area.

Prehistoric/historic sites are characterized as prehistoric camp/historic debris scatters, or lithic scatters/historic debris scatters. Of the 425 sites recorded in the EIS analysis area to date, 32% are recommended eligible (n=136) for nomination to the NRHP, 34% are recommended not eligible (n=145), and 34% remain unevaluated (n=144). Prior to 2003, approximately 20% of the area had been inventoried at a Class III level and site density is projected to be 0.008 sites per acre. Certain topographic settings have greater archaeological sensitivity including Aeolian deposits (sand shadows and sand sheets), and to a limited degree, colluvial deposits along lower slopes of ridges. Sensitive areas include drainages such as Muddy Creek, Cherokee Creek, Wild Cow Creek, Sixteen Mile Draw, Cottonwood Creek and Deep Creek along with their tributaries. The numerous springs in the area would likely be associated with cultural resources.

BLM has designated a quarter mile buffer surrounding the historic trails as highly sensitive and would result in the exclusion of disturbance of a maximum of 20,846 acres in order to protect the physical trace. The number of acres excluded from development would possibly be less as contributing segments are determined upon completion of inventory. For management purposes, BLM has established a two mile analysis area around the trails for consideration of the elements of setting as defined as those elements of integrity of location, feeling and association that contribute to the eligibility of the trails or associated sites. While two miles is the standard distance for consideration of setting, it does not preclude the consideration of a larger area, depending on the circumstances. The acres surrounding trails and associated Trail

for the purpose of view shed consideration has been calculated to be about 142,763 acres (not including the ¼ mile buffer). Once again, the acreage could change following field assessment

4.11.2 Impact Significance Criteria

Significance is measured by four categories defined by the Code of Federal Regulations (36 CFR 60.4):

> "the quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures and objects of state and local importance that possess integrity of location, design setting, materials, workmanship, feeling, and association; and that:
>
> A. are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. are associated with the lives of persons significant in our past; or
>
> C. embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> D. have yielded, or may be likely to yield information important in prehistory or history."

For archaeological sites, both prehistoric and historic, significance is primarily judged either by the site's ability or potential to yield information important in prehistory or history (Criterion D) or the site's association with events that have made a significant contribution to the broad patterns of our history (Criterion A). Each site's importance, however, is determined individually, so the existence of sites eligible under criteria B or C must not be discounted. Refer to Appendix M: Alternative C – Historic Trails and 2 Mile Visibility.

The BLM meets its responsibilities under Section 106 of the NHPA through the implementation of a national Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation (ACHP) and the National Conference of State Historic Preservation Officers and a State Protocol with the Wyoming SHPO rather than by following the procedure set forth in the ACHP's regulations (36 CFR Part 800).

> Destruction or alteration of all or part of a property.
>
> Isolation of a cultural resource from, or alteration of, its surrounding environment.
>
> Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.
>
> Neglect and subsequent deterioration.

The preferred strategy of cultural resource management is avoidance of affect to those elements that contribute to the eligibility of a historic property. If this strategy cannot be implemented, mitigation of adverse effects by project redesign, data recovery, project cancellation or numerous other mitigation options may be implemented.

4.11.3 Direct and Indirect Impacts

4.11.3.1 Proposed Action

It is proposed that 1800 Coal Bed Methane Wells and 200 conventional (deep gas) wells would be drilled over the next 20 years all within the project area. According to projections, it can be estimated that 15,803 acres of new surface disturbance could be expected including well pads, roads and pipelines and ancillary facilities. At that rate of disturbance, predicting the site density to be .008 sites per acre, 126 sites could be disturbed. Of those, 32% or 40 could be expected to be eligible for the NRHP. These calculations assume that the area-wide site density is equal across the ARPA and that 20% area inventoried is a valid sample.

Direct impacts would primarily take the form of alteration or disturbance of sites. Physical disturbance of eligible sites could result from construction of well pads, access roads, pipelines and ancillary facilities (including electric lines, compressor stations, etc.). Indirect impacts to those sites would result from associated erosion resulting from the changes in surface hydrology. In turn, the loss of integrity of surface cultural material or the exposure and degradation of subsurface material and their contexts could be expected. Indirect impacts also would result from the removal of vegetation which would serve to destabilize the soils and in turn cause additional erosion of site areas. In addition, as access to previously isolated areas becomes more abundant, the frequency of human intrusion and the possibility of looting also increase.

Where the setting of the trails and associated sites contributes to NRHP eligibility, actions resulting in the introduction of visual elements that diminish the integrity of the property's significant historic features would be a factor.

4.11.3.2 Alternative A – No Action

Under the No Action Alternative, the Proposed Action would not be implemented and further drilling would be allowed on federal lands only to the extent that it would be within the scope of existing environmental analyses and individual APDs would be approved on a case-by-case basis. No additional impacts to cultural resources could be expected beyond those analyzed in the previous environmental documents for projects within the ARPA.

4.11.3.3 Alternative B

Under this alternative, development would take place at timed intervals across the project area. This alternative envisions development areas into three zones, northern, central and southern. Federal leases would not be developed within non-active areas of the ARPA until drilling and interim reclamation operations are completed for earlier pod(s). The extent of gas production facilities would continue to accumulate as time passes with ultimately the same level of operational disturbance as the other action alternatives at completion. Consequently, direct impacts to sites would be the same over time as the other Action Alternatives.

Also, no differences in effects to site settings could be expected. While visual effects to sites where setting is contributory to their eligibility would be lessened during the development phase, as producing wells accumulate across the area, visual effects would increase and ultimately match the level associated with the other alternatives. Unauthorized collection could ultimately be anticipated at the same level as the Proposed Action.

4.11.3.4 Alternative C

Generally constraints would focus on surface disturbance limitations; limited operating periods, modification of drilling and construction practices, and in some cases no surface occupancy. Under this alternative sensitive cultural resource areas would be eliminated from development or be subject to extensive mitigation measures. A by-product would be the reduction of indirect effects resulting from unauthorized collection of cultural material due to limited available access into the area.

4.11.4 Impacts Summary

Gauging the effect of any impact depends on the level of information available for that particular property provided by inventory and/or testing data. If cultural resources on or eligible to, the National Register are to be adversely impacted by the proposed undertaking, then the applicant, in consultation with the surface managing agency and the SHPO, shall develop a mitigation plan designed to eliminate the adverse effects. Construction would not proceed until the terms of the mitigation plan are satisfied. A large amount of the Overland Trail and the Rawlins to Baggs Road are located in the checkerboard land pattern. As a result, impacts from projects occurring totally on private surface would be beyond federal control.

4.11.5 Additional Mitigation Measures

Additional mitigation measures may include but not be limited to the following:

Common to all alternatives:
Mitigation of Direct Impacts

- Collocate roads and pipelines
- Brush hog rights-of-way
- Allow no surface disturbance within ¼ mile of contributing segments of historic trails or trail associated sites
- Limit trail crossings to existing disturbance corridors
- No surface occupancy of JO Ranch or surrounding 18 acres

Mitigation of Impacts to Setting where contributory to eligibility

- Paint all surface facilities a color compatible with the local environment
- Surface all roads with gravel compatible in color with the local environment
- Collocate roads and pipelines
- Relocate project or hide disturbance
- No surface occupancy of JO Ranch or surrounding 18 acres

Additional mitigation measures under the Proposed Action would include the following:
Mitigation of direct impacts

- Collocate roads and pipelines
- Brush hog rights-of-way where physically possible
- Allow no surface disturbance within ¼ mile of contributing segments of historic trails or trail associated sites
- Limit trail crossings to existing disturbance corridors

Mitigation of impacts to segments where setting contributes to eligibility

- Paint all surface facilities a color compatible with the local environment
- Surface all roads with gravel compatible in color with the local environment
- Use low profile facilities
- Collocate roads and pipelines
- Relocate or hide the disturbance
- No surface occupancy of the JO Ranch or surrounding 18 acres

Additional mitigation measures under Alternative B

Mitigation of direct impacts

- Collocate roads and pipelines
- Brush hog rights-of-way
- Allow no surface disturbance within ¼ mile of contributing segments of historic trails or trail associated sites
- No surface occupancy of the JO Ranch or surrounding 18 acres.
- Collocate roads and pipelines
- Construct smaller well pads
- Construct narrower roads
- Multiple well locations per pad in order to decrease the total number of acres of disturbance
- Limit trail crossings to existing disturbance corridors

Mitigation of impacts to segments where setting contributes to eligibility

- Paint all surface facilities a color compatible with the local environment
- Surface all roads with gravel compatible in color with the local environment
- Use low profile facilities
- Collocate roads and pipelines
- Brush hog and gravel surface for temporary roads at the drilling phase instead of constructing crowned and ditched roads on all locations.
- Begin reclamation at the earliest possible time to regenerate the native species. Actively replace native shrubs to decrease visibility.
- Limit trail crossings to existing corridors
- Construct smaller well pads
- Construct narrower roads
- Multiple well locations per pad in order to decrease visibility
- Use existing roads/two-tracks if doing so would minimize visibility otherwise construct roads in minimally visible areas.
- No surface occupancy of the JO Ranch or surrounding 18 acres.

Additional mitigation measures under Alternative C

Mitigation of direct impacts

- No surface occupancy of the JO Ranch or surrounding 18 acres.
- Allow no surface disturbance within ¼ mile of contributing segments of historic trails or trail associated sites
- Collocate roads and pipelines
- Brush hog all rights-of-way
- Construct smaller well pads
- Construct narrower roads

- Multiple well locations per pad in order to decrease the total number of acres of disturbance
- Limit trail crossings to existing disturbance corridors

Mitigation of impacts to segments where setting contributes to eligibility

- Paint all surface facilities a color compatible with the local environment
- Surface all roads with gravel compatible in color with the local environment
- Use low profile facilities
- Collocate roads and pipelines
- Brush hog and gravel surface for temporary roads at the drilling phase instead of constructing crowned and ditched roads on all locations.
- Begin reclamation at the time most optimal to regenerate the native species. Replace native shrubs to decrease visibility.
- Limit trail crossings to existing corridors
- Collocate roads and pipelines
- Construct smaller well pads
- Construct narrower roads
- Multiple well locations per pad in order to decrease visibility
- Use existing roads/two-tracks if doing so would minimize visibility otherwise construct roads in minimally visible areas.

4.11.6 Residual Impacts

Given the implementation of the additional mitigation measures outline above, no residual impact discussion is required.

4.12 SOCIOECONOMICS

4.12.1 Introduction

Implementation of any of the Action alternatives or the No Action Alternative would result in both positive and adverse socioeconomic effects. Positive effects of the Action alternatives would include increased economic activity, income, employment and increased local, state and federal government tax and royalty revenues. Adverse effects of the Action alternatives would include disruptions in activities and lifestyles of those who own private land or use public land within the ARPA, including ranchers, grazing operators, hunters, and other recreation visitors. Implementation of the No Action Alternative would avoid the disruption of activities and lifestyles associated with the Action alternatives, but would also forego the employment and fiscal benefits associated with these alternatives.

4.12.2 Impact Significance Criteria

The following criteria are used to determine whether socioeconomic impacts of the Action alternatives and the No Action Alternative would be significant:

- an increase in county or community population that would strain the ability of affected communities to provide housing and services or otherwise adapt to growth-related social and economic changes;

- an aggregate change in revenue and expenditure flows likely to result in an inability on the part of affected units of government to maintain public services and facilities at established service levels;

- permanent displacement of residents or users of affected areas that would result from project-induced changes in or conflicts with existing uses or ways of life;

- disproportionately high and adverse environmental or human health impacts to an identified minority or low-income population, which appreciably exceed those to the general population around the Project Area.

4.12.3 Direct and Indirect Impacts

4.12.3.1 Proposed Action

Drilling and Field Development

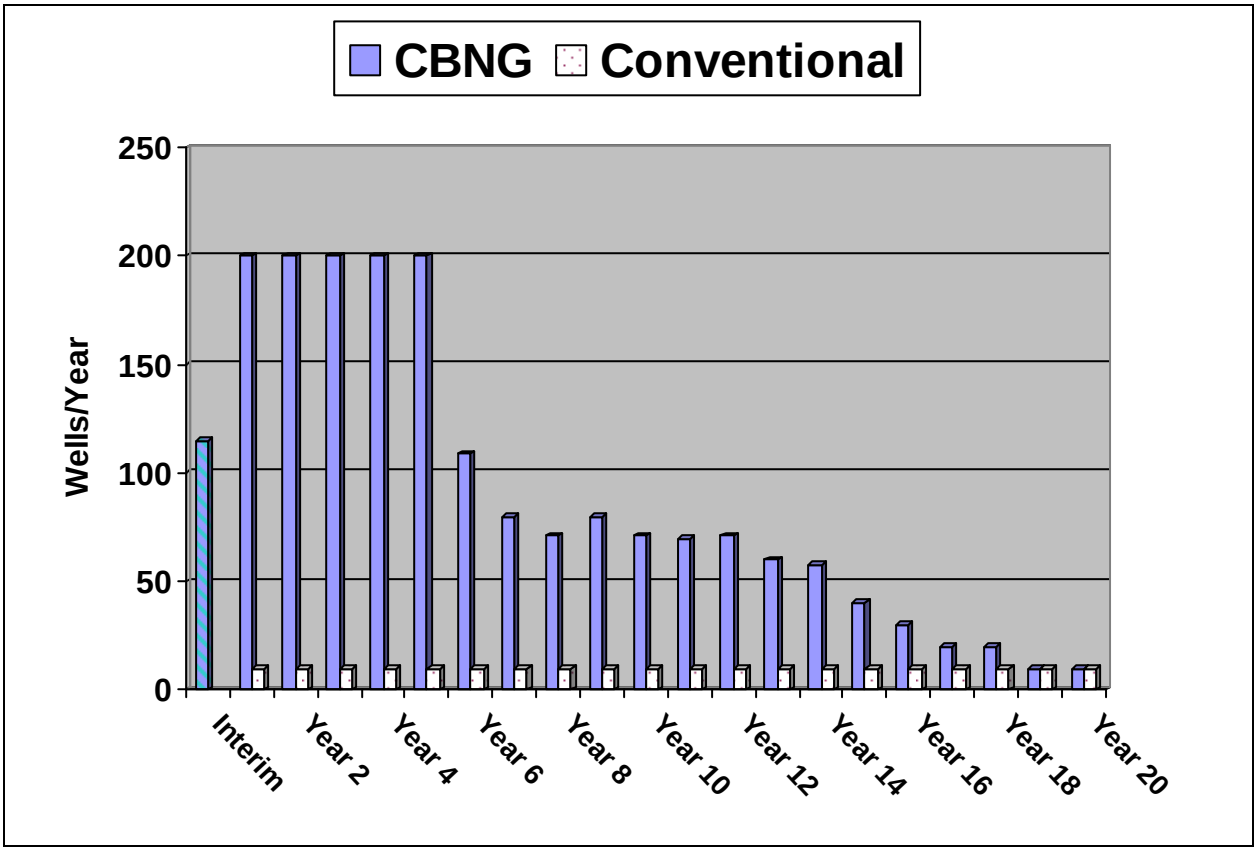
The level and pace of drilling and field development and the associated natural gas production would be key determinants of the socioeconomic effects of the Proposed Action and other Action alternatives. The pace and timing of drilling and field development within the ARPA would depend on a variety of factors including national and international energy demand and resultant commodity prices, actual production capabilities within the ARPA, and each Operator's development initiatives and strategies. This assessment assumes an annual rate of development provided by the Operators as shown in Figure 4-6. The Operators would drill a total of 2,000 wells under the Proposed Action. For the purposes of the assessment, it has been assumed that 1,800 would be CBNG wells and 200 would be conventional wells. Ten drilling rigs would be required during the first five years of the Proposed Action to achieve this pace of development. These rigs would be operating more or less continuously during the six-month drilling season.

Natural Gas Production

Figure 4-7 displays estimated Proposed Action-related CBNG production from the Atlantic Rim field. Estimates of production from conventional wells are not included in this assessment (see Section 4.12.3.1.1). APC has provided an average per/well production estimate for CBNG. Note that drilling continues throughout the 20-year drilling and field development period, therefore production is anticipated to continue for 32 years under the assumptions used for this assessment, generating ongoing economic and tax revenue effects.

Implementation of the Proposed Action would provide a substantial increment of natural gas production for Carbon County. Under the assumptions used for this assessment, gas production from Proposed Action-related drilling would not occur in the first year (production from the IDP would occur, but is not included in the assessment of impacts of the Proposed Action and Alternatives). Annual gas production from the Proposed Action would total almost 3.65 million MCF in Year 2, increase to 120 million MCF in Year 8, and then gradually decrease. For comparison, total Carbon County natural gas production in 2004 totaled 97 million MCF. Based on APC's estimated production for each successful CBNG well (750,000 MCF over 13 years) the Atlantic Rim field would produce over 1.35 TCF of CBNG over the 32-year assessment period.

Figure 4-6. Proposed Action Annual Drilling Assumptions by Well Type.



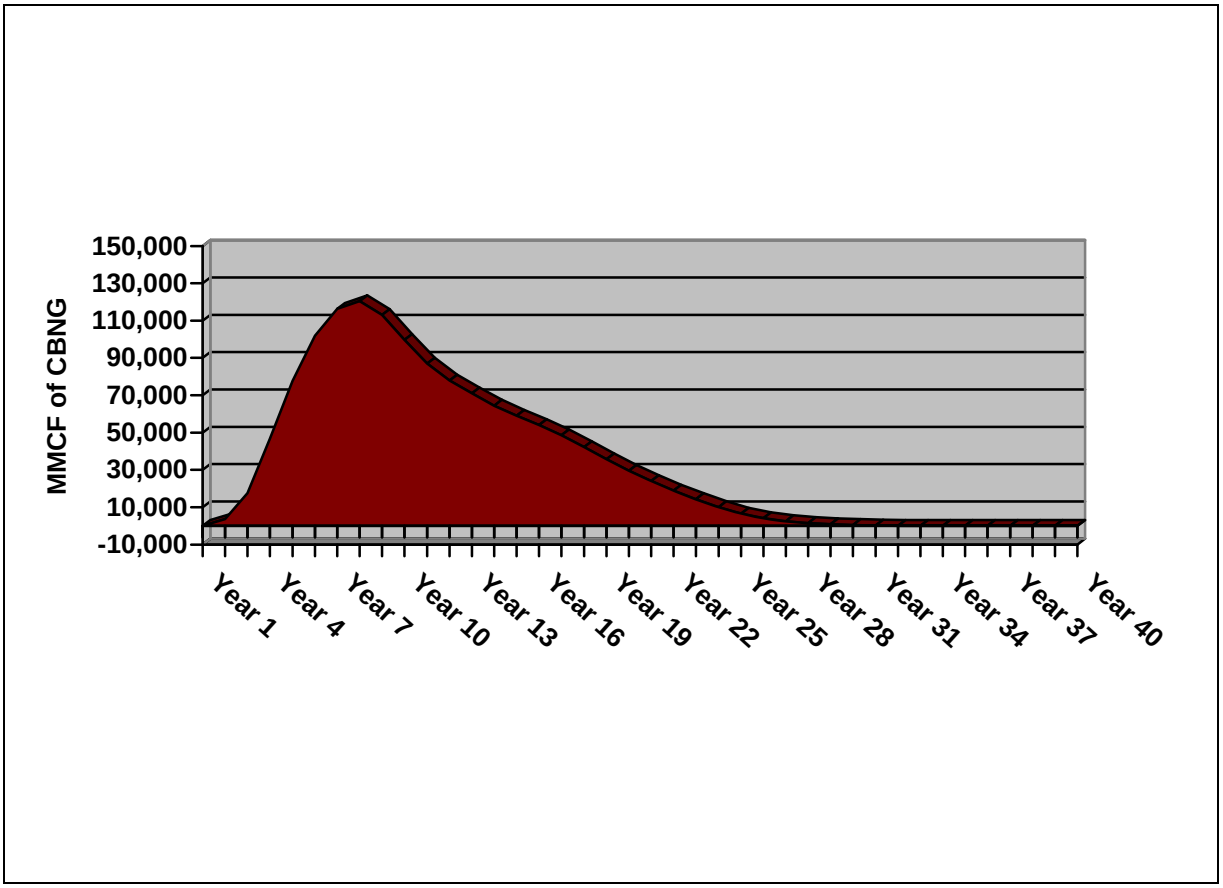
Sources: APC 2004a, BCLLC and IMPLAN model outputs

4.12.3.1.1 Economic Effects

The Proposed Action, as described in Chapter 2 of this assessment, would involve an estimated $2.1 billion capital investment for drilling, completion, gathering systems and field infrastructure, not including the investment for the IDP. This investment would occur over 20 years.

Development and operation of the Proposed Action would require goods and services from a variety of local, regional and out of state contractors and vendors in the oil and gas service industry and other economic sectors. Expenditures by the Operators for these goods and services, coupled with subsequent employee and contractor spending of earnings and profits, would generate positive economic effects in southwestern Wyoming, the State of Wyoming and the nation as a whole. These positive effects could be reduced in magnitude by Proposed Action-related reductions in other economic sectors.

Figure 4-7. Estimated Proposed Action-Related CBNG Production.



Source: APC 2004a
Note: Excludes production from the Interim Drilling Program

For this assessment, infrastructure and production estimates provided by the operators were used as inputs for a regional economic modeling process using the IMPLAN economic modeling software. IMPLAN (impact analysis for planning) is an input-output based model originally developed to assist the U.S. Forest Service in land resource management planning. Subsequently, the model and related software were transferred into the private sector, where it is the subject of ongoing refinement and enhancements to provide the analytical capacity to address a broader range of economic and impact planning issues. IMPLAN is widely recognized and accepted in regional economic and economic impact assessment circles. The model maps the flow of dollars through the region's economy and provides information about the interaction of individual sectors within the regional economy. The model considers both the direct effects on the producing sector(s) of a change in economic activity and the secondary effects on other local sectors due to the linkages within the region's economy. The model was used for the socioeconomic portion of the BLM's Southwest Wyoming Resource Evaluation (UW 1997) and for a variety of other NEPA assessments and BLM planning initiatives including the current revisions to the Rawlins Area RMP.

The model calibration and other elements of this assessment are based on the following assumptions:

- Drilling and field development in the ARPA would occur over 20 years, during which a total of 1,800 CBNG wells would be drilled, in addition to the 115 wells drilled during the IDP, with a success ratio of 100 percent, yielding a total of 1,800 producing CBNG wells (not including the IDP). For the purposes of this assessment, it is assumed that 200 conventional wells would also be drilled, also with a completion rate of 100 percent.

- The Operators estimate that each CBNG well would produce about 750,000 MCF of natural gas over 13 years. As noted above, under the Proposed Action some wells would be drilled late in the 20-year assessment period, therefore, production would continue for 13 years after the 20-year drilling and field development period ends.

- Although there are existing conventional gas wells within the ARPA, the Operators have not developed estimates for production associated with the conventional wells included in this assessment. Omitting production estimates for conventional wells may understate long-term economic, employment and fiscal benefits of production if drilling efforts in conventional formations meet with substantial success. However, because the employment and population effects of production would be substantially lower than employment and population effects of drilling and field development which are included, the assessment would not understate potentially adverse socioeconomic effects.

- Each CBNG well would require an average of $633,000 to drill and complete; an additional per well average of $379,000 would be spent on gathering and electrical systems, gas line laterals, compressor stations and injection facilities. Wells drilled to deeper conventional targets would be drilled with essentially the same equipment although completion and production techniques would differ; consequently conventional well costs are assumed to be approximately 50 percent higher than CBNG well costs.

- For the purpose of the assessment, wells would be drilled according to the schedule presented in Figure 4-6.

- Only a portion of the expenditures in each category would occur within southwest Wyoming; other materials and labor purchases would occur elsewhere in Wyoming or out of state. Estimates of local and non-local expenditures have been developed for each drilling and field development category (e.g., rig costs, labor costs, furl costs, pipe costs, etc.), based on actual APC expenditures during the interim drilling program.

- Revenues, expenditures and economic effects are expressed in terms of constant 2004 dollars.

- Annual average well head gas prices are based on the $4.25/MCF estimate for gas prices beyond 2005 contained in the October 2004 Wyoming Consensus Revenue Estimating Group Wyoming State Government Revenue Forecast (CREG 2004). These are likely conservative estimates. Note that CREG increased wellhead price estimates for natural gas to $6/MCF for 2006 and beyond in October of 2005. Spot prices at Wyoming hubs were over $10/MCF during the fall of 2005 as a result o f hurricanes Katrina and Rita.

Use of the foregoing assumptions and the IMPLAN model allow a reasonable but conservative assessment of the potential positive economic impacts of the Proposed Action and alternatives, however, economic effects of the alternatives except for No Action would be different than those forecast by the model if actual conditions vary substantially from these assumptions.

Estimated economic effects of drilling and field development are displayed in Table 4-10. Based on the foregoing assumptions, an estimated annual average direct regional expenditure of about $49 million would result in an annual economic impact of about $62 million in southwest Wyoming, or a total economic impact of almost $1.2 billion over the 20-year drilling cycle.

Estimated annual drilling and field development employee earnings in southwest Wyoming would average almost $22 million or about $434 million total over 20 years. These earnings would support an average of 578 annual job equivalents (AJE). AJE reflect an aggregation of all employees (existing and new) whose employment would be supported in whole or in part by Atlantic Rim project spending. The term AJE is used to emphasize that these are not all discrete or separate new jobs created by the Proposed Action, rather they represent both new and existing jobs and portions of jobs that are wholly or partially supported by the incremental economic activity associated with the Proposed Action.

Table 4-10. Estimated Economic Effects of Drilling and Field Development: Proposed Action.

	Direct Regional Expenditures[1]	Total Economic Impact[2]	Total Earnings[3]	Employment (AJE) Direct, Indirect & Induced)[4]
Annual Average	$49 million	$62 million	$21.7 million	578
Total	$981 million	$1.2 billion	$434 million	n/a

Source: IMPLAN Model results based on information provided by APC.
[1]Direct regional expenditures are purchases from vendors located in Carbon and Sweetwater counties by the Operators and their contractors for labor, goods and services. [2]Total economic impact reflects project-related direct expenditures and subsequent rounds of spending by vendors and employees in Carbon and Sweetwater counties. [3]Total earnings reflect wages and salaries paid to direct, indirect and induced employees associated with Proposed Action-related drilling and field development. [4]Direct, indirect and induced employment is defined in Section 4.12.3.1.3.

Estimated economic effects associated with production (not including production associated with the IDP) are presented in Table 4-11. Based on the assumptions outlined in the earlier part of this assessment, natural gas production would result in $5.7 billion in total economic impact over the 32-year production cycle (production impact estimates include impacts outside southwest Wyoming), and average annual earnings of $6.6 million supporting 161 annual average job equivalents. Production-related employment (direct, indirect and induced, defined in Section 4.12.3.1.3) would begin at an estimated 14 AJE in Year 2, increase to 461 in Year 8 and then steadily decrease. Production-related earnings and employment effects would occur in Carbon and Sweetwater counties.

Table 4-11. Estimated Economic Effects Associated with Proposed Action-Related Production.

	Total Economic Impact[1]	Total Earnings[2]	Employment (AJE) Direct, Indirect & Induced[3]
Annual Average	$200 million	$6.6 million	161
Total	$6.4 billion	$210 million	n/a

Source: IMPLAN model results based on information provided by APC.
[1] Total economic impact is the total economic activity that occurs in the region as a result of production, including the direct effect which represents the dollar value of the industry's production plus the secondary effects of increased business activity for industries that support the industry where the production occurs. [2]Total earnings reflect wages and salaries paid to direct, indirect and induced employees associated with Proposed Action-related drilling and field development. [3]Direct, indirect and induced employment is defined in Section 4.12.3.1.3

As shown in Table 4-12, the combined drilling, field development and production phases of the project would generate an estimated $7.6 billion in total economic impact, including $644 million in total earnings in southwest Wyoming over the 40-year LOP used for this assessment.

Table 4-12. Combined Proposed Action-Related Drilling and Production Economic Effects.

	Direct Expenditures[1]	Total Economic Impact[1]	Total Earnings	Average Annual Employment (AJE) Direct and Indirect)
Total	$ 6.7 billion	$7.6 billion	$644 million	578 drilling /161 production

[1] Includes impacts outside southwest Wyoming
Source: IMPLAN model results based on information provided by APC.

4.12.3.1.2 Proposed Action-Related Effects on other Economic Activities within the ARPA

As outlined in Section 3.11, existing land uses within the ARPA include wildlife habitat, grazing, hunting and other dispersed recreation, and oil and gas exploration, production and transmission.

Grazing

The economic assumptions for grazing contained in Appendix 35 of the Draft RRA RMP estimate that cattle grazing generates $64.36 per AUM in total economic impact in the region, and results in $18.77 in earnings/AUM and .000709 jobs/AUM. Each AUM of sheep grazing results in $42.36 in regional economic impact, $5.83 in earnings and generates .0009513 jobs.

Potential impacts to grazing activities and range resources are discussed in Section 4.6. In that assessment, it is estimated that grazing use of the allotments in the ARPA is 91 percent cattle and 9 percent sheep. One potential economic effect of the Proposed Action on grazing activities would be reductions in AUMs associated with losses of forage due to temporary and long-term disturbance. The total economic impact of reductions in AUMs associated with initial disturbance (2,026 AUMS) would be $126,382, assuming that the loss of forage associated with disturbance resulted in actual reductions in AUMs. Because the initial disturbance would be over the 20 year drilling and field development phase of the project, the economic impact would similarly be spread over the life of the project. It routinely takes more then one season for

reclaimed areas to become established, consequently economic impact associated with initial disturbance would be multiplied for each year required to re-establish forage, again assuming that disturbance resulted in actual reductions in AUMs.

However, the grazing assessment in Section 4.6 concludes that the amount of forage lost as a result of Proposed Action-related disturbance would be less than the normal variations in forage availability from year to year and therefore be minimal in the short-term and may actually increase available forage in the long-term because reclaimed vegetation would consist of herbaceous species, which cattle prefer. Consequently, short- or long-term disturbance-related reductions in AUMs for grazing allotments within the ARPA resulting from implementation of the Proposed Action cannot be predicted with certainty.

Some aspects of natural gas development may be beneficial for grazing operators, for example improved road access to grazing areas could facilitate livestock management for some operators, reducing costs.

Other aspects of development could generate adverse economic impacts to ranchers and grazing operators. Dust could reduce the palatability of forage near disturbed areas, requiring more intensive livestock management practices to ensure adequate forage. Incursion of noxious and invasive species could reduce available forage and require more intensive management practices. Operators may also have to manage livestock more intensively to avoid drilling and field development activity or to retrieve livestock scattered because of un-repaired damage to fences or cattle guards. More intensive livestock management practices would result in increased costs to operators. Unreported vehicle live-stock collisions could also result in economic losses for ranchers and grazing operators.

The collective effects of the above impacts could induce grazing operators whose allotments are concentrated within the ARPA to forgo use of their allotments for one or more seasons during periods of intensive development. If withdrawal of cattle were to occur, and if these grazing operators could not find comparable grazing lands within the county at comparable costs, or if they chose to forgo grazing entirely for one or more seasons, the economic impact associated with that operator's AUMs would be also be forgone. In this case, according to the range assessment in Section 4.6, losses associated with BLM allotments could range from 6,000 AUMs, which would generate a loss of $374,280 in total economic impact, to 12,000 AUMs which would generate a loss of $748,560. Including both BLM and private lands, reductions in AUMs could range as high as 20,000 which would result in a total economic impact of $1,247,600. The adverse economic impact of reductions in AUMs associated with grazing operators opting to forego use of their allotments would occur each year that cattle are withdrawn from the allotment, assuming that other grazing lands were not available.

If grazing operators were to forgo use of allotments, areas that were re-claimed would have more time to become established, reducing the potential for the spread of weeds, which could provide some economic benefit to grazing operators when they resumed use of the allotment.

Recreation

According to the recreation assessment contained in Section 4.9, some hunters and other recreation visitors to the ARPA may be temporarily displaced from the area by drilling and field development activity and land disturbance and by the result reductions in game. A lesser number of hunters and recreation visitors may be displaced long-term because of the loss of undisturbed landscapes and solitude. The above-referenced UW report provided estimates of

per/day total regional economic impact that range from $156 per day for non-resident hunting, $159 for non-resident OHV use and $51 per day for non-resident general recreation, and regional jobs range from 0.005/visiter day for non-resident hunting, 0.003 for non-resident OHV use to 0.001 per day for general non-resident recreation.

Estimates of the number of recreation visitors to the ARPA are not available. Estimates of the number of hunters and other recreation visitors who would be displaced temporarily or long term by the Proposed Action are similarly not available. Estimates of use of the hunt areas that include the ARPA are presented in Section 3.9 (Recreation). Based on these estimates and the total economic impact estimates of non-resident mule deer, elk and antelope hunting contained in the Draft RRMP, total economic impact of non-resident big game hunting in the hunt areas that contain the ARPA is about $1.5 million annually. Because the hunt areas are substantially larger than the ARPA, the portion of total economic impact attributable to non-resident hunting within the ARPA is smaller than the above estimate.

Big game hunting is economically important to communities near the ARPA. A number of landowners within the ARPA provide outfitting services to non-resident hunters and some lease their land to outfitters or allow hunting for a fee. This activity provides additional income for landowners; in years when cattle or sheep prices are low, it provides a substantial portion of total income (Caricco 2004, Hicks 2004, Hansen 2004, O'Toole 2004). Also motels, RV parks, cafes, convenience stores and gas stations in the Little Snake River Valley derive a portion of their business from big game hunters (Hicks 2004). Consequently, substantial reductions in big game hunting within the ARPA would have adverse economic effects on land owners, outfitters and businesses in the Little Snake River Valley. For individual land owners and outfitters, these losses could range from minimal to substantial, depending on the location of natural gas development in relation to a specific property, the timing of development, actual effects on big game and big game habitat, climatic conditions, the duration of adverse effects and the success of mitigation measures. Economic effects to businesses in the Little Snake River Valley could be offset by the economic activity associated with the Proposed Action.

4.12.3.1.3 Employment and Population Effects

Employment

Population effects of the Proposed Action would be associated with direct, indirect and induced employment. Direct employment would include workers in oil and gas service occupations, construction or other sectors involved in some aspect of Proposed Action-related drilling, field development or production. Indirect employment would include jobs and portions of jobs created by industries purchasing from other industries in response to local spending associated with the Proposed Action. Induced employment would be created by direct, indirect and induced employee spending of Proposed Action-related income for goods and services, and would occur across most economic sectors.

As a result of the Proposed Action, direct, indirect and induced jobs would be created in Carbon and Sweetwater counties, and include:

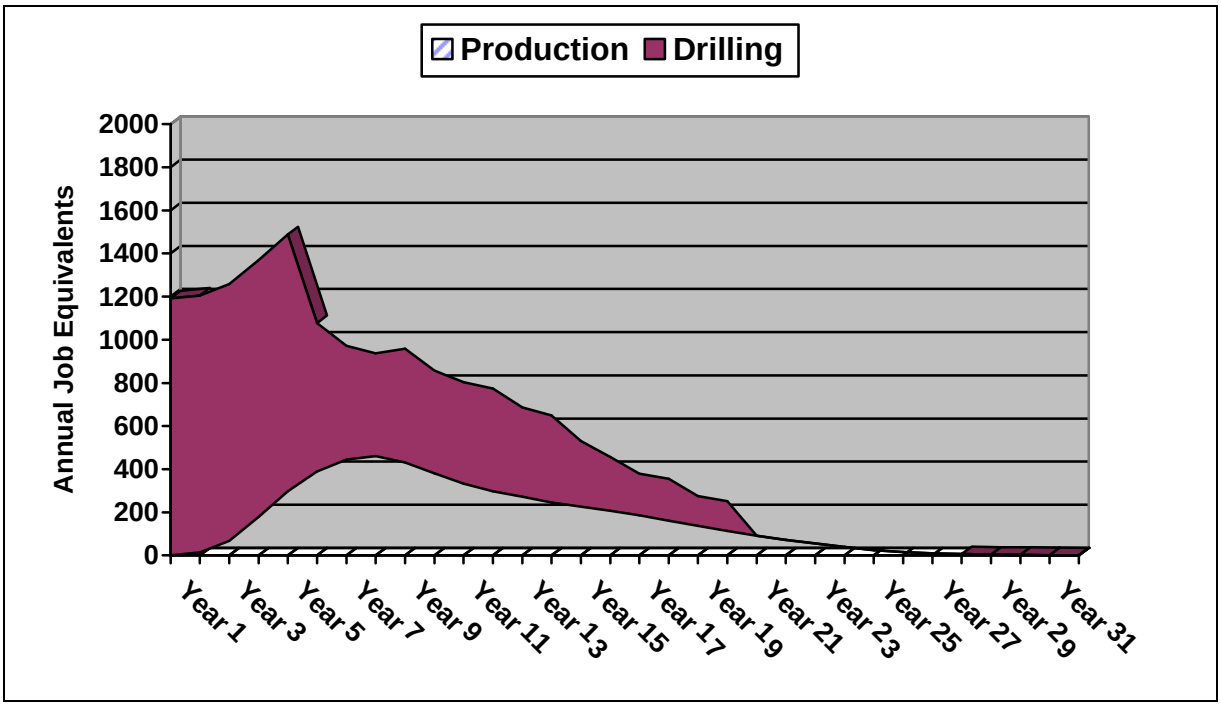
- temporary jobs, primarily in drilling, natural gas service and related construction industries, which would be primarily filled by non-local workers who would relocate to the area for the duration of the particular work assignment, and to a lesser extent by existing southwestern Wyoming residents. Work assignments can range in length from six months to a matter of hours at any one location.

- existing direct, indirect and induced jobs and portions of existing jobs that have in the past been linked to or supported by natural gas drilling, field development or production activities and would continue to be supported by these activities under the Proposed Action; and

- new jobs and portions of new jobs filled by existing southwest Wyoming residents or by in-migrant workers who relocate to southwest Wyoming for employment. In-migrant workers are defined as workers who move into the area for project-related employment purposes.

Figure 4-8 displays estimated total employment associated with the drilling/field development and production phases of the Proposed Action.

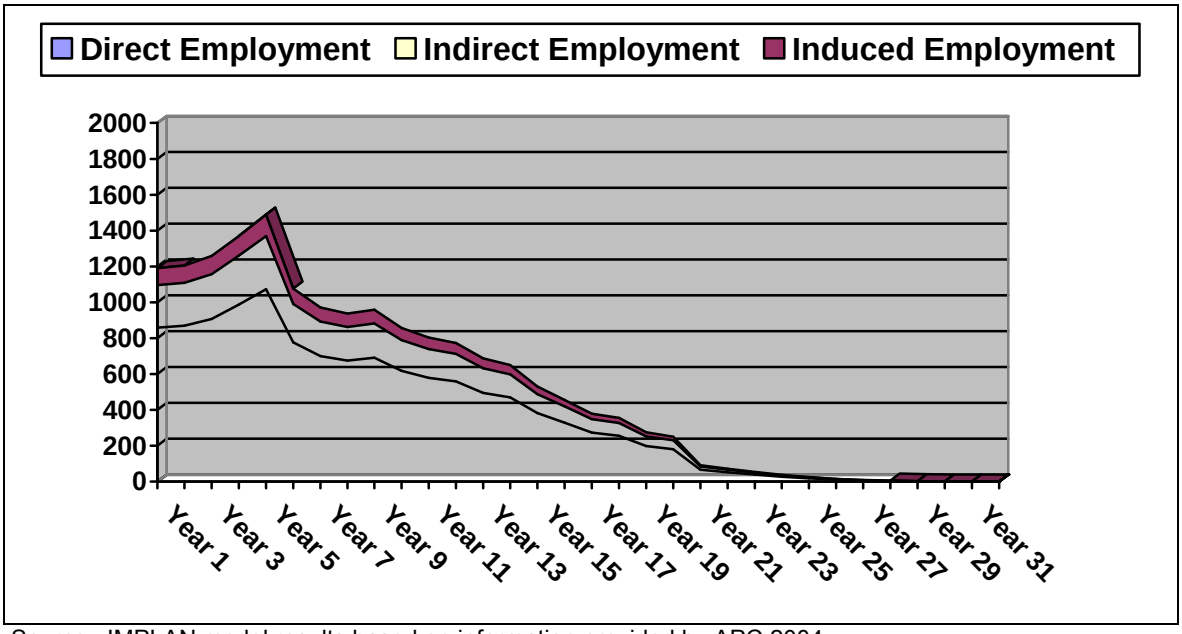
Figure 4-8. Estimated Proposed Action Total Drilling and Production Employment: Direct, Indirect and Induced.



Source: IMPLAN model results based on information provided by APC

Figure 4-9 displays the direct, indirect and induced components of Proposed Action-related employment.

Figure 4-9. Components of Total Proposed Action-Related Employment: Direct, Indirect and Induced.



Source: IMPLAN model results based on information provided by APC 2004

Population

Although the employment and income effects of the Proposed Action would be substantial and sustained at a high level of activity for 8 to 10 years, the Proposed Action is likely to result in moderate long-term population growth. A number of factors in the natural gas industry and the local economy would likely intervene to reduce the population effects of the economic stimulus.

Chief among these is the existence of a mature oil and gas service industry infrastructure in southwest Wyoming. Drilling and field development activities in the ARPA would be performed by a combination of local contractors (primarily located in Rawlins and Rock Springs, and to a lesser extent, the Little Snake River Valley and Wamsutter) and regional and national oil and gas service firms, many with local presences in these same communities. Between 1995 and 2004, APDs in Carbon and Sweetwater counties increased over 300 percent. In response to this activity, oil and gas service firms have expanded, particularly in Rock Springs, which is the major oil and gas service center for southwest Wyoming.

During the nine-year period that drilling activity increased dramatically in the two counties, Carbon County resident population decreased by five percent and Sweetwater County resident population decreased by seven percent. There are several apparent reasons for this phenomenon.

- Many oil and gas drilling and service companies are staffed by employees with primary residences in other parts of the country. These employees relocate to Carbon and Sweetwater counties in single status (i.e., without family members), on a temporary basis, and return to their homes when they are off shift, or at the end of their work assignment (Blodgett 2004, Kilgore 2004, Kot 2004). In some cases, these employees

are considered double transients who temporarily relocate to a service company's office in Rock Springs, and travel to other communities and stay in motels or RV parks for a matter of days, returning to Rock Springs for another assignment (Blevins 2004). Because of their temporary nature, these employees are not full time residents and therefore often not counted in population estimates, even though they generate demand for temporary housing and for some local government services.

- Coal mining employment decreased in both counties during the period and trona mining/soda ash manufacturing employment decreased in Sweetwater County, as did logging and lumber manufacturing in Carbon County. Some mine and timber industry employees may have obtained work in the oil and gas service industry and some indirect and induced employees may have retained jobs they otherwise would have lost because of economic activity in the oil and gas sector. As a result, increasing oil and gas industry activity may have slowed population decline in the two-county area.

- At the beginning of the accelerated drilling cycle, oil and gas service firms may have had some underutilized capacity and the local labor pool may have supplied a portion of the increased labor demand.

- During the mid 1990s several major construction projects helped maintain population in Sweetwater County as these projects were completed, workers left contributing to population decline.

Given that the allowable drilling period in the ARPA fields runs from June through October only, and drilling and field development in many other southwestern Wyoming gas fields are similarly limited to certain parts of the year, it is likely that many drilling and gas field service workers would continue to relocate to Carbon and Sweetwater counties on a temporary, single status basis, returning to their homes or relocating to other projects during the off season. This observation is supported by the fact that school enrollment in Carbon and Sweetwater counties declined by 26 percent and 29 percent, respectively, during the nine year period when drilling increased by over 400 percent, indicating that gas service industry workers have not relocated with families. Declines in school enrollment are also a result of declines in other employment and of aging populations in the two-county area. Indications are that school enrollment is beginning to increase in Rawlins and the Little Snake River Valley (Herold 2005, Kilgore 2005).

As noted above, the natural gas service industry in Carbon and Sweetwater counties has expanded considerably over the last several years in response to the increased drilling and field development activity in southwest Wyoming, and would likely be able to accommodate some portion of the activity associated with the Proposed Action with existing infrastructure and labor force. Additionally, there were four drilling rigs operating in the ARPA during 2004 under the IDP, and the local portion of field construction and gas service industry employment to serve this level of development (about 40 percent of the peak-year of the Proposed Action) is presumed to be already in place.

For this assessment, each employment category (direct, indirect and induced) has been assigned a residency status (non-local temporary, local and inmigrant) depending on the characteristics of the work, the existing labor pool and historical labor factors in southwestern Wyoming. The "local" category is further divided into existing employees (i.e., those who are already working and their employment would be sustained in whole or in part by the economic activity associated with the Proposed Action) and a smaller category of workers who would

obtain new employment as a result of the Proposed Action. Table 4-13 displays the hiring status factors used for this assessment.

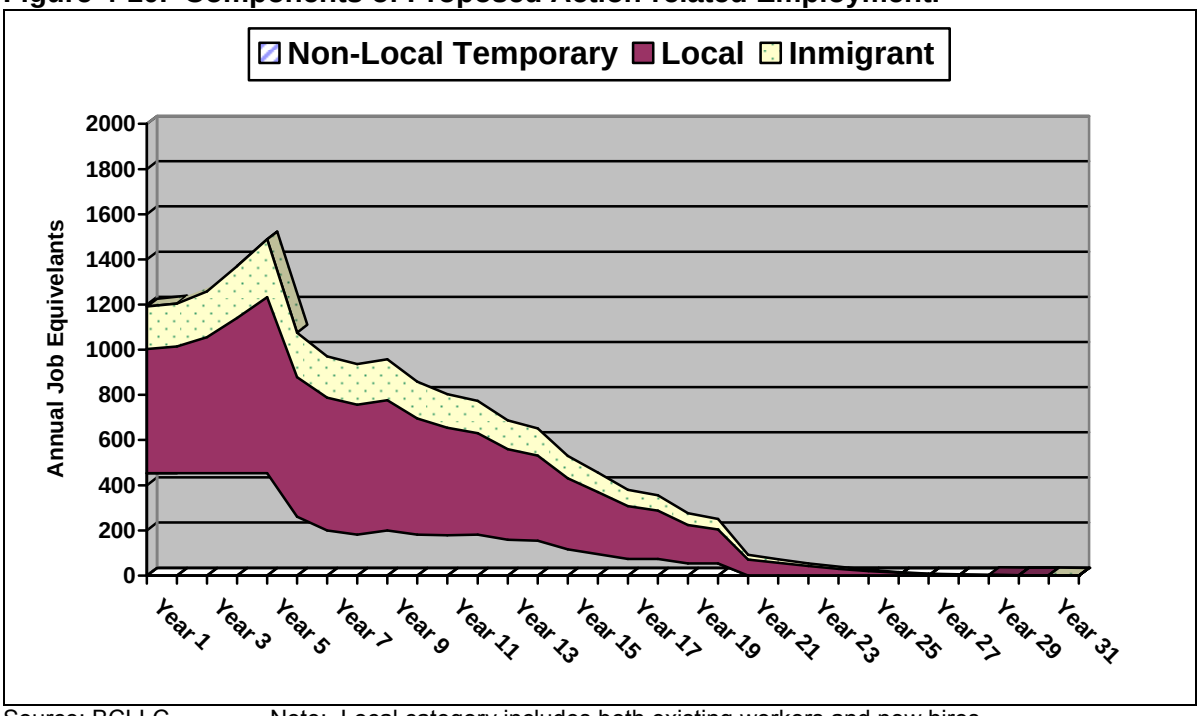
Figure 4-10 displays the estimated non-local temporary, local and inmigrant components of Proposed Action-related employment. During the fifth year of drilling, when an estimated peak of 1,488 direct, indirect and induced AJE would be associated with Proposed Action-related activities, an estimated 453 or 30 percent would be non-local and temporary, 780 or 52 percent would be local (already employed in jobs that would be sustained by Proposed Action-related activities or living locally and obtain new employment in a job created in response to Proposed Action-related activities) and 256 or 17 percent would be in-migrants (workers who relocate to the area with households on a longer term basis). The percentage of locally hired workers reflects the local portion of the 40 percent of the drilling and field development workforce that has been working on the IDP.

Table 4-13. Hiring Status of Proposed Action-Related Employment.

Employment Category	Non-Local Temporary	Local		Inmigrant
		Existing Employees	New Hires	
Drilling/Field Development				
Direct	50%	30%	5%	15%
Indirect	25%	45%	5%	25%
Induced	0%	75%	10%	15%
Operations				
Direct	0%	20%	30%	50%
Indirect	0%	75%	10%	15%
Induced	0%	50%	35%	15%

Source: BCLLC

Figure 4-10. Components of Proposed Action-related Employment.



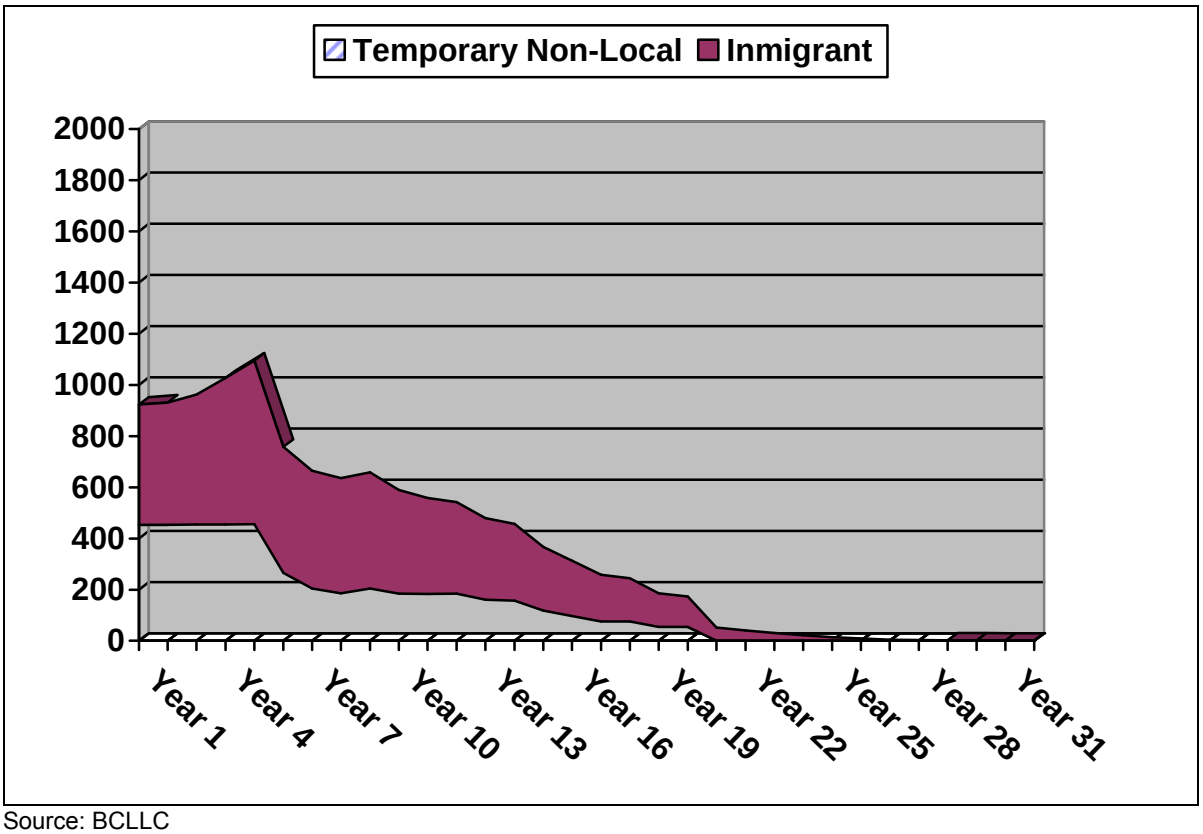
Source: BCLLC Note: Local category includes both existing workers and new hires.

The distinction between non-local temporary, local and in-migrant workers is useful because each would have different population implications and different demands for community services.

For this assessment, temporary non-local workers are assumed to relocate to southwestern Wyoming in single status, for six months or less. Local workers are assumed to be currently living and working in southwestern Wyoming. In-migrant workers are assumed to relocate to southwestern Wyoming bringing an average household size of 2.5 persons, the average household size for the State of Wyoming at the time of the 2000 census.

Based on these assumptions, the Proposed Action would result in a peak of 456 additional non-local single status temporary workers during the Year 1 through Year 5 of the Proposed Action and a peak in-migrant population of 1,096 during Year 5 of the Proposed Action (see Figure 4-11).

Figure 4-11. Proposed Action–Related Peak Temporary Single-Status and Inmigrant Population.



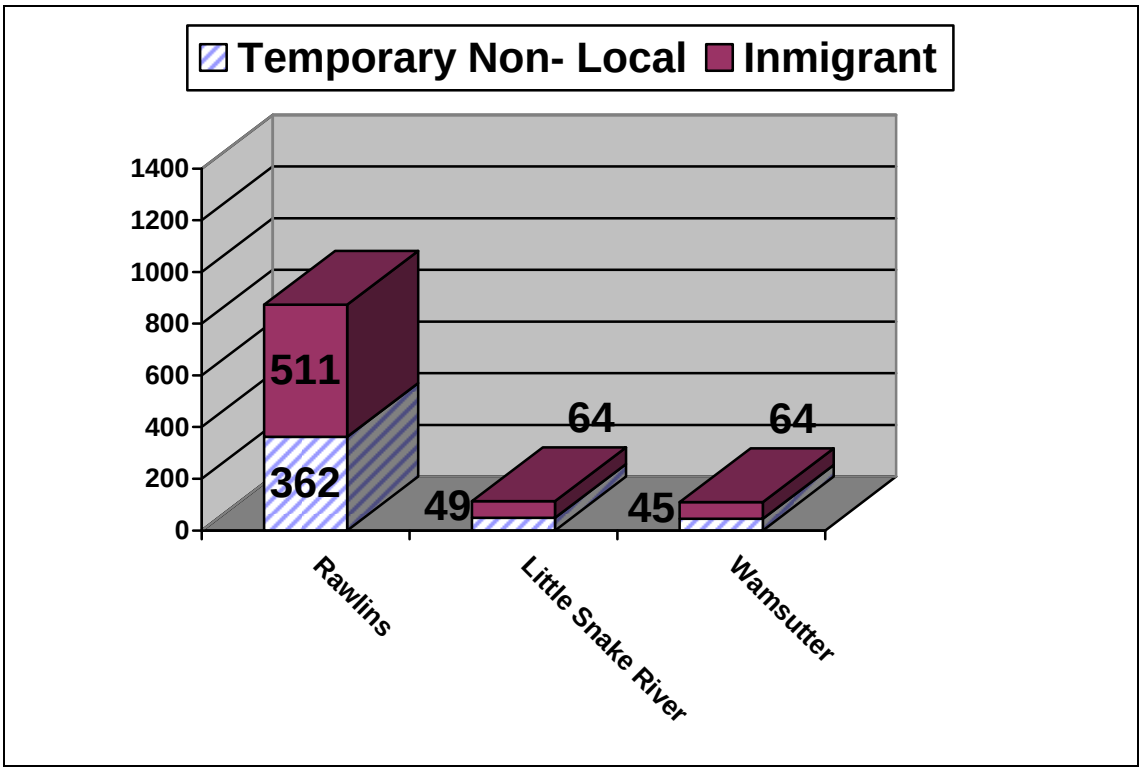
Source: BCLLC

Based generally on the size of the community, proximity to the ARPA and available housing, the Proposed Action-related population has been distributed to Rawlins (80 percent), Baggs and Dixon in the Little Snake River Valley (just over 10 percent) and Wamsutter (just under 10 percent). Using these percentages, Rawlins would receive a Proposed Action-related population of 873 persons (362 temporary and 511 longer term) during the peak (Year 5), Baggs and Dixon

in the Little Snake River Valley would receive a total of 113 (49 temporary and 64 longer term) and Wamsutter would receive a total of 109 (45 temporary and 64 longer term) (Figure 4-12).

It is important to note that these numbers are in addition to the population associated with existing direct, indirect and induced workers currently living in these communities whose employment would be supported in whole or in part by Proposed Action-related economic activity.

Figure 4-12. Distribution of Peak Year Proposed Action-related Population to Communities.



Source: BCLLC

Based on the above population estimates and the percentage of total population enrolled in school during 2000 (about 18 percent in Carbon County and in the State of Wyoming as a whole) an estimated 92 school age children associated with the Proposed Action would be enrolled in schools in Rawlins during the peak year (fifth year of drilling and field development), 11 would be enrolled in schools in the Little Snake River Valley and 12 would be enrolled in Wamsutter.

The Wyoming Division of Economic Analysis projects that Rawlins, Baggs, Dixon and Wamsutter would have small decreases in population over the next several years (WDEA 2004); if these projections are correct, the population associated with the Proposed Action may reduce population loss in these communities. However, it is more likely in the near term that the anticipated high-levels of natural gas development in southwest Wyoming may result in higher total population gain and for Wamsutter in particular, the Town may experience considerable temporary short-term population gain during the construction of two interstate pipelines and the

development of a worker housing facility by BP America near the town see Chapter 5 for a discussion of potential cumulative effects).

4.12.3.1.4 Housing Effects

First year and peak-year (fifth year of drilling and field development) housing demand associated with the Proposed Action is displayed in Table 4-14. Non-local temporary workers are anticipated to share housing at a rate of 2 workers per unit. For longer term housing demand, it is anticipated that every household would include an average of 1.2 workers and have an average size of 2.5 persons, the average size of Wyoming households identified by the 2000 U.S. Census.

As with population, it is important to note that the housing demand does not include housing currently occupied by existing workers whose employment would be supported in whole or in part by Proposed Action-related activities.

Table 4-14. First Year and Peak-Year (Year 5) Proposed Action-Related Housing Demand, by Type.

	Proposed Action-Related Housing Demand by Community					
	Rawlins		Little Snake River Valley		Wamsutter	
	1st Year	Peak Year	1st Year	Peak Year	1st Year	Peak Year
Temporary	181	181	23	24	23	23
Longer Term	125	170	16	21	16	21
Total	306	351	39	45	39	44

Source: BCLLC

Based on the housing inventory contained in Section 3.12, the Proposed Action-related increment of demand for both short-term and longer-term housing coupled with demand from other gas development projects would likely strain or exceed currently available resources in all communities within the analysis area.

Based on capacity, the motels, recreational vehicle parks and mobile home parks would be adequate to accommodate demand from temporary workers associated with the Proposed Action, however, competition from cumulative natural gas development demand would likely result in the need for drilling and field development contractors to provide temporary housing in the form of dormitory units or construction camps, depending on the level of activity occurring at the time (see Chapter 5 for a discussion of cumulative housing demand). It is becoming increasingly common for drilling and gas field service companies to provide mobile dormitory units for temporary workers and such units add to a community's temporary housing resources without creating an oversupply of units when drilling and field development is completed.

A portion of the longer term population associated with the Proposed Action could be accommodated in mobile home parks in Rawlins although demand from other projects may cause competition for these resources. Rawlins has some currently unused pads in mobile home parks and may initially attract both temporary and longer-term workers because of these resources, and because much of the initial development would likely occur in the central and

northern parts of the ARPA. As the development moves to the southern portion of the ARPA and as communities in the Little Snake River Valley and Wamsutter respond to the demand, more long-term workers may relocate to these communities.

Longer–term housing availability is currently tight in both Wamsutter and the Little Snake River Valley although there is some subdivision activity in Wamsutter and limited dispersed housing development in the Little Snake River Valley. The longer tenure of the relatively small increment of housing demand would allow time for local housing markets to respond to demand for rental or owner-occupied housing units. But it may be that some Proposed Action-related operations workers would initially have to seek housing resources in mobile home parks in Rawlins and either wait for housing to become available in the Little Snake River Valley or Wamsutter or contract for development of new housing.

4.12.3.1.5 Effects on Community Services

As discussed in Section 3.12, most community facilities in Carbon County and the communities near the ARPA were developed for a substantially larger population than currently exists. As a result, the population increment associated with the Proposed Action could be readily accommodated by most existing community facilities and by area schools. The enrollment increment in Rawlins could strain the elementary school capacity if Proposed Action-related enrollment were to be concentrated in the lower grades; however, given the excess capacity in the middle school and high school, capacity should be adequate if enrollment is evenly distributed. Additionally, Rawlins should have a new elementary school and completed remodeling of the middle school by the time the peak year occurs.

The additional water supply that the recently completed High Savery reservoir would provide to the Town of Baggs would accommodate the relatively small population increment projected for that community. A new Carbon County jail has recently been completed, which should alleviate overcrowding, at least for the near term. Some project-related tax revenues associated with the Interim Drilling Program would be available to offset increased service demand, but, because ad valorem property taxes from production would provide the largest source of project-related revenue to county and special district government and affected schools, there would be a several-year lag before substantial Proposed Action-related revenues flow. Given recent increases in natural gas production from other fields and elevated natural gas prices, Carbon County and affected special districts may have substantial revenues to deal with the increase in service demand associated with the Proposed Action until production-related revenues begin to flow.

Local government services most affected during the annual six-month drilling and field development season are likely to be law enforcement, emergency response (fire suppression and ambulance) and county roads (effects on county roads are discussed in Section 4.13). As demonstrated in Section 4.12.3.1.6, Carbon County would receive substantial revenues to help support increased demand for these services over the life of the project.

Although Proposed Action-related local government facility and service demand in Rawlins is anticipated to be moderate and demand in smaller municipalities is anticipated to be minimal, it is worth noting that communities would receive few direct revenues from Proposed Action-related development or production, therefore impacts which result in demand for new infrastructure or services are unlikely to be directly offset by Proposed Action-related revenues. Wamsutter is located in Sweetwater County and would therefore receive no project-related tax

revenues except a small portion of severance tax revenues distributed to local governments throughout the state.

4.12.3.1.6 Fiscal Effects

The Proposed Action would generate substantial tax revenues including:

- local ad valorem property taxes on production and certain field facilities;
- sales and uses taxes on materials, supplies and equipment;
- Federal and State Mineral Royalty payments; and,
- Wyoming State severance taxes.

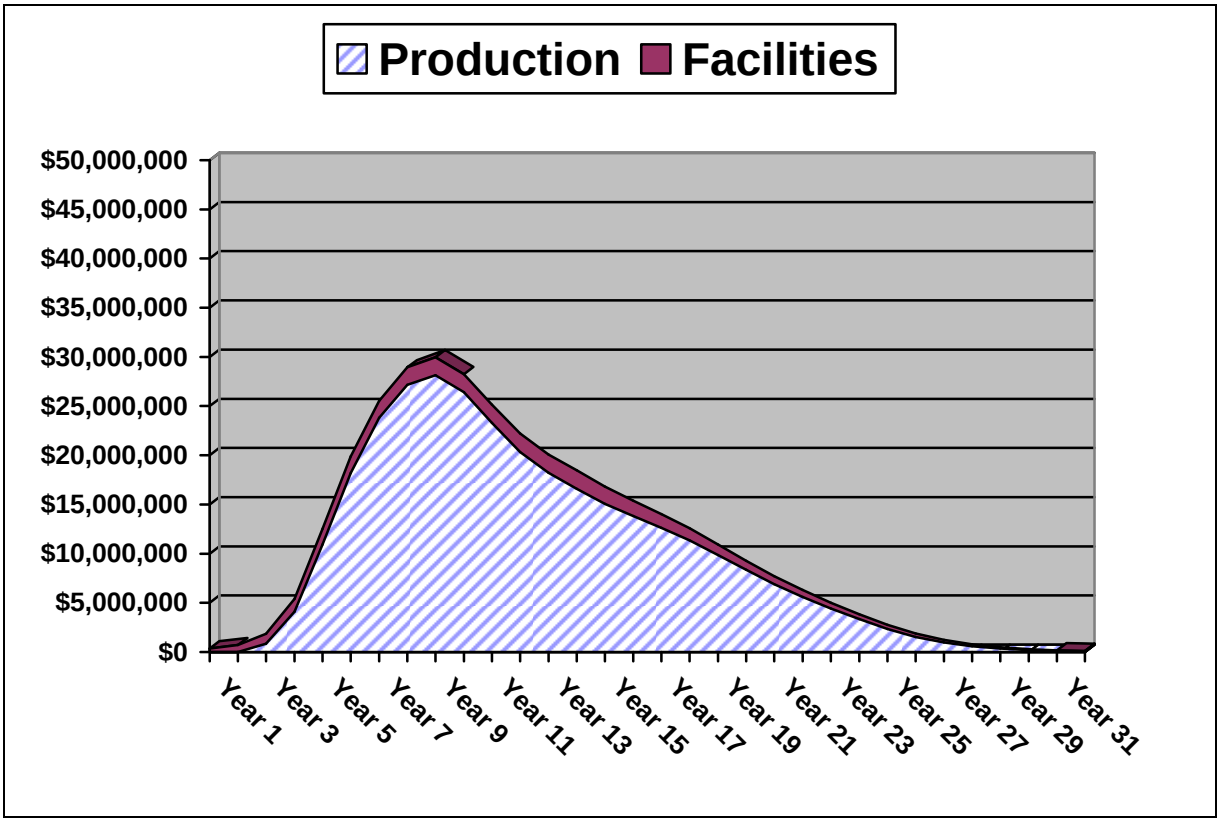
4.12.3.1.6.1 Ad Valorem Property Taxes

The Proposed Action would generate ad valorem property tax to Carbon County, the Wyoming School Foundation Fund, Carbon County School District #-1 and a number of special taxing districts. Direct ad valorem property taxes would be generated from two sources: (1) the value of natural gas produced and sold; and (2) the value of certain well field and production facilities (underground facilities associated with wells are exempt). Indirect ad valorem tax revenues may be generated by the infrastructure investments made by gas service companies and vendors that expand facilities as a result of the incremental economic activity. Long term employees of gas companies and vendors may purchase new properties or improve existing properties generating additional property taxes. Potential indirect revenues have not been estimated for this assessment.

Constant 2003 mill levies were used to prepare property tax estimates. The Wyoming School Foundation Program and shared county school mill levies are set by statute. Other mill levies are set each year by the county commissioners and officials of the various taxing districts within limits imposed by the state legislature; some change each year. Mill levies reflect the revenue needs of the taxing entity and estimates of assessed valuation within the entity. Natural gas is assessed based on the previous year's production. Well field facilities are depreciated after the first year of production.

Figure 4-13 displays annual Proposed Action-related ad valorem property tax estimates, based on the assumptions outlined earlier and assuming a constant total mill levy of 62.85 mills. Table 4-15 displays estimated ad valorem property tax revenues to major property taxing entities in Carbon County. Under the assumptions used for this assessment, ad valorem property tax revenues from production and facilities would total $349 million over the 32-year life of the project, or an annual average of almost $11 million.

Figure 4-13. Proposed Action-Related Ad Valorem Property Tax Estimates.



Source: BCLLC

Carbon County and certain special districts would receive approximately $96 million over 32 years under the assumptions used for this assessment. Note that some affected special districts only cover part of the ARPA; therefore an average of special district levies has been used for the assessment.

Table 4-15. Estimated Proposed Action-Related Ad Valorem Property Tax Revenues: Carbon County and Affected Special Districts.

	County (12 mill)	Weed & Pest (1 mill)	Recreation (1mill)	Conservation Districts (1 mill)	Avg. Total Special Districts (2.35 mill)	Total County & Special Districts
Total (32 year)	$66.6 million	$5.6 million	$5.6 million	$5.6 million	$13 million	$96 million
Average Annual	$2.1 million	$173,000	$173,000	$173,000	$408,000	$3 million

Note: Table does not breakout all special districts. Columns may not sum due to rounding.
Source: BCLLC

Table 4-16 displays Proposed Action-related revenues that would accrue to local schools and to the Wyoming School Foundation fund that benefits schools across the state. A portion of the revenue collected under the School District U-1 26.5 mill levy would accrue to the Wyoming School Foundation Fund, because the district is a "recapture" district under the provisions of the School Foundation Program, which means that revenues above a certain level are collected by the state for redistribution to other school districts (see Chapter 3). District U-1's budget could increase as a result of student enrollment increases associated with Proposed Action-related longer term population.

Table 4-16. Estimated Proposed Action-Related Ad Valorem Property Tax Revenues: Carbon County School District # 1 and Other School Entities.

	School Dist U1 (26.5 mill)*	State School Foundation Fund (12 mill)	County School (6 mill)	BOCES (1 mill)	Total Schools
Total (32 year)	$147 million	$66.6 million	$33.3 million	$5.6 million	$252.6 million
Average Annual	$4.6 million	$2.1 million	$1 million	$173,000	$7.9 million

***** Much of the revenue associated with District U1 levy is likely to accrue to the Wyoming School Foundation Fund.
Note: Columns may not sum due to rounding.
Source: BCLLC

It should be noted that mill levies that produce revenues in excess of expenditures are frequently reduced; the potential for reduced mill levies in Carbon County is high given anticipated increases in both production and gas prices. Reduced mill levies would benefit county property owners and other commercial and industrial interests in the county and likely result in positive economic effects.

4.12.3.1.6.2 Federal and State Mineral Royalties and Wyoming Severance Taxes

The federal government collects a 12.5 percent royalty on the fair market value of gas produced from federal leases, less production and transportation costs. Half of the mineral royalty revenues are returned to the state where the minerals were produced. In Wyoming, a portion of the state's share is distributed to local governments and to the Wyoming School Foundation Fund. It is difficult to predict with certainty where all CBNG wells within the ARPA would be located. For this assessment, it is assumed that 64 percent of the CBNG associated with the Proposed Action would be produced from federally-owned minerals, 31 percent would be produced from privately-owned minerals and 5 percent would be produced from minerals owned by the State of Wyoming. As noted above, production associated with conventional wells has not been estimated for this assessment.

The State of Wyoming collects either a 16 2/3 percent or a 12 ½ percent royalty on natural gas produced from state-owned minerals, depending on the circumstances of the lease. For this assessment, State mineral royalties were assumed to be 12 ½ percent.

The State of Wyoming collects a six percent severance tax on the fair market value of natural gas produced within the state. Federal mineral royalty payments and production and

transportation costs are exempt from this tax. The state distributes revenues from this fund to a variety of accounts including the General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve, and distributes a fixed one percent of the revenues to counties and municipalities.

Estimated mineral royalty and severance tax revenues are displayed in Table 4-17. Actual mineral royalty and severance tax revenues would vary based on production levels, well locations, gas sales prices, and actual production and transportation costs. Actual severance tax revenues may be less than these estimates if a portion of the gas is used for production purposes.

Table 4-17. Federal Mineral Royalty and Wyoming Severance Tax Estimates.

	40 Year Total	Average Annual
Federal Mineral Royalties	$320 million	$10 million
Wyoming Share of Federal Mineral Royalties	$160 million	$5 million
Wyoming State Mineral Royalties	$8.4 million	$264,000
Wyoming Severance Taxes	$271 million	$6.8 million

Source: BCLLC
Note: Columns may not sum due to rounding.

4.12.3.1.6.3 Sales and Use Tax

Wyoming collects a four percent sales and use tax on the gross receipts of sales of tangible goods and certain services (drilling services are exempt). The state returns 31 percent of the revenue (less administrative costs) to the county where the taxes were collected. Counties distribute the revenues to incorporated municipalities based on population. As a local option, Carbon County also collects a one-percent general-purpose sales and use tax which is distributed to the county and its municipalities and a one-percent dedicated sales and use tax for capital facilities.

Table 4-18 displays the estimated state and local revenues which would flow from expenditures made during the drilling and field development phase of the Proposed Action, assuming that all sales and use tax payments are appropriately credited to Carbon County. Total sales and use tax revenues over the 20-year drilling cycle would be $17.2 million dollars. Of the total, an estimated $ 9.5 million would be distributed to the State of Wyoming and $7.7 million to Carbon County and its municipalities. In addition, the Proposed Action would contribute one percent of taxable sales until the current local option facilities tax expires, these revenues have not been estimated.

Table 4-18. Estimated Sales and Use Tax Revenues and Distributions.

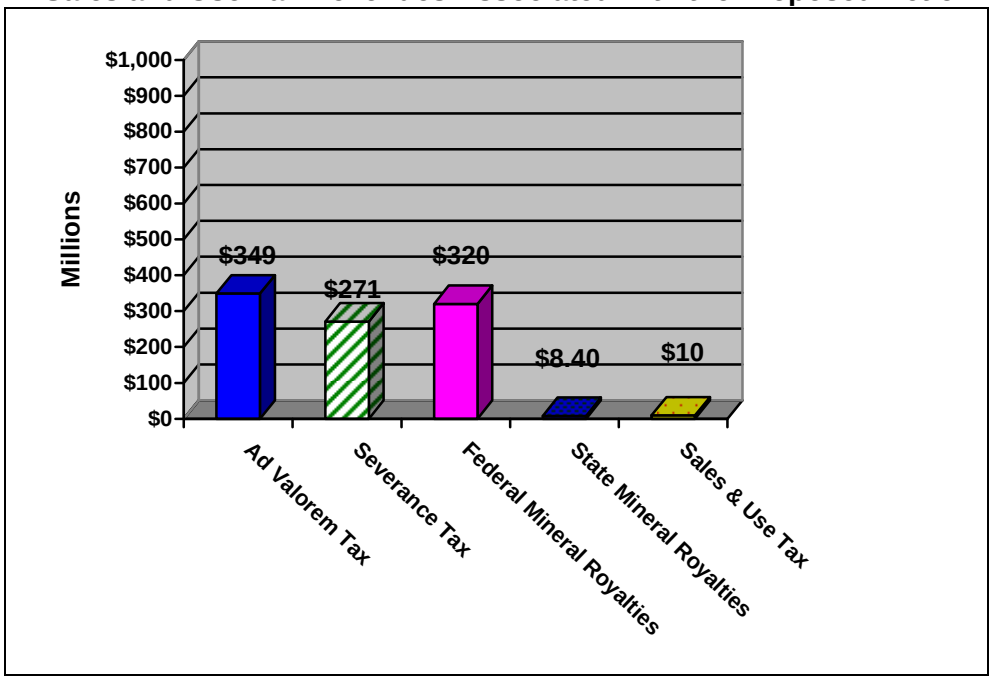
	State of Wyoming					
Total	$5.4 million					
Average Annual	$271,000					
	Carbon County Total	**County Share**	**Rawlins**	**Baggs**	**Dixon**	**All Other Towns**
Total	$4.4 million[1]	$623,000	$2.5 million	$98,000	$22,000	$1.1 million
Average Annual	$220,000	$31,000	$127,000	$4,900	$1,100	$56,000

[1] Excludes proceeds from 1 percent local option facilities tax.
Note: Columns may not sum due to rounding.
Source: BCLLC

4.12.3.1.6.4 Total Revenues

Figure 4-14 summarizes the estimates of the main tax and royalty revenues attributable to the Proposed Action. The revenues are based on production, gas sales prices, tax rates and exemption estimates, all of which are subject to change as development proceeds. In addition to these revenues, other revenues would be associated with the Proposed Action including sales and use tax payments for ongoing operations of the project and from employee and vendor spending, Oil and Gas Conservation charges, and federal income tax payments by the proponent and its employees. These revenues have not been estimated for this assessment.

Figure 4-14. Total Ad Valorem Property Tax, Federal Mineral Royalty, Severance Tax and Sales and Use Tax Revenues Associated with the Proposed Action.



Source: BCLLC

4.12.3.1.7 Local Attitudes, Opinions and Lifestyles

The Proposed Action has the potential to affect local attitudes, opinions and lifestyles in two ways. Affected communities would experience change related to the increase in economic activity, employment and population growth associated with natural gas development. The Proposed Action also has the potential to affect ranchers who own land in the ARPA, and users of the project area such as grazing operators, outfitters, hunters and other recreationists.

Carbon County has a relatively long history of oil and gas development; consequently residents are familiar with natural gas industry activities and their economic benefits. The combination of familiarity and anticipated economic benefit creates a climate of general community acceptance of and support for continued natural gas development in Carbon County, particularly in Rawlins, and the Little Snake River Valley. Because the economy of Carbon County has generally declined since the early 1980s due to closure of several coal mines and problems in the timber industry, many residents of Carbon County and Rawlins welcome the current economic expansion resulting from natural gas development (Kilgore 2004, Grabow 2004). Rawlins in particular has unused public and commercial infrastructure that could be redeveloped to accommodate population growth.

Within this general climate of acceptance are resident attitudes and values that may diminish support or create opposition for a particular development proposal. These attitudes and values include concern for use of public lands and preservation of wildlife habitat and recreation resources.

These attitudes and values are evident in a number of the comments submitted during the scoping process for this EIS. Additionally, a discussion of these attitudes and values, as expressed by Carbon County residents, is included in the findings of the 1996 resident survey conducted for the Carbon County Land Use Plan (discussed in Section 3.12).

According to the Carbon County Land Use Plan, resident response to the survey suggests “a need to balance the conservation of natural resources and the economic viability of resource-based industries in the county.” This sentiment coupled with partial support for leasing more federal lands for oil and gas development (about 50 percent countywide) suggests that development of natural gas resources on existing leases could be generally supported by residents of Carbon County, as long as they perceive that such development does not damage wildlife habitat or degrade the quality of recreation resources in the area.

Some land owners and grazing operators within the ARPA, the group that would be most directly affected by the Proposed Action, have mixed feelings about the development. While they generally support resource development on public lands and believe development of natural gas resources within the ARPA is in the national interest, they are concerned about the potential effect on their operations, about changes in the currently relatively undeveloped landscape and about effects to their traditional way of life (Hansen 2004, Hicks 2004, O’Toole 2004).

Members of this group have expressed some or all of the following concerns:

- fragmentation of the landscape, grazing lands and wildlife habitat caused by gas field roads, well pads and infrastructure;
- disruption of grazing operations;

- soil erosion from disturbance and the potential effects of erosion on streams and stock ponds;
- the potential for encroachment of weeds on disturbed land, particularly since the recent drought has weakened and killed some native plants;
- the increased potential for trespass and damage to private lands and improvements given the increased access that well field roads would provide;
- affects on game (many ranchers also have outfitting operations on their lands or lease lands to outfitters and hunters); and
- the potential that the Operators may seek more dense well spacing in the future, further increasing the potential for each of the above identified impacts.

Other sections of this assessment analyze potential impacts to range resources, noxious and invasive species and wildlife and wildlife habitat and a variety of measures to mitigate these impacts are either committed or proposed. Some ranchers and grazing operators are concerned that mitigation measures for these identified impacts would not be rigorously enforced or effective.

But even if mitigation measures are enforced and effective, most ranchers and grazing operators believe that the Proposed Action would change the current relatively undisturbed character of much of the rangeland/wildlife habitat within the ARPA. The effect would be to introduce or expand resource extraction, a type of low density industrial use, which would in turn alter their traditional use and way of life.

Based on these observations, it is likely that the Proposed Action would receive general support in Carbon County communities, but specific groups with interests and concerns more directly affected by the Proposed Action, such as landowners, grazing operators, outfitters and recreation users of the ARPA would experience varying degrees of dissatisfaction with the change in use of the land.

4.12.3.1.8 Environmental Justice

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

Environmental Justice includes impacts to air, water or other environmental values or health and safety risks that are experienced disproportionately by minority or low income populations. As noted in Section 3.12, there are no human populations (including populations in these categories) located within the ARPA. There are no residences within the ARPA that are occupied year round, although some residences on ranches are temporarily or seasonally occupied. The ARPA is relatively distant from population centers, so no populations would be subjected to direct physical impacts from the Proposed Action. Therefore the Proposed Action would not directly affect the health and safety of any minority or low income populations, nor would it directly affect their social, cultural, or economic well-being.

The Proposed Action could result in beneficial effects on low-income populations living in communities near the ARPA area, however. The Proposed Action would create or sustain an annual average of 578 jobs (annual job equivalents) over the 13 year drilling and field

development phase of the project, and an annual average of 161 jobs during the production phase of the project. These direct, indirect and induced employment opportunities would occur in all sectors of the economy and provide additional job opportunities for unskilled low-income residents as well as those that might become skilled through local training programs. The increased labor demand would have the likely effect of reducing unemployment in the county and increasing labor force participation, two factors that could also increase incomes in low-income populations.

While in many cases skilled workers would be imported into the area to fill skilled and specialized labor demand, the availability of local unemployed or under- employed individuals would offer the companies the opportunity to retain workers who are already located and housed within the area. The applicant- committed measure to "Implement hiring policies that would encourage the use of local or regional workers who would not have to relocate to the area" should enhance this opportunity.

Employment of local unemployed or under–employed individuals for skilled or specialty occupations would require training and development, generally in a trade school or institution of higher education. Post high school training in Carbon County is currently offered by the Carbon County Higher Educational Center. Management, administrative, technical and trade-related training and certification opportunities are offered, including some energy industry-specific courses and certifications. Some courses qualify for college credit and can lead to college degrees and/or trade certification. The opportunity for post-high school level education for both blue collar and white collar jobs within Carbon County could provide opportunities for low-income residents to obtain and benefit from skilled and specialty employment locally.

4.12.3.2 Alternative A - No Action

Drilling and Field Development

Under this alternative the ARPA area would not experience the CBNG development associated with the Operator's proposal. Those portions of the Atlantic Rim with existing wells and interim drilling activity could continue to operate and produce gas with associated effects as disclosed in previous NEPA documents.

Production

Under this alternative no incremental natural gas production would occur within the ARPA area, beyond that associated with existing wells and the IDP.

4.12.3.2.1 Economic Effects

Implementation of this alternative would not generate incremental economic benefits to leaseholders, area residents, governmental agencies, or surface or sub-surface mineral owners.

4.12.3.2.2 Alternative A-Related Effects on other Economic Activities within the ARPA

Ranchers, grazing operators and local businesses that serve recreation visitors and hunters within the ARPA would not experience incremental effects beyond those associated with the IDP and existing oil and gas development under alternative A.

4.12.3.2.3 Employment and Population Effects

Employment

Implementation of Alternative A would not be anticipated to result in substantial changes in employment within the analysis area.

Population

Implementation of Alternative A would not be anticipated to result in substantial changes in local population levels within the analysis area.

4.12.3.2.4 Housing Effects

Implementation of Alternative A would not be anticipated to result in substantial changes in demand for temporary or longer-term housing demand within the analysis area.

4.12.3.2.5 Effects on Community Services

Implementation of Alternative A would not be anticipated to result in substantial changes in demand for community services within the analysis area.

4.12.3.2.6 Fiscal Effects

Implementation of Alternative A would not be anticipated to result in substantial changes in local government fiscal conditions within the analysis area.

4.12.3.2.7 Local Attitudes, Opinions and Lifestyles

Under Alternative A, the change in relatively undisturbed landscapes would be limited to those associated with the IDP. No incremental dissatisfaction associated with CBNG activities and disturbance would be anticipated for ranchers and grazing operators within the ARPA and for individuals that use the ARPA for outfitting, hunting or other recreation purposes.

Other local residents who may have benefited economically from the proposed AR development may be dissatisfied with the forgone opportunities.

4.12.3.2.8 Environmental Justice

No low income or minority populations would be directly affected by Alternative A. The indirect increases in employment opportunities for minority and low income residents associated with the AR project would not occur under this alternative.

4.12.3.3 Alternative B

4.12.3.3.1 Economic Effects

Because the pace and level of drilling and level of production are assumed to be the same as under the Proposed Action, Alternative B-related economic effects, would be similar to those associated with the Proposed Action.

4.12.3.3.1.1 Impacts to Leaseholders

Economic and fiscal effects to leaseholders could occur under Alternative B. Federal oil and gas leases (Form 3100-11) give the leaseholders the exclusive right to drill for, mine, extract, remove, and dispose of all the oil and gas within the lease area. Rights granted are subject to applicable laws, the terms, conditions, and attached stipulations of the lease. Under this alternative, federal leases within the Atlantic Rim EIS area would not be developed within inactive zones. Development activities would not be approved until the subject zone becomes active. BLM would direct suspensions of operations and production for all currently inactive leases within inactive zones. Here "inactive leases" mean where a lease does not contain active producing or service wells or where production is allocated to a lease. Proposals to develop leases within inactive zones would be denied until the zone becomes active for development under the Atlantic Rim ROD.

Proposals for development within the active area would be received, analyzed, and approved as appropriate. Existing oil and gas operations outside of the active development zone would continue as it currently exists. The existing ARPA pods outside of the active zone could be developed to the extent allowed in the existing individual EA Decision Record for the project. For those leases suspended by the BLM no lease rental fees would accrue and the lease term would be tolled until activity is allowed on the lease. The lease would remain in this status during the period the zone remained in an inactive status.

No revenue from the suspended oil and gas production would be realized during the term of the suspension by leaseholders and the BLM. Delayed revenue from the inactive area could possibly be off-set by increased revenue from the actively developed areas for royalties and taxes for governmental authorities, and possibly by leaseholders who have leases in both zones. Correlative rights issues could occur along boundaries of active areas due to drainage of natural gas resources. Drainage of oil and gas resources within inactive zones would be viewed as lost revenue to the lessees and the BLM. Depending on the ownership of the minerals this drainage would affect federal, fee and state mineral estates.

BLM doesn't approve or control development proposals upon state and private lands. Within inactive zones not open to development under the ARPA ROD proposals for rights-of-way authorization across federal lands for oil and gas development and production related activities could be received, be processed, and as appropriate approved or disapproved by the BLM. This authority arises from the BLM Manual, Part 2800.06 "Policy", which states

"It is the policy of the BLM to:

D. Allow owners of non-federal lands surrounded by public lands managed under FLPMA a degree of access across public lands which would provide for the reasonable use and enjoyment of the non-federal land."

4.12.3.3.2 Alternative B-Related Effects on other Economic Activities within the ARPA

Under Alternative B economic effects to ranchers, grazing operators , outfitters, hunters and other recreation visitors would be similar to those associated with the Proposed Action except that potential economic effects would be concentrated in a specific zone during the period that the zone would be active for drilling and field development purposes. Concentrating drilling and field development activities in an active zone may increase negative effects on other economic activities (grazing, outfitting, hunting and other recreation) within the active zone. As drilling and field development is completed in an active zone. Effects on other economic activities would

diminish within that zone. Effects on other economic activities in inactive zones would be minimal while the zone was inactive.

The concentration of drilling and field development activities in the smaller geographic area of a zone would increase the likelihood that grazing operators whose allotments are principally located within an active zone may chose to forgo use of the allotment for one or more seasons during periods of intensive development in that zone. As with the Proposed Action, if these grazing operators cannot find comparable grazing lands within the county at comparable costs, or if they chose to forgo grazing entirely for one or more seasons, the economic impact associated with that operator's AUMs would be also be forgone for the period of non-use.

4.12.3.3.3 Employment and Population Effects

Employment

Employment effects of Alternative B would be similar to those associated with the Proposed Action, except that drilling and field development employment would be concentrated in each zone as it becomes active.

Population

Depending on the location of the particular active zone, the residential distribution of drilling and field development workers under Alternative B may deviate slightly from the estimates for the Proposed Action, as workers may attempt to find housing in communities nearer their work site.

4.12.3.3.4 Housing Effects

Similarly under Alternative B, demand for temporary housing to accommodate field development workers may shift to communities nearer a particular zone as that zone becomes active.

4.12.3.3.5 Effects on Community Services

Minor differences in demand for community services may occur under Alternative B as contrasted to the Proposed Action. These would be associated with the minor differences in population distribution as drilling and field development workers seek temporary housing near active zones.

4.12.3.3.6 Fiscal Effects

Local, state and federal government fiscal effects for alternative B are expected to be similar to those identified for the Proposed Action, except that ad valorem tax revenues for certain special districts may differ in timing when development in an active zone is outside the district's boundaries. Over time, given the assumptions used for Alternative B, total revenues would be similar to those identified under the Proposed Action.

4.12.3.3.7 Local Attitudes, Opinions and Lifestyles

Alternative B-related effects on local attitudes opinions and lifestyles would be similar to those associated with the Proposed Action, except that effects of development of previously undisturbed landscapes would be delayed for inactive zones until development occurred. The more intensive levels of activity in a zone associated with the condensed development period

for that zone could result in elevated levels of dissatisfaction for ranchers, grazing operators, outfitters, hunters and other recreation visitors who use that zone.

4.12.3.3.8 Environmental Justice

No minority or low-income populations would be directly affected by project activities associated with Alternative B; therefore Alternative B would not be anticipated to have disproportionate adverse effects upon minority or low income populations.

As with the Proposed Action, indirect beneficial effects of Alternative B would be expected to include increased employment opportunities for Carbon County residents including low income and minority populations. The current availability of higher-education and training opportunities within Carbon County may allow low income and minority residents the opportunity to obtain better paying skilled and specialty jobs.

4.12.3.4 Alternative C

Because the pace and level of drilling and level of production under Alternative C is assumed to be the same as under the Proposed Action, impacts to local socioeconomic conditions would be expected to be similar to those associated with the Proposed Action. However, development protection measures that resulted in lower levels of drilling or production would also result in lower values for all socioeconomic elements.

4.12.3.4.1 Economic Effects

Economic effects of Alternative C would be anticipated to be similar to those associated with the Proposed Action. Reductions in economic effects could occur if fewer wells were allowed or economically feasible under development protection measures. Similarly, changes in production levels or operating costs associated with development protection measures would result in different economic effects than those associated with the Proposed Action.

4.12.3.4.1.1 Impacts to Leaseholders

Under this alternative natural gas development could be proposed anywhere within the ARPA area during the life of the Atlantic Rim project. In some areas surface disturbance restrictions from the various development protection measures would limit the amount of surface disturbance allowable. Construction and development constraints could arise where resources such as wildlife, vegetation, soils, visual, recreation, erosion or other environmentally sensitive conditions exist and / or overlap. Where development protection measures are applied, natural gas extraction could be constrained, potentially leaving un-extracted natural gas resources in the ground and causing corresponding increased relative construction and operations costs and decreased revenues. Limited operating periods would affect the timing of development and could affect the intensity and cost of construction activities by focusing them into tighter construction windows.

4.12.3.4.2 Alternative C - Related Effects on other Economic Activities within the ARPA

Under Alternative C, economic effects to ranchers, grazing operators, outfitters, hunters and other recreation visitors would be similar to those associated with the Proposed Action except that development protection measures that reduce impacts to range resources, wildlife, wildlife

habitat and scenic values could result in fewer adverse economic effects to grazing operators, ranchers, outfitters and businesses that serve recreation visitors to the ARPA as compared to the Proposed Action.

Given the substantially smaller area of disturbance associated with Alternative C, it is less likely that grazing operators whose allotments are concentrated within the ARPA may chose to forgo use of the allotment or it is likely that they would forgo use of a portion of the allotment rather than the whole allotment. Still, if these grazing operators could not find comparable grazing lands within the county at comparable costs, or if they chose to forgo grazing entirely for one or more seasons, the economic impact associated with that operator's reduction in AUMs would be also be forgone for the period of non-use.

4.12.3.4.3 Employment and Population Effects

Employment

Employment effects of Alternative C would be similar to those associated with the Proposed Action, except that drilling and field development activity could intensify in response to development requirements associated with development protection measures that forced drilling activities into a tighter window or diminish if fewer wells are ultimately allowed or economically feasible under these restrictions.

Population

Population effects of Alternative C would be anticipated to be similar to those identified under the Proposed Action. Differences could occur related to the employment effects identified above.

4.12.3.4.4 Housing Effects

Housing effects of Alternative C would be anticipated to be similar to those identified under the Proposed Action. Differences could occur related to the employment and population effects identified above.

4.12.3.4.5 Effects on Community Services

Demand for community services related to Alternative C would be anticipated to be similar to those identified under the Proposed Action. Differences could occur related to the employment and population effects identified above

4.12.3.4.6 Fiscal Effects

Fiscal effects of Alternative C would be anticipated to be similar to those identified under the Proposed Action. Reductions in production-related property and severance taxes and Federal Mineral Royalties could occur if fewer wells were allowed or economically feasible under development protection measures. Certain facility-related property and sales tax revenues could increase if development protection measures required special production or gathering facilities. Increased operations cost could also reduce federal mineral royalty, state severance tax and county ad valorem property tax revenues on production.

4.12.3.4.7 Local Attitudes, Opinions and Lifestyles

Effects on local attitudes opinions and lifestyles associated with Alternative C would be similar to those associated with the Proposed Action, except to the extent that development protection measures preserved key environmental values within the area, ranchers, grazing operators, outfitters, hunters and other recreation users could be likely to experience less dissatisfaction with the changes to the relatively undisturbed landscapes in certain portions of the ARPA.

4.12.3.4.8 Environmental Justice

No minority or low-income populations would be directly affected by project activities associated with Alternative C; therefore Alternative C would not be anticipated to have disproportionate adverse effects upon minority or low income populations.

As with the Proposed Action, indirect beneficial effects of Alternative C would be expected to include increased employment opportunities for Carbon County residents including low income and minority populations. The current availability of higher-education and training opportunities within Carbon County may allow low income and minority residents the opportunity to obtain better paying skilled and specialty jobs.

4.12.4 Impacts Summary

Economic impacts of natural gas development and production would be largely positive under the Proposed Action and Alternatives B and C. Based on the assumptions used for this assessment, natural gas development would enhance regional economic conditions and generate substantial local, state and federal tax and royalty revenues. Economic benefits would be similar for the Proposed Action and Alternatives B and C, unless development and the associated production were precluded from a specific area. Economic and fiscal benefits to leaseholders could also be less under Alternatives B and C.

Natural gas-related economic benefits may be diminished slightly by reductions in grazing, hunting and other recreation activity in the project area under all Action Alternatives and individual land owners and outfitters within the ARPA could experience economic losses associated with reductions in hunting activity. For individual land owners and outfitters, these losses could range from minimal to substantial, depending on the location, development in relation to a specific property, the timing of development, actual effects on big game and big game habitat, the duration of adverse effects and the success of mitigation measures. Businesses in the Little Snake River Valley that provide goods and services to hunters could also experience reductions in income from reductions in hunting activity. For many of these businesses, reductions in hunting activity would be offset by increases in drilling and field development activity.

For all action alternatives, the population increment associated with drilling and field development coupled with cumulative drilling and field development activities would be likely to strain existing housing resources. The relatively small in-migrant population increment anticipated for communities in the Little Snake River Valley and Wamsutter could be accommodated by existing community infrastructure. Project-related sales tax, use tax and property tax revenues would offset project-related demand for local government services in Carbon County, although revenues may lag demand in the early years of the project. Rawlins and the communities in the Little Snake River Valley would receive minimal direct tax revenues

from natural gas development and Wamsutter would receive no direct revenues, except for a relatively small portion of mineral royalties and severance taxes.

Community acceptance of natural gas development would be mixed. Many residents would support the development, but land owners, grazing operators, outfitters, hunters and other recreational users of the ARPA are likely to experience varying degrees of dissatisfaction with the change in land use and the change in character of lands within the ARPA. The level of dissatisfaction would be correlated with the level, pace and location of development, therefore the Proposed Action is likely to result in higher levels of dissatisfaction for more people in affected groups than the other two action alternatives.

4.12.5 Mitigation

The economic and employment effects of all three Action Alternatives would be substantially positive. The Operator–committed policy of hiring local workers, to the extent that such workers are available, would enhance local economic and employment effects and reduce demand for housing and community services.

The Operator-committed policy of coordinating project activities with ranching operations to minimize conflicts involving livestock movement or other ranch operations, including scheduling of project activities to minimize potential disturbance of large-scale livestock movements and establishing effective and frequent communication with affected ranchers to monitor and correct problems and coordinate scheduling, could reduce conflicts and dissatisfaction among some directly affected users of land within the ARPA.

Because project-related demand for both temporary and longer-term housing is likely to strain or exceed existing housing resources in all communities in the assessment area when coupled with cumulative demand, it may be necessary to develop rig camps and construction camps for project workers. The development of these camps would also free up spaces in mobile home parks in Rawlins, which could be used by longer-term workers until the local housing market is able to respond to longer-term demand.

During the interim drilling program, the BLM RFO has initiated a transportation planning process with representatives of directly affected interests in the BLM including the BLM, WGFD, Carbon County, the LSRCD (representing landowners and grazing operators), and the Operators. Although initially intended to address transportation issues, it has emerged as a forum for identifying existing and potential development issues and opportunities and developing cooperative approaches to addressing issues and opportunities. As this process evolves and matures, it has the potential for reducing conflict and dissatisfaction with CBNG development in the ARPA.

4.12.6 Residual Impacts

Even after implementation of the mitigation measures, it is likely that dissatisfaction would remain among some landowners, grazing operators, outfitters, hunters and other recreational users of public lands within the ARPA.

4.13 TRANSPORTATION

4.13.1 Introduction

This section identifies potential effects of the Proposed Action, No Action, and other Action Alternatives on the transportation system providing access to the ARPA (federal and state highways and Carbon County roads) and the road network within the ARPA (Carbon County roads, BLM roads, private roads and Operator-maintained roads). Potential effects of new and improved roads within the ARPA on soils, noxious and invasive species, range resources, wildlife habitat, recreation resources and visual resources are described in sections 4.3, 4.5, 4.6, 4.7, 4.9 and 4.10 respectively.

The RMP (USDI-BLM 1990) contains the following Transportation Management Direction common to all alternatives:

> "The public land transportation system would be maintained or modified to provide for public health and safety and adequate access to public lands."

4.13.2 Impact Significance Criteria

The following criterion is used to determine whether transportation impacts would be significant:

- Increases in traffic levels on the local public transportation system that would cause the level of service on the system to fall below acceptable levels as defined by the responsible government agency.

4.13.3 Direct and Indirect Impacts

4.13.3.1 Proposed Action

<u>Highways and Roads Providing Access to the ARPA</u>

Transportation effects of natural gas development and production would include increased traffic on federal and state highways and county roads providing access to the ARPA, primarily US I-80, WY 789, WY 70, CCR 605N and CCR 608. Depending on the outcome of the Coordinated Transportation Planning process described below, traffic could also increase on CCR 501, CCR 503 and BLM Road 3309.

Although access from WY 71 on the east side of the ARPA is possible from several Carbon County roads, there are no communities in that area, consequently few trips would originate from areas served by those routes.

Most traffic accessing Pods 1 through 4 (Red Rim, Jolly Roger Alpha and Beta and the currently dormant Pod #1) would travel on Carbon County 605N. Trips originating in Rawlins would access CCR 605N southwest of Rawlins. Trips originating in Rock Springs or Wamsutter would travel I-80 east to CC 605N; trips originating in the Little Snake River Valley are likely to travel WY 789 north and I-80 east to the CCR 605N entry point.

Traffic accessing Pods 5 through 9 (Doty Mountain, Sun Dog/Cow Creek, Blue Sky, Brown Cow and Muddy Mountain) are likely to use CCR 608, entering the ARPA east of Dad. Trips

originating in both Rawlins and Rock Springs would travel I-80 west to WY 789 south to Dad, trips originating in Wamsutter would use SCR 23/CCR 701 (the Wamsutter/Dad Road) east and trips originating in the Little Snake River Valley would use WY 70 west to WY 789 north, entering CCR 608 at Dad. Although some trips originating in the LSRV and destined for the Muddy Mountain Pod may enter the ARPA from the south, using CCR 503 or CCR 501, the Operators intend to establish primary access from CCR 608 and develop a new road or improve existing roads from the north to provide access to the Muddy Mountain pod. CCR 503, which passes through Cottonwood Canyon north of Dixon, is a narrow winding road which passes through areas with important resources values. CCR 501 is minimally improved in its upper reaches and would require substantial improvement to serve as a primary access point from the south. These factors and the fact that most ARPA traffic will originate in communities to the north would discourage heavy use of these roads for project access.

Access to the southwestern portion of the ARPA is possible using BLM Rd #3309; however, this road is only minimally improved and crosses critical wildlife habitat. Both the BLM and the Operators intend to develop policies to discourage use of this road for project access.

Table K-2 (Appendix K) shows the estimated average number of trips associated with drilling, field development and well field operations activities. Drill rigs and certain other items of heavy equipment would be transported to the ARPA and remain within the project area until their relevant work is completed. Materials and supplies would be delivered on an as-needed basis. Drilling and completion crews would commute to ARPA daily. Other contractors and vendors would commute on an intermittent, as-needed basis.

Average annual daily traffic (AADT) estimates were developed based on a simulation of drilling activities for typical CBNG and conventional wells, construction of ancillary facilities, performance of routine operations activities and well workovers and consideration of miscellaneous visits. Based on the results of the simulation, the Proposed Action would generate an estimated AADT of 419 (210 round trips) during the peak drilling year (Year 5). This would include an AADT of 254 for drilling and field development activities. Note that AADT is calculated on a 365-day basis and drilling and field development activities would be limited to six months out of each year, so average daily traffic would be substantially higher during the active drilling period or about 490 trips or 245 round trips per day. During the peak drilling year, AADT for well field operations would be an estimated 165 (83 round trips) for 840 producing wells. In subsequent years, drilling and field development traffic would diminish but operations traffic would increase as more wells come into production until 2025 when wells would begin to come off-line under the assumptions used for this assessment (see Figure 4-15). Under the assumptions used for this assessment, Proposed Action-related AADT would be in the 350 to 430 range for about 20 years.

Table 4-19 contrasts peak drilling year (Year 5) AADT for federal and state highways providing access to the ARPA with 2002 and projected 2012 AADT on those highways. Proposed Action-related peak drilling-year AADT would total 2 percent of 2002 AADT on I-80, 28 percent of 2002 AADT (51 percent of truck AADT) on WYO 789 and 9 percent of 2002 AADT (63 percent of truck AADT) on WY 70. Peak drilling year Proposed Action-related traffic would make up a slightly lower percentage of projected 2012 traffic except on WY 789, where base traffic is anticipated to decrease by 2012. However, given the potential for increased drilling and field development in the area, these traffic forecasts may change.

The Proposed Action-related increase in traffic, particularly truck traffic, would accelerate maintenance requirements on federal and state highways. Wyoming severance tax revenues

and the State's share of federal mineral royalty revenues associated with the Proposed Action would offset these costs. The Proposed Action-related increase of traffic on federal and state highways would result in a corresponding increase the statistical probability of accidents on these highways, although actual accident rates would depend on a variety of factors.

Figure 4-15. Proposed Action AADT Estimates, Drilling/Field Development and Operations: 2005 – 2044.

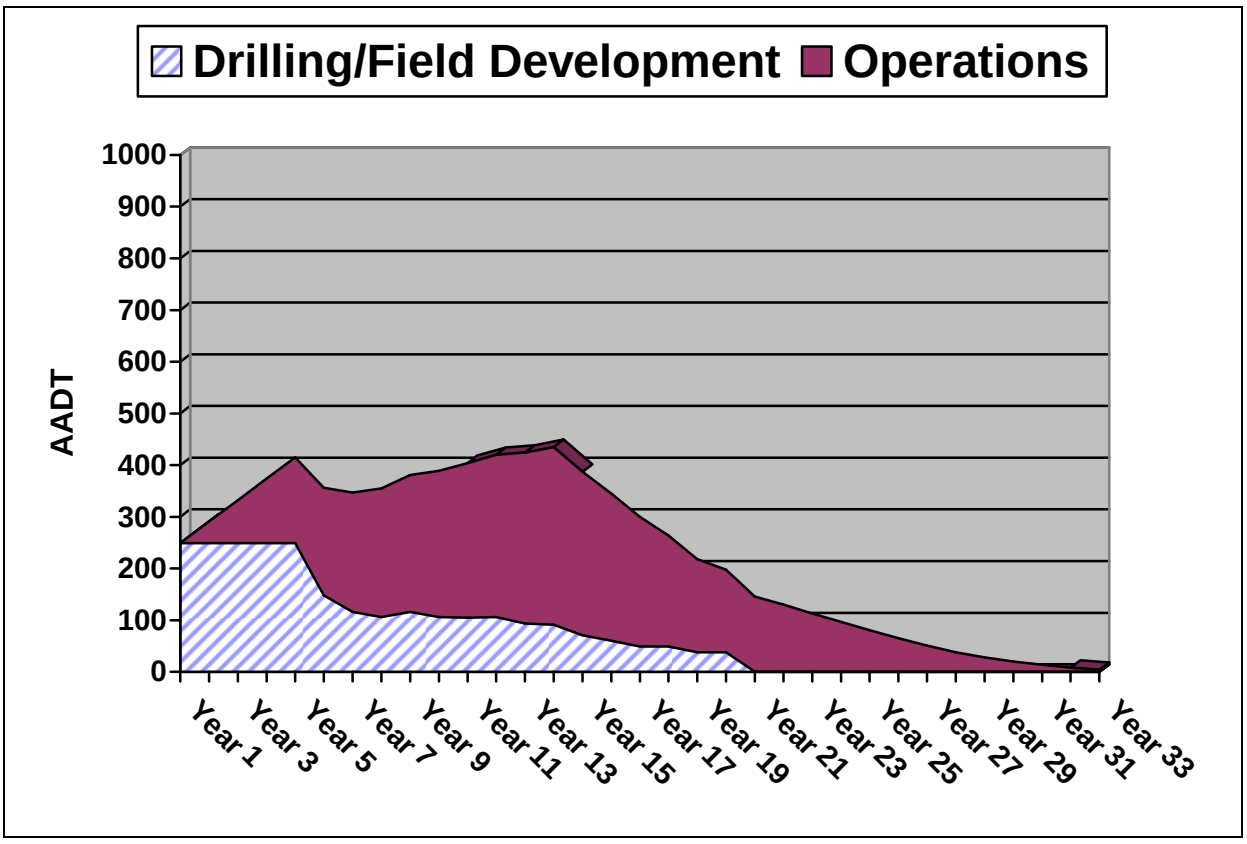


Table 4-19. Proposed Action Peak Drilling Year (Year 5) AADT Compared with 2002 AADT and 2012 Projected AADT on Affected Highways.

Highway	2002 AADT	Projected 2012 AADT	Estimated Peak Drilling Year AADT	% 2002 AADT	% Projected 2012 AADT
I-80 (Junction WY 789)	11,760 (6,460 trucks)	15,000	213 (96 trucks)	2% (1% trucks)	1%
WY 789 (Creston Jct. - Baggs)	860 (210 trucks)	800	240 (108 trucks)	28% (51% trucks)	30%
WY 70 (Dixon west)	480 (30 trucks)	550	42 (19 trucks)	9% (63% trucks)	8%

Table 4-20 displays estimated peak drilling year AADT on Carbon County roads providing access to the ARPA. Although no current traffic counts are available for these roads, the estimated peak year traffic would be a substantial increase over pre-gas development volumes.

As described in Section 3.12, CCR 605N has been extensively improved by the Carbon County Road and Bridge Department to accommodate natural gas traffic. The estimated volume of traffic on CCR 605N would require a relatively high level of ongoing maintenance by the county.

Table 4-20. Proposed Action Peak Year (2008) AADT on Affected Carbon County Roads.

Carbon County Road	Peak Year AADT
CCR 605N (20 Mile Road)	184
CCR 608 (Wild Cow Road)	230
CCR 501 (Cherry Grove Road)	4

The Carbon County Road and Bridge department plans to conduct extensive improvements to CCR 608 during 2005, also to accommodate the high level of anticipated natural gas traffic. Although some ARPA road improvement projects have been conducted under a cooperative effort between Carbon County and the Operators, the county has been required to fund improvements and increased maintenance activities in advance of substantial tax revenue flows from ARPA natural gas development. However, as described in Section 4.12.3.1.6, Carbon County would receive substantial project-related ad valorem property taxes as production begins to flow.

Access within the ARPA

Currently, CCR 605N, CCR 608 and BLM Road 3305 serve as the transportation "spine" within the ARPA. Operator-constructed roads provide access from these roads to the pods. Based on the Operators' estimate of an average of 0.5 miles of new roads per well, an initial total of 1,000 miles of new roads would be developed over the 20-year drilling and field development period. The Operators would be required to construct new roads and improve existing roads to BLM standards, except in cases where roads cross private surface. Operators would also be required to maintain new and existing roads that access natural gas facilities within the ARPA.

Potential positive effects of the Proposed Action on the transportation network within the ARPA would include improved access and new access to portions of the ARPA for landowners, grazing operators and recreation users. Potential negative effects would include damage to important resource values. Portions of the ARPA are located in areas that contain sensitive resources. Construction of new roads or improvement of existing roads in these areas have the potential to impact those sensitive resources, although successful implementation of BLM road standards, RMP stipulations, Operator-proposed mitigation measures, the preconstruction planning and site layout process and the coordinated transportation planning process described in Section 4.13.5 would reduce these impacts.

The traffic associated with Proposed Action-related drilling, field development and operations would require substantial improvements on Carbon County and BLM roads used for access within the ARPA and would also accelerate maintenance requirements on existing, upgraded and new roads. Exacerbating road maintenance factors include the unavoidable use of roads during wet and muddy conditions to maintain gas field facilities and excessive speed.

Carbon County would have substantial costs associated with improving and maintaining county roads for natural gas development and operations. The substantial revenues that would accrue to the county from natural gas production would offset these costs; however, Carbon County has and would expend funds for road improvement and maintenance in the ARPA prior to receipt of substantial project-related revenues.

The increased traffic in the ARPA, particularly during the drilling and field development phase, would correspondingly increase the potential for vehicle/livestock accidents and conflicts with livestock operations and damage to range improvements (gates, cattle guards, etc.) during that period. These potential impacts are discussed in Section 4.6.

4.13.3.2 Alternative A - No Action

Under Alternative A- No Action, transportation effects would be limited to impacts associated with previously approved oil and gas development. No additional roads would be created, and traffic would be limited to trips necessary to develop and maintain production of existing wells and wells associated with the IDP.

4.13.3.3 Alternative B

Transportation effects of Alternative B would be similar to those associated with the Proposed Action, .however, focusing development into active zones would temporarily increase the amount of traffic on area roads providing access to and within an active zone, possibly requiring higher standard collector roads, and higher levels of maintenance. Transportation impacts in inactive zones would be delayed until those zones become active.

Impacts to highways and roads providing access to the ARPA could also change as development is concentrated in a particular zone. For example more traffic could be anticipated to access the ARPA from Dad during development of the central zone, causing corresponding reductions in traffic on the northern or southern access highways and roads. Concentrations of traffic on access routes would change as development proceeded from zone to zone.

4.13.3.4 Alternative C

Transportation effects of Alternative C would be similar to those associated with the Proposed Action, except that development protection measures could reduce the number of roads in portions of the ARPA with high environmental values and/or result in re-routing of roads to avoid such areas. Where development protection measures require re-routing of roads, limitations on disturbance, or other actions, additional road development costs and increased road construction times could occur. Under the ARPA EIS Record of Decision, specific effects from implementation of these measures would be identified during subsequent site-specific NEPA analyses conducted in response to specific development proposals.

4.13.4 Impact Summary

Transportation effects of natural gas development and production associated with the Proposed Action and other Action Alternatives would include increased traffic on federal and state highways and county roads providing access to the ARPA. There would also be a statistical increase in the potential for accidents on these roads.

Transportation effects within the ARPA would occur on Carbon County, BLM, private and Operator-maintained roads. Operators would be required to construct new roads and improve existing roads to BLM standards, except in cases where roads cross private surface. Operators would also be required to maintain new and existing roads accessing natural gas facilities within the ARPA. All action alternatives would increase and improve access within the ARPA for ranchers, grazing operators and recreation users. Conversely development of new roads and improvement of existing roads could adversely affect resource values and result in higher road maintenance costs for Carbon County, which would be offset by project-related revenues to the county.

4.13.5 Mitigation Summary

In addition to the Operator-committed measures, a coordinated transportation plan (TP) would be developed for the ARPA. A TP would minimize construction of new roads, foster proper sizing of roads and assign road maintenance responsibilities. The coordinated transportation process would include the BLM, the Operators, Carbon County, WYDOT, the LSRCD, WG&F, private landowners, livestock operators and other affected parties. The initial transportation planning effort would identify the most efficient and resource-sensitive locations for collector and local roads (existing roads would be used as collectors and local roads whenever possible to minimize the amount of surface disturbance within the area). In addition to development of new roads, the ARTP would consider administrative closure and seasonal closure of existing roads, and the restriction of well field traffic on certain existing roads. The transportation planning process would also consider erosion prevention and minimization and prevention and eradication of noxious and invasive species.

Transportation planning would continue to occur on an annual basis to 1) assess ongoing effects on resource values, 2) identify the minimum road network necessary to support annual drilling and field development activities, 3) review and assign construction and maintenance responsibilities, 4) identify roads appropriate for abandonment and reclamation, and 5), identify fences, gates and cattle guards which should be upgraded to accommodate heavy trucks and equipment.

Operator responsibilities for preventive and corrective maintenance of roads in the ARPA would extend throughout the duration of the project and include blading, cleaning ditches and drainage facilities, dust abatement, control of noxious and invasive species, maintenance of fences, gates and cattle guards and other requirements as directed by the BLM and private landowners.

4.13.6 Residual Impacts

The transportation impacts described above would continue throughout the LOP. The implementation of the transportation planning process would help minimize residual impacts on transportation systems. Under the action alternatives a residual network of improved roads could be left in place of the existing two-track and lower standard roads depending on the needs of the BLM, Carbon County, and surface owners.

4.14 HEALTH AND SAFETY

4.14.1 Introduction

Potential health and safety impacts associated with the action alternatives are similar to those associated with existing conditions in the ARPA, although the risk of certain types of impacts would increase as the amount of natural gas development increases. Potential health and safety impacts include occupational hazards associated with oil and gas exploration and development, risk associated with vehicular travel on improved and unimproved roads and range fires.

4.14.2 Impact Significance Criteria

No specific health and safety standards were identified in the GDRA RMP. IN general health and safety effects of the action alternatives would be considered significant if they resulted in substantially increase risk to the public.

4.14.3 Direct and Indirect Impacts

4.14.3.1 Proposed Action

Potential health and safety effects associated with the Proposed Action include hazards associated with natural gas development and operations; risk associated with vehicular travel on county, BLM and Operator-maintained roads; firearms accidents during hunting season and by casual firearms use such as plinking and target shooting; and natural events such as range fires.

Health and safety impacts of the Proposed Action would include a relatively low risk to project workers from industrial accidents, firearm accidents and natural disasters. There would be a slight increase in risk of traffic accidents and range fires for the general public during drilling and field development; that increased risk would be reduced but not eliminated during field operations.

Occupational Hazards

The US BLM, OSHA, USDOT and WOGCC each regulate certain safety aspects of oil and gas development. The primary federal regulations related to health and safety requirements for oil and gas operations are specified under 43 CFR Ch. II, subpart 3162.5. These regulations require the prior approval of a drilling and operations plan by the BLM that addresses the procedures to be employed for protection of environmental quality, including safety precautions, control and removal of waste, spill prevention, fire prevention and fire fighting procedures. Adherence to relevant safety regulations on the part of the Operators and enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the project area, and the relatively low use of these lands by others (primarily grazing operators and hunters), occupational hazards associated with the Proposed Action would mainly be limited to employees and contractors rather than the public at large.

Pipeline Hazards

Increasing the miles of gathering and transmission pipelines within the ARPA would increase the chance of a pipeline failure. However, the low probability of failure, the remoteness of the

project area and the low level of anticipated non project-related construction and excavation would result in minimal risk to public health and safety. Compliance with signing requirements for pipeline rights-of-way would reduce the likelihood of pipeline ruptures caused by excavation equipment - particularly in the vicinity of road crossings or areas likely to be disturbed by road maintenance activities.

Hazardous Materials

Drilling, field development and production activities require use of a variety of chemicals and other materials, some of which would be classified as hazardous. A Hazardous Materials Management Plan is provided as Appendix C to this document, pursuant to BLM Instruction Memoranda Numbers WO-93-344 and WY-94-059, which require that all NEPA documents list and describe any hazardous and/or extremely hazardous materials that would be produced, used, stored, transported or disposed of as a result of a proposed project.

Potential impacts associated with hazardous materials include human contact, inhalation or ingestion and the effects of exposure, spills or accidental fires on soils, surface and ground water resources and wildlife.

The risk of human contact would be limited predominately to ARPA Operator and contractor employees. A Hazard Communication Program, Spill Prevention Control and Countermeasure (SPCC) Plans, and other mitigation measures described in Appendix H, Required Best Management Practices would reduce the risk of human contact, spills and accidental fires, and provide protocols and employee training to deal with these events should they occur.

Other Risks and Hazards

Highway and road safety impacts are discussed in Section 4.13 (Transportation). Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Appendix H, Required Best Management Practices.

The potential for firearms-related accidents would occur primarily during hunting season. The increased activity in the ARPA during drilling and field development would be likely to discourage hunting in the immediate vicinity of the activity during that period. Consequently the risk of fire arms-related accidents should be minimal. During project operations, the relatively few personnel on site would also result in minimal risk of firearms-related accidents.

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

There would be an increased potential for weather related hazards associated with the Proposed Action. Many development locations in the ARPA are remote and rapidly moving storms can impair or prevent driving conditions in a fairly short time. It is possible that workers may get stranded in remote locations requiring rescue operations by emergency management personnel. Proper training of development and operations workers, coordination with emergency management agencies and frequent mapping of development locations can reduce the potential for weather related impacts.

Based on the foregoing assessment, risks to public health and safety should not substantially increase as a result of the Proposed Action.

4.14.3.2 Alternative A - No Action

Under this alternative no oil and gas related development would occur so no effects to health and safety would occur for this alternative.

4.14.3.3 Alternative B

Under this alternative effects are anticipated to be the same as the Proposed Action.

4.14.3.4 Alternative C

Under this alternative effects are anticipated to be the same as the Proposed Action.

4.14.4 Mitigation

The mitigation measures would be sufficient to mitigate risks to public health and safely.

The Operators should coordinate emergency response planning with the Carbon County Emergency Management Agency and provide documentation regarding compliance with Federal Hazardous Material Regulations and the Uniform Fire Code.

4.14.5 Residual Impacts

Risk to health and safety of workers, contractors and other users of the project area associated with industrial accidents, transportation accidents, shooting accidents and natural disasters would remain for the life of the project. However, these risks to the public would be small, given the remoteness of the area, the few visitors anticipated and the proposed mitigation measures.

4.15 NOISE

4.15.1 Introduction

Noise associated with the action alternatives would be caused by machinery used during drilling and construction of pipelines and access roads, construction and operation of ancillary facilities, and be heavy trucks and related equipment.

4.15.2 Impact Significance Criteria

The following criteria was used to assess the significance of noise impacts related to this project:

Long-term activities that would exceed federal 55dBA maximum standards for noise at either human or animal sensitive locations.

4.15.3 Direct and Indirect Impacts

4.15.3.1 Proposed Action

Noise levels associated with drilling, field development and operations activities may temporarily exceed the threshold EPA average 24-hour noise level of 55 dBA at specific locations within the ARPA, but the lack of year-round occupied human residences and the low level of non project-related human occupation of the project area would result in minimal noise impacts to persons other than project employees. Although noise impacts associated with compression facilities would be long term in duration, these same factors, lack of human residences and low human densities, would result in minimal compression facility noise impacts.

Implementation of the Proposed Action has the potential to create noise-generated impacts that emanate from machinery used during drilling and completion and during construction of drill sites, pipelines, access roads and ancillary facilities, and from the operation of heavy trucks and related equipment. During field operations, noise would be generated by compression facilities, pumper trucks, road maintenance equipment and well workover operations.

Noise associated with natural gas drilling, field development and field operations can affect human safety (at extreme levels) and comfort. Noise impacts can also modify animal behavior (see Section 4.7 for a discussion of the potential noise impacts to wildlife resources). The magnitude of noise impacts are contingent on a number of factors including the intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. A variety of heavy equipment and machinery commonly used during drilling, field development and production operations generate noise levels in excess of the 55 dBA maximum standard. Noise impacts created by these activities are short-term, lasting as long as drilling, construction or field maintenance activities are performed at well sites, access roads, pipelines, and ancillary facilities. Under typical conditions, noise levels decline below the 55 dBA maximum standard at a relatively short distance (less than one mile from the source) depending on the factors outlined above.

Drilling, field development and field operations workers would be the only groups directly affected by Proposed Action-related noise disturbances for more than a brief period of time. These groups are subject to OSHA regulations regarding industrial noise protection. Grazing operators and recreation users of the area would typically be affected by noise impacts only for the brief period required to pass by sites where drilling, field development and field operations occur.

Natural gas compression facilities would be a source of long-term noise impacts. These impacts would exceed the 55 dBA maximum standard at the compression site, but noise levels would be attenuated to below acceptable levels a mile or less from the compression site. There are no year-round occupied residences located with in the ARPA and residences occupied occasionally (during livestock operations) are located on private land. Locations of compressor

stations would be determined in negotiations for surface use agreements. Therefore, field operations workers are likely to be the only group affected by compression noise for other than a brief period of time.

Based on the foregoing and the noise mitigation measures contained in Appendix E, Wildlife Mitigation and Monitoring Plan, noise impacts to the public associated with the Proposed Action would be minimal and short-term in nature.

4.15.3.2 Alternative A - No Action

Under this alternative there would be no noise related effects.

4.15.3.3 Alternative B

Under this alternative effects are anticipated to be generally the same as the Proposed Action. Focusing development into one area at a time would increase the intensity and extent of noise during the development period within the active zone, off-set by no noise or operational noise in other zones, depending on their status. Once construction and reclamation has ended within a zone operational noise associated with gas production activities would be the same as the Proposed Action.

4.15.3.4 Alternative C

Under this alternative effects are anticipated to be the same as the Proposed Action.

4.15.4 Additional Mitigation

In addition to the measures described in Appendix E, Wildlife Mitigation and Monitoring Plan, measures to mitigate noise impacts would include the following:

> In any area of operations (drill site, compressor site, etc.) where noise levels may exceed federal OSHA safe limits, the Operators and contractors would provide and require the use of proper personnel protective equipment by employees.

4.15.5 Residual Impacts

Although both intermittent (field maintenance and workover activities) and long-term (compression facilities) exceedences of 55 dBA noise levels would occur for the life of the project, the lack of year-round occupied human residences and the low human occupation of the project area would result in negligible noise impacts under the action alternatives. There would be no residual effects from the no action alternative.

4.16 WILD HORSES

As discussed in Chapter 3, no wild horses or designated wild horse management areas (HMAs) are within the ARPA. Therefore, potential impacts to wild horses from project-related activities do not exist and further discussion is not required.