CHAPTER 4

ANALYSIS OF ENVIRONMENTAL CONSEQUENCES

4.0 INTRODUCTION

This chapter of the environmental assessment provides an analysis of the potential environmental consequences that would result from implementation of the Proposed Action (federal land development of eight well locations, access roads, associated facilities and reclamation) and No Action (denial of further federal land development beyond the existing LSRCD reservoir; two existing wells; four recently-approved CBM wells, access roads, and associated facilities which total 46.7 acres of disturbance) in the CCPA. Measures that would avoid or reduce impacts under the Proposed Action have been included in Chapter 2. The following impact assessment takes these measures into consideration. Additional opportunities to mitigate impacts beyond the measures proposed in Chapter 2 are presented in this chapter under Mitigation Summary for each resource discipline.

As discussed in Chapters 1 and 2 of this EA, the CCPA lies within the proposed Atlantic Rim CBM project area (Figure 1-2). Drilling and field development activities proposed for the CCPA EA Proposed Action could be allowed under terms and conditions described in the Interim Drilling Policy (see Appendix A).

This analysis of environmental consequences addresses only those direct and indirect impacts associated with exploration and development of the Cow Creek interim development pod.

The description of the environmental consequences for each resource section in this chapter includes the following subsections:

Impacts The level and duration of impacts that would occur as a result of the Proposed Action or the No Action Alternative. The impact evaluation assumes that the applicant-committed practices described in Chapter 2 would be implemented

Mitigation - A summary of additional measures that could be applied to avoid or reduce impacts. Mitigation items specified in the Mitigation Summary are *assumed to be* applicable to impacts on all lands, regardless of ownership. However, Double Eagle would coordinate with private land owners to determine which measures would be applied, to what degree, and where. Also, because of the similarity between the Proposed Action and No Action, it is assumed that the mitigation described applies to both alternatives. The measures identified under this section would be considered for application to all BLM administered lands. If no additional mitigation is proposed, the mitigation and residual impact sections will not be discussed.

Residual Impacts - A summary of impacts that are unavoidable and cannot be reduced or eliminated through the application of available and reasonable mitigation and, therefore, would remain throughout the duration of the project and to some point beyond.

Cumulative Impacts - A description of impacts likely to occur due to this project in combination with other on-going and recently approved activities, recently constructed projects and other past projects, and projects likely to be implemented in the near future (reasonably foreseeable future actions or RFFA's).

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This EA addresses cumulative impacts associated with exploration and development of 200 interim CBM wells and other activities, on-going or proposed, within the Atlantic Rim project area. Cumulative impacts associated with exploration and development of the Cow Creek pod are shown in Section 4.15 of this EA.

4.1 GEOLOGY/MINERALS/PALEONTOLOGY

4.1.1 Impacts

4.1.1.1 Proposed Action

Utilization of proper construction techniques described in Chapter 2 would minimize impacts resulting from the topographic alteration of developing eight CBM wells and associated facilities. As discussed in Chapter 3, no major landslides have been mapped within the project area. Following prescribed procedures construction activities would not likely activate landslides, mudslides, debris flow, or slumps. Seismic activity is low in the area, so the potential for damage of project facilities is minimal.

Inventory of geologic resources revealed no major mineral resources that would be impacted by implementation of the project other than CBM reserves. Drilling of CBM wells would better define the location and nature of CBM resources available within the CCPA. Recovery of CBM would result in the depletion of the natural gas resource.

As discussed in Chapter 2, Project-Wide Mitigation Measures, the mitigation measures presented in the Soils and Water Resources sections would avoid or reduce potential impacts to the surface geologic environment. Implementation of these measures and adherence to Federal and State rules and regulations regarding drilling, testing and completion procedures would avoid or reduce potential impacts to the subsurface geologic environment.

Construction excavation associated with the development of access roads, CBM well pads, gas and water pipelines, and related gas production and water disposal facilities could directly result in the exposure and damage or destruction of scientifically significant fossil resources. For example, fossils may be subject to damage or destruction by erosion that is accelerated by construction disturbance. In addition, improved access and increased visibility, as the result of construction and on-going production activity, may lead to fossils being damaged or destroyed by unauthorized collection or vandalism. The Lewis Shale of Cretaceous age, which underlies the area, has produced scientifically significant fossils elsewhere in Wyoming (and thus meets BLM Condition 2), but there are no reported occurrences in the project area. The potential for recovery of significant vertebrate fossils in the CCPA is considered to be low to moderate. Mitigation measures discussed in Chapter 2 are reasonable measures to protect potential paleontologic resources that may be inadvertently uncovered during excavation.

4.1.1.2 Alternative A - No Action

Under the No Action Alternative, denial of further federal land development would result in impacts similar to those under the Proposed Action, but slightly reduced.

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4.2 AIR QUALITY

4.2.1 Impacts

4.2.1.1 Proposed Action

No violations of applicable state or Federal air quality regulations or standards are expected to occur as a result of direct or indirect project air pollutant emissions from CBM well development (including both construction and operation) in the CCPA.

Under the Proposed Action, air emissions would occur from the construction and production of CBM wells within the CCPA. Construction emissions would include PM-10, SO_2, NO_x, CO, and VOC's, from ground-clearing, heavy equipment use, drilling, and completion activities, as well as the construction of access roads. Construction emissions are temporary and would occur in isolation, without significantly interacting with adjacent wells.

Production emissions of NO_x, CO, VOC, and HAP's (formaldehyde) would result primarily from operation of compressor engines. Estimated air quality impacts from compressor engines assumed that the compressor engines would have an average potential NO_x emission rate of approximately 2 grams per horsepower-hour (g/hp-hr) of operation. This reflects emission control levels which have already been required in similar applications, although WDEQ-AQD operating permit records have shown existing facility hourly emission levels to be substantially less. The emissions generated from compressor operation would contain negligible amounts of SO_2 and particulate matter due to the composition of coalbed methane gas. Production emissions from the compressor engines would occur over the LOP.

Emissions from production wells would be negligible since the produced gas is nearly 100 percent methane and will require no ancillary production facilities at the well site.

Pollutant emissions from the construction and operation of natural gas fields in the vicinity of the CCPA have been analyzed in recent air quality studies performed under NEPA by the BLM. Studies conducted for the Continental Divide/Wamsutter II and South Baggs Natural Gas Development Projects (BLM 2000 and 1999) indicated potential near-field increases in CO, NO_2, PM-10, and SO_2 concentrations, however, the predicted maximum concentrations would be well below applicable state and National Ambient Air Quality Standards. Similarly predicted HAP (formaldehyde) concentrations would be below various 8-hour maximum Acceptable Ambient Concentration Levels, and the related incremental cancer risks to residences would also be below applicable significance levels

The emissions resulting from the implementation of this project would be much the same as those found on similar oil and gas projects such as Continental Divide, but on a much smaller scale. The 8-well project described in this EA is well under the limit of the 3,000 well air quality analysis prepared for the Continental Divide EIS, considering only 2,130 wells were approved. The analysis for the Continental Divide EIS project included impacts to Class I areas from oil and gas development in southern Wyoming. Based on the relative size of the Proposed Action when compared to the magnitude of these projects, no ambient air quality standards would be violated and no adverse air quality conditions would result from the Proposed Action.

4.2.1.2 Alternative A - No Action

Air quality impacts from the previously approved CBM wells are similar but less than those described under the Proposed Action.

4.3 SOILS

4.3.1 Impacts

4.3.1.1 Proposed Action

Approximately 20.2 acres of soils resources would be temporarily disturbed during drilling and field development; after initial reclamation, approximately 8.16 acres would remain disturbed over the life-of-project (see Table 2-2).

Increased susceptibility to wind and water erosion would be a direct impact in newly disturbed areas and may cause sedimentation into drainage channels or impoundments. Soil compaction caused by equipment traffic or by increased raindrop impact after loss of surface vegetation cover would decrease infiltration and percolation, increase runoff, and reduce overall water storage capacity. Susceptibility to erosion would occur primarily in the short term and would decline rapidly over time due to the use of proper construction and reclamation techniques and the implementation of mitigation measures described in Chapter 2.

Due to the high amount of salt or sodium content/high clay material within the project area disturbance and/or use of this material is discouraged. Sodium affected soils could contaminate suitable material and cause dispersion of clays and sealing of reclaimed surfaces. Other direct chemical impacts to the soil resource would include reduction of overall fertility based on length of stockpiling of material and loss of nutrients; possible oxidation and release of elements such as boron or selenium, although no analyses were conducted.

Stripping of high clay material, surface sandy or gravelly material, as well as channery material in the subsoil, could reduce the physical suitability of the soil resource used from reclamation. If stripped and stockpiled with suitable material, contamination could result in increased droughtiness and decreased fertility, of reclamation material, as well as hamper actual seeding operations. Other physical impacts to the soils resource during stripping may include: loss of soil structure and decreased permeability; mixing of various textures; and solution of surface organic matter and subsequently soil biota. Stockpiling soil material could degrade physical properties of the soil resource such as bulk density, in addition to the biological and chemical effects mentioned earlier. In addition, stockpiling of material can increase the potential for soil loss until the soil is revegetated.

Topsoil quality in the project area varies based on local topography and source of parent material. Primary limitations overall include: salt or sodium content; high clay content; thin soil development or inaccessibility to stripping operations; channery or high coarse fragment content; or sandy or gravelly soils. Revegetation potentials range from mostly fair to poor, with some areas rated as good. In addition to these limitations, low annual precipitation, susceptibility to wind and water erosion, and short growing season could make reclamation in the project area more difficult.

Due to the small area of disturbance and use of proper construction and reclamation techniques and implementation of mitigation described in Chapter 2, impacts to soil resources in the CCPA are anticipated to be minimal.

4.3.1.2 Alternative A - No Action

Under this alternative, impacts to the soils environment would be similar to those described for the Proposed Action but of a smaller magnitude.

4.4 WATER RESOURCES

4.4.1 Impacts

4.4.1.1 Proposed Action

Surface Water Potential impacts that could occur to the surface water system due to the Proposed Action include increased surface water runoff, off-site sedimentation due to soil disturbance associated with construction activities, water quality impairment of surface waters due to increased sedimentation and lower quality CBM water, and stream channel morphology changes due to road and pipeline crossings and increased water flow. 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, water management methods, soil character, duration of time within which construction activities occur, and the timely implementation and success/failure of mitigation measures. Adverse sedimentation is not expected to occur as a result of the implementation of the Proposed Action due to compliance with RMP management directives and Executive Order 11990. Both regulations require avoidance of stream channels to the maximum extent possible. Where total avoidance is not practical the BLM AO will be shown why a stream channel and/or floodplain can not be avoided and how the impacts would be minimized.

Construction activities would occur over a relatively short period of time. Construction impacts would likely be greatest shortly after the start of the project and would decrease in time due to stabilization, reclamation, and revegetation efforts. The construction disturbance would not be uniformly distributed across the project area, but rather, project construction activities would be concentrated within and around the wells.

With total surface containment, there would be no increase in overall surface flow and no increased erosion and sedimentation due to the discharge of CBM water. Due to the rip-rapped outfall and low slope and stability of the ephemeral channel receiving discharge to the LSRCD reservoir, increased erosion would be slight. The NPDES permit and Water Management Plan require periodic monitoring of the drainage for erosion. If erosion is occurring, prompt mitigation using appropriate BMP's (best management practices) is required. By allowing water contained in the reservoirs to infiltrate, a dynamic hydrologic system is created, minimizing the concentration of salts due to evaporation and recharging shallow aquifers in the project area. The point of compliance is positioned near the LSRCD reservoir to provide early detection of surface flow from the reservoir; it is not intended to detect infiltration. The seepage from the outlet structure of the LSRCD reservoir is a preexisting condition, localized at the dam. It will be carefully monitored for any increase. The POC for the NPDES permit is located down-channel from this reach. The POC must be monitored daily by Double Eagle for flow; if flow is observed, it must be reported and a

sample taken. Water reaching the POC must meet the stringent standards of the discharge permit. If the water is out of compliance, the discharge of CBM water into the LSRCD reservoir must cease until there is no flow at the POC or the water meets the discharge standards.

A required 2.5 feet of free board in the reservoir alleviates concern of the reservoir's holding capacity for a 25-year storm event. A 25-year storm event is a statistic indicating a storm of that size has a probability of occurring once every 25 years. Given a project life of 10 to 15 years, a 25-year event may never occur while the project is in operation. Should it occur, a larger storm event (>25-year) could lead to temporary water discharge from the reservoir. If that occurs, the water would be significantly diluted. For example, two hours of peak flow from a 50-year event would generate 100 ac-ft of water. Given the reservoir capacity of 120 ac-ft, this is a dilution of 45%. In any case, any water discharged from the LSRCD reservoir must meet the standards set in the NPDES permit at the point of compliance. If the standards are not met, discharge of CBM water into the reservoir must cease until surface containment in the reservoir is reestablished. The NPDES permit also requires daily monitoring of the POC for surface discharge. It should also be noted that a discharge from the reservoir during an event greater than the 25-year storm would be temporary and short-lived, with the water rapidly being lost to infiltration into the stream sediments and to evapotranspiration. In a large storm event the impact of natural sheet flow over a large area, dissolving surface salts and moving sediment, would have a much larger impact than diluted water temporarily discharged from the LSRCD reservoir. The impacts from this type of event should be minimal because of the requirements of the NPDES permit.

Reservoir water loss to infiltration and evaporation is expected to be approximately 200 gpm for each reservoir, based on industry experience in the Powder River Basin (PRB). It is beneficial to have water infiltrate into the subsurface from reservoirs. It reduces the buildup of salts due to evaporation and the interaction of the water with the rock matrix filters, dilutes and allows geochemical reactions to modify the water to natural quality. If the projected water rates are correct, only one off-channel reservoir would be needed.

The proposed project would require relatively little water demand and would not adversely affect existing surface or groundwater sources or rights.

Ground Water The primary impact of the Proposed Action on ground water resources is best described as the loss of some hydraulic pressure head in the affected coal seam aquifer. The partial removal of groundwater from the coal aquifer results in the reduction of the hydraulic pressure head, thus lowering the water levels in nearby wells completed in the same coal seam. The lowering of water levels in an aquifer is also referred to as drawdown.

The Lewis sands would be the receiving aquifer for the aquifer recharge well. The DEQ permit for the recharge well requires the analysis of a sample of Lewis sand water to confirm the water quality is the same or less than the CBM water. This is possible and must be done prior to any injection of CBM water into the Lewis sands. The requirement for a downhole submersible pump would be waived by DEQ. The hydrostatic head would be increased at the recharge well location(s) due to the gravity injection of CBM water. This, in effect, creates a "mound" in the potentiometric surface (pressure) of the ground water that decreases with increasing radial distance from the injection well. The westerly geologic dip and flow gradient of the Lewis sands would transport the injected water westward, deeper into the Washakie sub-basin. Shale aquitards above and below the Lewis sands would confine the injected water to the Lewis sands aquifer. The recharge area for the Lewis sands are their outcrops trending north-south along the east edge of the project area. The Lewis Formation does not outcrop again until the eastern edge of the Rock Springs Uplift, approximately 50 miles west of the project. The Lewis sands are over 300 ft thick at the location

of the aquifer recharge well. If the sands are unsaturated, and the effective porosity is 15%, one square mile can contain 223,430,400 bbls of produced water. Fourteen wells, producing 8 gpm each for 10 years, will produce a total of 14,016,000 bbls of water. There would be more than adequate storage capacity. If the Lewis sands are saturated, calculations using a hydraulic conductivity of 10 gpd/sq ft (friable sand, Driscoll) and storativity of 0.0001 result in a gravity injection rate of 211 gpm (7,235 bpd) after one year. One recharge well should provide adequate injection capacity for the project. The project area would be monitored for the surface release of water injected into the Lewis sands. If such a release is directly related to the recharge well, injection would cease. Given the large volume of Lewis sands, the relatively short life of the project and the finite volume of produced water, it is unlikely that any surface discharge would occur into the Colorado River drainage.

Infiltration from the LSRCD Reservoir and the off-channel reservoir would provide recharge to shallow aquifers. This could provide a shallow, beneficial water supply within the project area. The CBM water quality is acceptable for livestock watering.

Based on the performance of the #1X-12 and #34-12 wells, the initial water production rate of each of the 8 CBM wells in the CCPA is expected to be approximately 29 gpm (1,000 bpd, 0.065 cfs). A 50% annual decline results in a per well water rate: 14.5 gpm after one year and 7.3 gpm after two years. Because of the expected initial rates, a combination of discharge into the existing LSRCD reservoir, discharge into a new, off-channel reservoir and injection into an aquifer recharge well would be needed to manage the produced CBM water. This approach would also allow a site-specific, operational evaluation of each method used.

SEO records indicate only one permitted well completed in the Mesaverde Group is within a one-mile radius of a project CBM well; this is a BLM well converted to stock watering (NWSE Section 12, T16N:R92W). SEO records show the well is completed in an interval above the coal zones being completed by Double Eagle; the well is also presently non-productive and shut in, therefore it would not be impacted by CBM production. It is known that water wells completed in coals in the Powder River Basin have historically produced some associated gas, prior to any CBM development. Observation of stock-water wells in the project area indicates the same to be true. There are no known springs or seeps within the project area.

Double Eagle has reviewed the ***Ground Water Vulnerability Study*** conducted by the State of Wyoming at the office of the LSRCD and has received their indications that the proposed alternative would not conflict with the results of that study.

Well drilling and completion should have little adverse impact on existing ground-water quality. The improbable degradation of ground-water quality within any aquifers in the project area essentially eliminates the possibility of adverse effects to the area's groundwater right holders. A description of the geology and hydrology of the CCPA is given in Chapter 3. The focus of this groundwater impact assessment is the coal seam aquifers within the Almond Formation, a member of the Upper Cretaceous Mesaverde Group. These targeted coal seams are classified as confined to semi-confined aquifers because they are bound by aquitards consisting of impervious to semi-pervious layers of shale and siltstone. Hydraulic connection between the Almond Formation coal seams and any aquifer stratigraphically above or below the coal seams is therefore very limited. The hydrostatic pressure head of the water measured in coal seam test wells completed in the project area can be considerably higher (100 to 300 feet higher) than the ground level elevation at any respective well location. Confined, or artesian, aquifer conditions of this type are indicative of an effective seal or aquitard above and below the aquifer. However, lowering of the hydraulic pressure head in the coal seam aquifer by dewatering activities may induce a slight leakage of water through

the semi-pervious shale layers into the pumped aquifer. 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 significant period of time would drawdown effects in any overlying aquifer become apparent.

It is acknowledged that implementation of the Cow Creek Project would temporarily decrease water levels from present static conditions within the coal seam aquifer. Relative to the available drawdown within the aquifer, these impacts would not be significant. A complete drawdown analysis will be presented in the Atlantic Rim EIS. There will be a slight increase in the water levels in the Lewis sands during injection. The injection permit requires the injected water to be of a similar or better quality than the water in the Lewis sands. No significant impacts to ground-water quantities or qualities are expected from this project.

4.4.1.2 Alternative A - No Action

Impacts to water resources under this alternative would be similar to the Proposed Action but of a lesser magnitude.

4.5 VEGETATION/ WETLANDS/NOXIOUS WEEDS

4.5.1 Impacts

4.5.1.1 Proposed Action

The Proposed Action assumes construction of 8 CBM wells and associated roads, pipelines and water disposal facilities. Construction and installation of well sites, access roads, and ancillary facilities would directly reduce the extent of vegetation cover types.

During the production phase, all pipelines and portions of well pads would be reclaimed. A portion of each well pad (15 x 15 feet, approximately 0.005 acre) would remain disturbed for the life of the project. Disturbance associated with the compressor station, injection well, water disposal facilities, and pumping stations would remain for the life of the project. Total vegetation disturbance would be reduced from 20.2 acres to approximately 8.16 acres after reclamation.

The Wyoming big sagebrush, greasewood, and desert shrub cover types disturbed under the Proposed Action are commonly found across southwest Wyoming. The short- or long-term loss in acreage described above would have little impact to the overall abundance and quality of these habitats.

In general, the duration of impacts on vegetation in the project area would depend on the time required for natural succession to return disturbed areas to pre-disturbance conditions of diversity (species diversity and structural diversity). Reestablishment of pre-disturbance conditions would be influenced by climatic (growing season, temperature, and precipitation patterns) and edaphic (physical, chemical, and biological soil conditions) factors. This would include the amount and quality of topsoil salvaged, stockpiled, and re-spread over disturbed areas.

Surface disturbance activities could affect vegetation directly and indirectly by destroying individuals or their habitat, and introducing weeds. Weedy species often thrive on disturbed sites such as road ROW's and out-compete more desirable plant species. Increased weed invasion may render a

site less productive as a source of forage for wildlife and livestock. However, application of mitigation measures summarized in Chapter 2, would minimize the introduction of weed species.

No federally listed threatened or endangered plant species are known to occur in the CCPA; therefore, implementation of the proposed development would not adversely impact federally listed species.

The distribution of plant species of concern is likely limited on the CCPA due to a lack of suitable habitat for most of the species. Due to the low likelihood of the sensitive plant species to occur on the CCPA and the small amount of disturbance associated with the Proposed Action, minimal impacts upon the plant species of concern are expected.

Special Aquatic Sites and Wetlands. Water discharged into the ephemeral drainage from the leaking well (1X-12) and other CBM wells will not exceed 180,600 gallons (0.28 cfs). The channel into which the additional produced water will be discharged is stable, and supports a well developed riparian vegetation community as a result of years of well water discharge into this channel. However, without the input of artificial flows, this would be an ephemeral channel, exhibiting no wetland characteristics.

The recently impounded LSRCD reservoir currently does not exhibit well developed wetland vegetation or soil characteristics. The source of flow for this impoundment is the flow from a leaking well (1X-12) and other CBM produced waters. Again, without this artificial water source, the reservoir would not remain filled.

Thus, wetlands within the project area occur and remain intact due to human development activities. Placement of rip-rap at the produced water discharge point, in addition to the well developed riparian vegetation along the inflow channel will prevent channel erosion and major downstream sediment inputs due to surface well water discharge. The reservoir is designed to totally contain the produced waters, and no downstream discharge of water downstream from the reservoir is proposed. Additionally, the LSRCD reservoir will act as a stilling basin to prevent downstream movement of sediments and other hydrocarbon pollutants. The continuation of stream flow and potential for wetland evolution along the channel upstream from the reservoir and at the LSRCD reservoir, may provide a beneficial impact from the CBM development. Furthermore, the absence of any natural wetlands within the project area will preclude adverse impacts associated with this habitat type due to implementation of this project.

4.5.1.2 Alternative A - No Action

Impacts to vegetation and wetlands would be similar to those described under the Proposed Action but of a lesser magnitude.

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4.6 RANGE RESOURCES AND OTHER LAND USES

4.6.1 Impacts

4.6.1.1 Range Resources

4.6.1.1.1 Proposed Action

Anticipated impacts to range resources associated with the Proposed Action are limited to a minimal loss of forage and associated AUM's, an increased potential for vehicle/livestock collisions and an increased potential for the spread of noxious and invasive weeds.

The CCPA lies within the Doty Mountain grazing allotment, described in Section 3.6. Livestock grazing activities would continue during the drilling, field development and operations phases of the project. Forage in the project area would be reduced slightly during drilling and field development and restored as soon as practical thereafter, except for areas used for roads, production equipment and ancillary facilities, which would remain disturbed throughout the productive life of the field. The increased traffic in the CCPA during the drilling and field development phase would correspondingly increase the potential for vehicle/livestock accidents during that period.

The Proposed Action would result in an estimated 20.2 acres of short-term disturbance during drilling and field development, an estimated 8.16 acres of long-term disturbance would remain after the initial reclamation activities described in Chapter 2 are completed (see Table 2-2). The short-term drill pad and ancillary facility disturbance would be reclaimed as soon as possible, but no later than one year of completion of the operation, as would all areas disturbed for gas and produced water pipelines. All remaining disturbed areas would be reclaimed at the end of field operations, except those facilities which the BLM may identify as desirable for other use.

The average stocking rate for the for the Doty Mountain allotment is 12 acres per AUM. Consequently, the Proposed Action would result in a short-term loss of forage associated with about two AUM's, and long-term loss of only one AUM. These losses would amount to a negligible loss of total AUM's in the allotment.

There is potential for conflict between Proposed Action-related activities and range operations. The increased activity associated with drilling and field development would result in increased opportunities for vehicle/livestock collisions, particularly during and just after calving season when calves are difficult to see and tend to congregate on roads (Warren 2000). Since most of the livestock use in this pasture occurs in the fall when calves are larger, impacts would be minimal. Given the low traffic volumes associated with field operations (one to two trips per day on average), vehicle/livestock collisions are of less concern for the long term.

Based on the assumptions and estimates contained in this assessment, the Proposed Action would result in minimal impacts to range resources.

4.6.1.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.6.1.2 Other Land Use

4.6.1.2.1 Proposed Action

Potential impacts to other land uses are limited to recreation resources and wildlife habitat, which are discussed under the sections dealing with those resources.

As described in section 3.6, other land use on and adjacent to the Proposed Action include wildlife habitat; oil and natural gas exploration, development, and transportation; and dispersed outdoor recreation (primarily hunting in the fall). Effects on wildlife resources are described in Section 4.7. Effects on recreation resources are described in Section 4.9. The preconstruction planning and site coordination process and measures described in Chapter 2 would reduce the potential for conflict with existing oil and gas pipelines, road ROW's and other oil and gas leases.

4.6.1.2.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.7 WILDLIFE/FISHERIES

4.7.1 Impacts

4.7.1.1 Proposed Action

The proposed development would disturb approximately 20.2 acres of general wildlife habitat as a result of the Proposed Action. Analysis of potential impacts of the proposed development upon wildlife assumes development of the wells, roads and pipelines in the approximate locations identified in Figure 4-1.

During the production phase, the unused portion of well sites and pipelines would be reclaimed. Following completion of production operations (life of the project is estimated at 10-15 years), the well field and ancillary facilities would be reclaimed and abandoned. Well pads would be removed and the areas revegetated with seed mixes approved by the BLM, some of which are specifically designed to enhance wildlife use. The duration of impacts to vegetation would depend, in part, on the success of mitigation and reclamation efforts and the time needed for natural succession to return revegetated areas to predisturbance conditions. Grasses and forbs are expected to become established within the first several years following reclamation, however, much more time would be required to achieve reestablishment of shrub communities. Consequently, disturbance of shrub communities would result in a longer-term loss of those habitats.

In addition to the direct loss of habitat due to construction of well pads and associated roads and pipelines, disturbances from human activity and traffic would lower wildlife utilization of habitat immediately adjacent to these areas. Species that are sensitive to indirect human disturbance (noise and visual disturbance) would be impacted most. Habitat effectiveness of these areas would be lowest during the construction phase when human activities are more extensive and localized. Disturbance would be reduced during the production phase of operations and many animals may become accustomed to equipment and facilities in the gas field and may once again use habitats adjacent to disturbance areas.

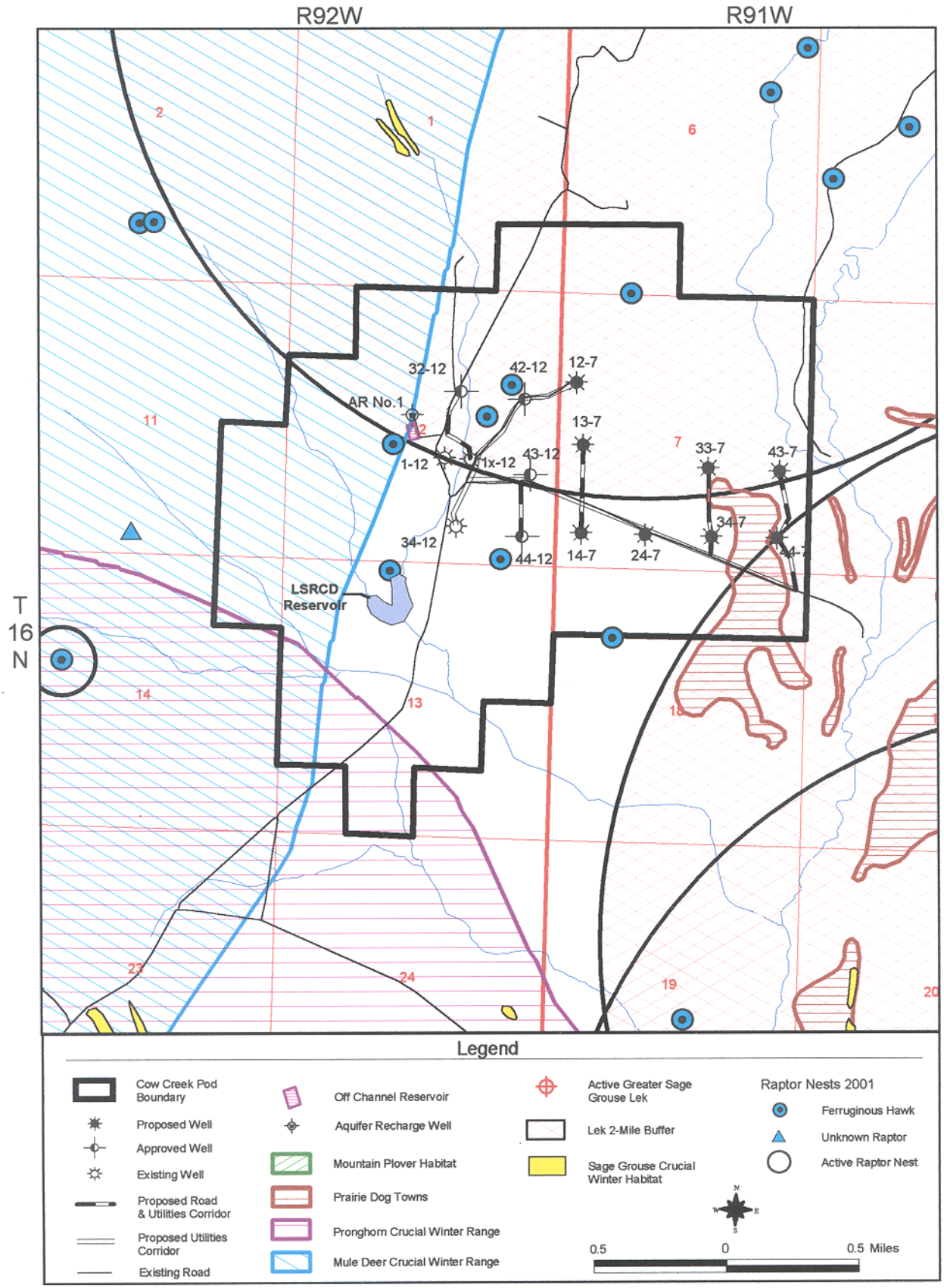


Figure 4-1. Wildlife Concerns in and around the Cow Creek Pod.

4.7.1.1.1 General Wildlife

The direct disturbance of wildlife habitat in the CCPA under the proposed development would reduce habitat availability and effectiveness for a variety of common small mammals, birds and their predators. The initial phases of surface disturbance would result in some direct mortality to small mammals and the displacement of songbirds from construction sites. In addition, a slight increase in mortality from increased vehicle use of roads in the project area is expected. Quantification of these losses is not possible; however, the impact is likely to be low over the short-term. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed, small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation of pipelines, unused portions of roads, well pads, and wells that are no longer productive. No long-term impacts to populations of small mammals and songbirds are expected.

4.7.1.1.2 Big Game

In general, impacts to big game wildlife species would include direct loss of habitat and forage, and increased disturbance from drilling, construction, and maintenance operations. Disturbance of big game species during the parturition period and while on winter range can increase stress and may influence species distribution (Hayden-Wing 1980, Morgantini and Hudson 1980). There may also be a potential for an increase in poaching and harassment of big game, particularly during winter. According to management directives in the RMP (BLM 1990), crucial big game winter ranges will be closed to new construction from November 15 - April 30; this closure of areas located in crucial big game winter ranges will reduce disturbance to wintering big game. This closure would also limit the potential for poaching and/or harassment of big game species wintering in the area. A small area of pronghorn crucial winter/yearlong range and mule deer crucial winter/yearlong range overlaps in the southwest portion of the CCPA (Figure 4-1). According to the Interim Drilling Policy, no development or disturbance will be allowed in areas of overlapping big game crucial winter ranges. As currently proposed, no disturbance is expected to occur in this area of overlapping crucial ranges. The potential for vehicle collisions with big game would likely increase as a result of increased vehicular traffic and speeds associated with the presence of construction crews and would continue (although at a reduced rate) throughout all phases of the operations.

Mule Deer. The CCPA supports mule deer year round. The pod contains winter/yearlong range (1,596 acres) and crucial winter/yearlong range (454 acres). Construction of the proposed development would not disturb any of the crucial winter/yearlong mule deer range. Approximately 20.2 acres of mule deer winter/yearlong range would be disturbed. Following reclamation, approximately 8.16 acres of mule deer winter/yearlong range (0.0008% of that range type in the Baggs Herd Unit) would remain disturbed for the remaining life of the project. No major mule deer migration routes pass through the CCPA (WGFD 1999a).

During winter, mule deer primarily utilize shrubs including sagebrush, mountain mahogany, and antelope bitterbrush (DeBolt 2000). Mountain mahogany is also an important mule deer forage during the spring, summer, and fall (DeBolt 2000). Specific placement of roads and wells to avoid destroying habitat patches containing these shrub species will lessen the impact upon the winter/yearlong range vegetation in the pod. Overall, impacts upon mule deer winter habitat should be limited, and no long-term significant impacts to mule deer in the area are expected because a very small percent of the winter/yearlong range in the herd unit would be disturbed.

Disturbances from drilling activities and traffic could affect utilization of the habitat immediately adjacent to these areas and displace some animals. Mule deer, however, are known to be extremely tolerant of most human activities, except hunting, and quickly adjust to non-threatening, predictable human actions (Irby et al. 1988, Gusey 1986). During a three-year study of response of pronghorn and mule deer to petroleum development on crucial winter range in central Wyoming, Easterly et al. (1988) found that mule deer "did not avoid oil fields" and that "deer did not move significant distances from the well site after the start of drilling activity." Similarly, in an assessment of the effects of winter 3D seismic operations on mule deer in western Wyoming, HWA (1994) found that although deer avoided areas of major seismic activities, they quickly moved back onto such areas following completion of work. Furthermore, the deer were not displaced long distances and remained immediately adjacent to active seismic operations. Although seismic activities were seen to displace mule deer, there was no evidence that such displacement caused undo stress or negative effects. Most deer responses consisted of avoidance of uncomfortable proximity to the operations and deer carried out normal activities of feeding and bedding within 1/8 to ½ mile of most active seismic operations (HWA 1994). Impacts upon the mule deer population utilizing the pod are expected to be minimal, provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

Elk. The CCPA supports elk during the winter months and all of the pod is classified as elk winter range. A total of 20.2 acres of elk winter range would be disturbed under the Proposed Action. Following reclamation, approximately 8.16 acres of elk winter range would remain disturbed (0.004% of that range type in the Sierra Madre Herd Unit) for the remaining life of the project. Major elk migration routes do not cross the pod (WGFD 2000a).

During winter, elk primarily consume grasses. Despite differences in diet, elk and mule deer will utilize the same areas (DeBolt 2000). Overall, impacts upon elk winter range habitat will be minimal because only 0.004% of the elk winter range in the herd unit will be disturbed. The primary impact upon elk will be due to disturbance during the development phase. Human activities within 0.5 miles of elk may result in evasive movement by elk (Ward et al. 1973). Elk are known to avoid disturbances associated with active logging areas and road construction operations (Ward 1976, Lyon 1979), however, elk do become easily conditioned to patterned human activity (Ward 1973). Therefore, elk may become accustomed to human activity on the project area during the long-term production phase of the project. Minimal impacts upon the elk population utilizing the CCPA are expected provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

Pronghorn Antelope. The CCPA supports antelope throughout the year. The pod contains both winter/yearlong (1,899 acres) and crucial winter/yearlong (151acres) pronghorn range. As currently proposed, developments under the Proposed Action would not disturb any pronghorn crucial winter/yearlong range. Approximately 20.2 acres of pronghorn winter/yearlong range would be disturbed. Following reclamation, approximately 8.16 acres of winter/yearlong range (0.004% of that range type in the Baggs Herd Unit) would remain disturbed for the remaining life of the project. Major pronghorn migration routes do not cross the pod (WGFD 2000a).

Activities associated with the construction phase of the project will likely temporarily displace antelope, however, once construction is complete antelope will likely habituate and return to pre-disturbance activity patterns. Reeve (1984) found that pronghorn acclimated to increased traffic volumes and machinery as long as the traffic and machines moved in a predictable manner. The displacement of pronghorn and disturbance of habitats is considered minimal because of the temporary nature of the displacement and the availability of comparable habitats in adjacent areas. Overall, impacts upon the antelope population utilizing the pod are expected to be minimal,

provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented.

4.7.1.1.3 Upland Game Birds

Greater Sage Grouse. Suitable greater sage grouse habitat is abundant on and around the CCPA. The amount of habitat disturbance is minimal considering the amount available in the project area, however, greater sage grouse can be impacted by other activities associated with CBM development including increased human activity, increased traffic disturbance, and pumping noises.

The RMP contains stipulations that nesting activities of greater sage grouse be protected from February 1 to July 31, including strutting grounds and nesting habitat. Exceptions may be granted if the activity will occur in unsuitable nesting habitat. The area of the CCPA included within the 2-mile buffer areas of the active greater sage grouse leks is a sensitive resource area according to the Interim Drilling Policy and mitigation measures and stipulations must be followed to protect this area. If all avoidance and mitigation measures in this document, the RMP, and the guidance provided by the IDP are implemented, impacts to greater sage grouse are expected to be minimal.

4.7.1.1.4 Raptors

The principal potential impacts of the Proposed Action on raptors are: (1) nest abandonment and/or reproductive failure caused by project related disturbance, (2) increased public access and subsequent human disturbance resulting from new road construction, and (3) small, temporary reductions in prey populations. During 2001 surveys, one active ferruginous hawk nest was located approximately 3/4 mile southwest of the pod boundary. The RMP states that no activity or surface disturbance will be allowed near raptor nesting habitat from February 1 - July 31. The size of the restrictive radius and the timing restriction may be modified depending on species of raptor and whether or not the nest is within the line of sight to construction activities. According to the current proposed development, no disturbance would occur within 1 mile of this active nest. Twelve inactive ferruginous hawk nests were located within 1 mile of the CCPA. One additional inactive unknown buteo nest was located within 1 mile of the pod. Steps would be taken to ensure that these inactive nests are not destroyed. Impacts to breeding raptors are expected to be minimal, provided that avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are followed.

4.7.1.1.5 Threatened and Endangered Species - Wildlife, Fish, and Other Aquatic Species

The following species are either threatened, endangered, or proposed for listing under the ESA. These species may have potential to occur on or near the project area and therefore potential impacts to these species caused by the Proposed Action are considered.

Threatened and Endangered Wildlife Species

Black-Footed Ferret. In Wyoming, white-tailed prairie dog colonies provide essential habitat for black-footed ferrets. Ferrets depend almost exclusively on prairie dogs for food, and they depend upon prairie dog burrows for shelter, parturition, and raising young (Hillman and Clark 1980). One prairie dog town is located within the CCPA (town #1; Figure 4-1). This prairie dog town meets the requirements to be considered suitable black-footed ferret habitat (Biggins et al. 1989). Ferret surveys would need to be conducted in this prairie dog town prior to any disturbance (USDI-FWS

1989). The proposed development would avoid the prairie dog town. Therefore, no impact to black-footed ferrets would occur provided avoidance and mitigation measures outlined in this document, the RMP, and the Interim Drilling Policy have been implemented.

Mountain Plover. Given the unsuitable nature of the habitat for plovers within the CCPA and the fact that the proposed development avoids the prairie dog town, no impacts to mountain plovers are expected.

Bald Eagle. Bald eagles typically build stick nests in the tops of large coniferous or deciduous trees along streams, rivers or lakes. This type of habitat is not present on the CCPA, therefore, bald eagles are not expected to nest on the pod. Bald eagles may utilize the CCPA during winter months when big game species are more concentrated on winter ranges. However, the CCPA does not support concentrated use by bald eagles and bald eagle use of the pod is likely incidental. Bald eagles may feed on road-killed carrion in the general vicinity of the pod and workers should be educated about the danger of striking a bald eagle with a vehicle along the main highways and roads providing access to the CCPA (especially Wyoming Highway 789). The Proposed Action is not expected to impact bald eagles provided that the avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are implemented.

Canada Lynx. The Canada lynx is not expected to occur on the CCPA because of the lack of suitable habitat, therefore, the Proposed Action is not expected to impact Canada lynx.

Threatened and Endangered Fish and Other Aquatic Species

Contemporary occurrence of these endangered fish species has not been confirmed for the Muddy Creek drainage or immediately downstream in the Little Snake River, although their probability of occurrence is highly unlikely. If any of these species are identified within the downstream portion of Muddy Creek or immediately downstream in the Little Snake River, the BLM will consult with the FWS and develop a protection plan for the fish.

Construction and use of well access road crossing and road grades within the CCPA could contribute to an increase in sediment levels in Muddy Creek. Offsite sediment movement will only be a major problem during spring thaw and other heavy runoff events such as localized thunderstorms. Implementing reasonable precautions, such as the measure described in Chapter 2, would limit offsite sediment movement from disturbed areas and prevent substantial increases in sediment loadings in the downstream section of Muddy Creek and downstream from its confluence with the Little Snake River, and remain in compliance with Wyoming Surface Water Quality Standards (WDEQ 2001).

According to the water management plan for the CCPA, effects of the subterranean water withdrawals are not expected to be detrimental to current instream flows. Additionally, to avoid impacts to downstream fisheries, no downstream surface discharge from the LSRCD reservoir would occur. Although no downstream flow is planned, limited seepage from the dam does occur, creating a wetted condition in portions of the channel immediately downstream from the dam. The wetted channel results from seepage at the dams outlet structure and is a pre-existing, localized condition. This site would be closely monitored to identify any increase. If measurable discharge occurs downstream from the dam, it must be reported and a water sample for testing must be collected at the point of compliance (POC). All water reaching the POC must meet the stringent standards of the Double Eagle NPDES discharge permit. Overall, the project is not expected to have a negative impact on threatened or endangered fish species that may potentially occur

downstream from the CCPA, since all CBM produced water would be contained in the LSRCD reservoir.

4.7.1.1.6 Species of Concern - Wildlife, Fish, and Other Aquatic Species

Wildlife Species of Concern. The wildlife species of concern with the highest potential to occur on the CCPA are the burrowing owl, Columbian sharp-tailed grouse, and the Wyoming pocket gopher. Since suitable habitats for the remaining species (northern goshawk, snowy plover, swift fox, and smooth green snake) do not occur on the project area, the likelihood of impacts associated with the Proposed Action is expected to be low. Burrowing owls are typically associated with prairie dog burrows. Burrowing owls may utilize the prairie dog town located within the CCPA, however the total disturbance that would occur is small, therefore the proposed development is not expected to impact burrowing owls. However, if an active burrowing owl nest is found within 0.75 - 1.0 mile of proposed disturbance, construction would be restricted during the critical nesting season. No Columbian sharp-tailed grouse leks are located within 2 miles of the CCPA, and no winter habitat (upland shrub communities and wooded riparian areas) for Columbian sharp-tailed grouse is located on the pod. Therefore, use of the CCPA by Columbian sharp-tailed grouse is unlikely and no impacts are expected. The Wyoming pocket gopher is typically associated with loose gravely soils in greasewood plant communities. Although the Wyoming pocket gopher may be present on the CCPA, the small amount of disturbance associated with the Proposed Action is not expected to significantly impact the species if it is present. Two sagebrush obligate species, Brewer's sparrow and sage sparrow, may be present within the CCPA. Because of the small amount of disturbance associated with the project, their inherent mobility, and the availability of suitable habitats on undisturbed land, the effects on these species should be minimal.

Suitable waterfowl and shorebird nesting sites within the ½ mile of perennial riparian areas found on the CCPA are severely limited and are present only as a result of surface discharge of produced CBM waters. Well developed riparian vegetation occurs along the inflow /outflow stream channel, however the floodplain is only a few feet wide and limited development of the wetland vegetative community associated with the LSRCD reservoir restricts its usefulness as a waterfowl and shorebird nesting and nursery site. Perennial water bodies that support more extensive riparian vegetation probably comprise the bulk of breeding/brood rearing habitat for waterfowl and shorebirds in this region. Therefore, stopovers by migrant groups of waterfowl for feeding and resting is probably the predominant use of the area by waterfowl and shorebird species, and impacts to this use are expected to be minimal.

Two shorebird species of concern (white-faced ibis and long-billed curlew) have been observed in the vicinity of the CCPA. White-faced ibis (*Plegadis chihi*) were observed southwest of the project area in Muddy Creek near Dad, Wyoming in 1988 (one individual) and 1992 (two individuals) (WGFD 2000). Nine other sightings of this species occurred near the northern end of the greater Atlantic Rim project area (WGFD 2001). Additionally, five white-faced ibis were observed in 2001 seven miles northeast of the project area by HWA personnel. In Wyoming, long-billed curlew (*Numenius americanus*) are uncommon summer residents, but may be locally common in suitable habitat (WGFD 1999b). Long-billed curlew have been observed in Carbon and Sweetwater counties (WYNDD 2001) and one was observed approximately three miles west of the greater Atlantic Rim project area (WGFD 2000) and three within six miles of the northen boundary of this area (WGFD 2001). However, none of the observations of these species were reported within five miles of the CCPA.

In summary, only minimal impacts upon the wildlife species of concern would be expected,

provided that avoidance and mitigation measures in this document, the RMP, and the Interim Drilling Policy are followed.

Fish Species of Concern. Development of the LSRCD reservoir and continued flows provided by CBM produced water in the inflow channel for this reservoir may provide some new habitat for fish species within the CCPA. To avoid impacts to downstream fisheries, no downstream discharge from the LSRCD reservoir would occur. Although no downstream flow is planned, limited seepage from the dam does occur, creating a wetted condition in portions of the channel immediately downstream from the dam. The wetted channel results from seepage at the dam's outlet structure and is a pre-existing, localized condition. This site will be closely monitored to identify any increase. If measurable discharge occurs downstream from the dam, it must be reported and a water sample for testing must be collected at the POC. All water reaching the POC must meet the stringent standards of the Double Eagle NPDES discharge permit. Overall, the project is not expected to have a negative impact on fish species of concern found downstream from the CCPA, since all CBM produced water would be contained within the project area.

Other Aquatic Species of Concern. Two species, the northern leopard frog and the Great Basin spadefoot, may exist on the CCPA and could be impacted by increased human activities within the project area, in proportion to the amount of their habitat disturbed or removed. A slight increase in amphibian mortality would be expected from increased traffic within the project area. Additional impacts to these species would be limited, since project-wide mitigation measures including avoidance of wetland/riparian areas (which are essential amphibian habitats) would occur during project implementation.

Development of the LSRCD reservoir and continued flows provided by CBM produced water in the inflow channel for this reservoir may create some new habitat for amphibian species. Overall, the project is expected to result in minimal impacts to amphibian species of concern and may potentially provide some benefits for these species through increased available habitat.

4.7.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.8 RECREATION

4.8.1 Impacts

4.8.1.1 Proposed Action

Impacts to recreation would involve a temporary displacement of some hunters, particularly during construction and drilling. Some hunters perceive these activities as displacing game species and creating an environment that detracts from the hunting experience. Hunter displacement would be highest during the general deer and elk season when the most users are in the area. The proposed drilling schedule would limit displacement to one season. Hunters could relocate to other hunting areas near the CCPA.

Undisturbed landscapes, isolation and solitude are often important to non-consumptive users such

as photographers and back packers. Project related disturbances that adversely impact the characteristic landscape could also contribute to a decline in the recreation experience for these users. There may be some displacement of these users to more pristine landscapes such as the Adobe Town Wilderness study area. The recreation experience for those continuing to use the area would be less satisfying than use under the pre-disturbance conditions described in Chapter 3.

The affects described above would diminish substantially once drilling and construction were completed. However, they would persist at reduced levels. Patterns of game use and population densities would change slightly as a result of the project. Some long term displacement, permanent or relocation, of hunters and non-consumptive users would result from the project. Further, there may be reduced levels of satisfaction for those recreationists who might continue to use the area. Overall impacts to the recreation resource would be minimal due to the short term nature of drilling and construction activities, and concentrated locations of activities. Conversely, fisheries recreation experiences may benefit from the development. Should discharge from the CBM wells produce water of sufficient quality and quantity to fill the LSRCD reservoir, the WGFD may consider stocking fish. If a fishery is feasible, it would result in a beneficial impact in an area with few fishing opportunities.

4.8.1.2 Alternative A - No Action

Under the No Action alternative, similar impacts as described for the Proposed Action are expected to occur, but of a lesser magnitude.

4.9 VISUAL RESOURCES

4.9.1 Impacts

4.9.1.1 Proposed Action

As noted in Chapter 3, Affected Environment, the CCPA is not pristine. Several two-track roads exist throughout the area used by ranchers, recreationists and mineral developers.

Short term impacts to the visual resource associated with construction and drilling in the CCPA would include contrasts in line, form, color, and texture. These contrasts would be associated with drilling rigs, construction equipment, service trailers and the general industrial character of drilling activities. Additional impacts may occur from fugitive dust produced by construction activities.

The CCPA would not be visible from Wyoming State Highway 789 or from the community of Baggs. Potential viewers of the contrasts described would be few in number and would include hunters and other recreationists, ranchers, and oil and gas field workers.

In the BLM's VRM rating system, the severity of impact is related to the scenic quality, sensitivity level, and distance zone of the affected environment. In general, short term impacts would be most severe where the level of contrast is high and highly visible to potentially large numbers of viewers.

The short term impacts would exceed the level of contrast permitted in Class 3 areas; however,

because the contrasts would be seen by relatively few viewers and would be short in duration, they would be considered minimal.

Permanent production facilities, as described in Chapter 2, would remain once well drilling activities were completed. The presence of permanent production facilities would have continued impacts in the long term.

These facilities would create contrasts in line, form, color, texture and overall pattern in the landscape and would remain for the duration of the project. Fugitive dust impacts as part of on-going operations would also persist. However, as noted for short term impacts, these contrasts would not be visible to many viewers. With the application of measures described in Chapter 2, the level of contrast would not exceed Class 3 standards. Levels of contrast would, however, detract from the experience of those recreating in the immediate area.

Additional fixed facilities such as access roads (improved and unimproved roads and overland routes) would be required to service production facilities. Roads would create additional contrasts in line, color and texture to those described above. With appropriate mitigation, the level of contrast would not exceed Class 3 standards. However, contrasts could diminish the experience of motorists and recreationists.

4.9.1.2 Alternative A - No Action

Impacts resulting from the implementation of this alternative would be similar to those described under the Proposed Action, but of a lesser magnitude.

4.10 CULTURAL RESOURCES

4.10.1 Impacts

4.10.1.1 Proposed Action

Direct impacts would primarily result from construction related activities. Activities considered to have the greatest effect on cultural resources include blading of well pads and associated facilities, and the construction of roads and pipelines. Sites located outside the CCPA would not be directly affected by the construction activities. If the area of the site crossed by earth disturbing activities does not possess the qualities that contribute to the eligibility of the site, the project is judged to have no effect. Alteration of the environment abutting eligible historic properties may be considered an adverse effect in the form of a direct impact.

Indirect impacts would not immediately result in the physical alteration of the property. Indirect impacts to prehistoric sites primarily would result from unauthorized surface collecting of artifacts which could physically alter the sites. At historic sites this could include bottle collecting and the introduction of visual impacts.

Contributing segments of historic trails would be avoided by a ¼ mile buffer zone or outside the visual horizon, whichever is closer. These actions are designed to provide protection for the historic trail corridors.

Block surveys have been completed in the CCPA, as required by the Interim Drilling Policy.

Identification of important sites prior to disturbance would minimize impacts to cultural resources. The likelihood exists that buried sites could be disturbed during construction. Implementation of measures described in Chapter 2 would reduce impacts and minimize the loss of information.

4.10.1.2 Alternative A - No Action

Under this alternative, impacts to cultural resources would be similar to those described above, but of a lesser magnitude.

4.11 SOCIOECONOMICS

4.11.1 Impacts

4.11.1.1 Proposed Action

Socioeconomic Impacts of the Proposed Action would be largely positive. The project would enhance regional economic conditions and generate local, state and federal government tax and royalty revenues. The relatively small, short-term drilling and field development workforce would not generate significant demand for temporary housing or local government services.

4.11.1.1.1 Economic and Employment Effects

The Proposed Action as described in Chapter 2 of this assessment would involve capital investment in gas wells, produced water injection wells, gathering systems, compression stations and other field infrastructure. The project would require between 16 and 36 drilling and field development workers over a 30 to 45 day period and one operations worker over a 15 year period (see Table 2-1).

Development and operation of the Proposed Action would require goods and services from a variety of local and regional contractors and vendors, from the oil and gas service industry and from other industries. Expenditures by the proponent for these goods and services, coupled with employee and contractor spending, would generate economic effects in Carbon County, southwest Wyoming and the nation as a whole.

The direct and indirect effects of CBM on the Wyoming economy have not been specifically analyzed. However, the BLM commissioned a study in the mid-1990's to assess the economic effects of a variety of activities which occur on public lands in southeast Wyoming, including oil and gas development. The study, prepared by the University of Wyoming Agricultural Economics Department (UW), estimated that one job (direct and indirect) was created for every 203 million cubic feet (MCF) of natural gas produced in the state, at a gas sales price of $1.30/MCF (University of Wyoming 1997). This ratio yields a peak of about eight direct and indirect jobs associated with the Proposed Action in the second year of production, decreasing to about one job during the fifteenth year of production. Because gas sales prices may be substantially different in the future than in the 1997 study (this analysis uses a range of $3.00 to $2.25/MCF) and the employment, infrastructure and maintenance requirements for CBM are lower than traditional natural gas development, actual employment per MMCF of gas produced from the Proposed Action could be higher or lower than the UW estimate.

Similarly, the UW study found that $1,606 of economic activity was generated in southwest

Wyoming by every MMCF of traditional natural gas production, at a sales price of $1.30/MCF. Using this ratio, total economic activity generated by the Proposed Action would range from a high of about $2.6 million during the second year of production, decreasing to about $188 thousand in the fifteenth year of production. Again, gas sales price estimates used for this assessment are higher than $1.30/MCF, which would tend to push economic activity higher, but the lower labor and development requirements of CBM fields would tend to reduce resultant levels of economic activity per unit of gas produced.

Although the UW study did not specifically address CBM development, it is reasonable to assume that the direct and indirect economic benefits of the Proposed Action would be positive.

4.11.1.1.2 Carbon County Oil and Gas Activity

Successful completion of the Proposed Action would slightly increase natural gas production in Carbon County, particularly during the first several years of production. For example, the Proposed Action would result in an estimated 1.6 MMCF of methane during the second year of production. This is about one percent of total 1999 Carbon County natural gas production. Proposed Action methane production is anticipated to decrease each year thereafter (see Figure 4-2).

In 1999, a total of 127 APD's were issued for Carbon County. The 8 wells associated with the Proposed Action would be about six percent of the 1999 APD level for the county. However, the relatively short drilling time and low infrastructure and labor requirements associated with CBM wells would not result in a substantial increase in drilling activity or drilling employment in the county.

4.11.1.1.3 Effects on Economic Activities in the Vicinity of the Proposed Action

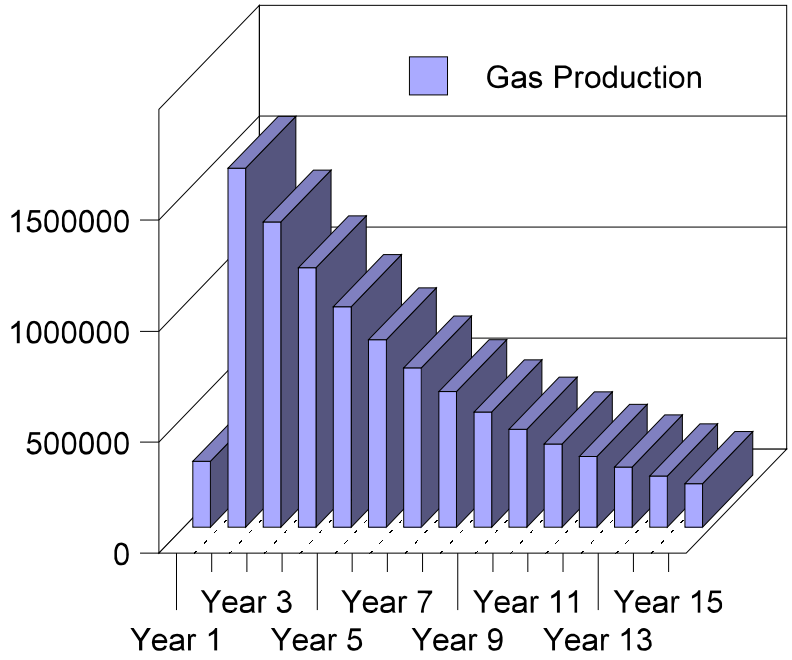
As outlined in Section 3.11, economic activities occurring in the vicinity of the Proposed Action include other oil and gas exploration, grazing, and recreation, primarily hunting.

Properly performed, the pre-construction planning and coordination activities outlined in Chapter 2 would avoid economic effects on other oil and gas interests in the vicinity of the Proposed Action.

Economic effects on grazing activities would include losses of forage due to temporary and long-term disturbance. As described in Section 4.6, temporary disturbance would result in a minor loss of AUM's. A recent UW study estimated that each AUM of cattle grazing was worth $65.07 in total economic impact in the region (UW 2000). Using this estimate, the Proposed Action would result in a loss of $846 in total economic activity during field development, and $260 annually for the life of the project.

According to the recreation analysis conducted for this assessment (see Section 4.8), some hunters and other recreationists may be temporarily displaced from the area associated with the Proposed Action during drilling and field development, and perhaps a lesser number during project operations. The effects of the Proposed Action on the Carbon County hunting and recreation economy are anticipated to be minimal, given the short term nature of the drilling and field development period, the relatively few hunters and recreationists who use the CCPA and the potential that hunters and recreationists may use other areas within Carbon County during this period.

Figure 4-2. Projected Proposed Action-Related Total Annual Gas Production.



Source: PEDCO

4.11.1.1.4 Population Effects

Population effects of the Proposed Action would be minimal. Some of the skills and services required for the Proposed Action are available in the local labor pool, although the recent increase in both conventional and CBM drilling activity in southwest Wyoming has absorbed much of the available oil and gas service workforce. Of the short-term demand for 16 to 36 drilling and field development workers, a portion would likely be contractors from other areas of Wyoming (Rock Springs, Gillette, Casper) and from the Craig area of northern Colorado. The remainder would be hired from the local workforce. Given the short duration of the drilling phase under two months), most non-local workers would be likely to relocate to Carbon County single status, i.e., without family members.

Non-local workers would attempt to obtain temporary housing as close to the work site as possible, most likely in Baggs. Workers not able to secure temporary housing in Baggs might locate in Rawlins, Rock Springs or Craig, Colorado. Given the current level of drilling and field development activity occurring in Wamsutter, it is unlikely that Cow Creek project drilling and field development workers would find temporary housing accommodations in that community.

Given the relatively small workforce and short-term nature of the drilling and field development phase of the Proposed Action, it is likely that area businesses would accommodate the increase in economic activity with existing employees.

For the operations phase, it is assumed that eight total direct and indirect jobs in south west

Wyoming would be generated by the Proposed Action during the peak operations year, decreasing to one job by the fifteenth year. Consequently, the population associated with the operations phase of the Proposed Action would be minimal.

4.11.1.1.5 Temporary Housing Demand

The relatively small Proposed Action-related demand for temporary housing during drilling and field development would be accommodated by existing temporary housing resources. Demand may be accommodated in Baggs, Rawlins, Rock Springs and/or Craig, depending on seasonal considerations and other oil and gas industry activity.

4.11.1.1.6 Law Enforcement and Emergency Response

The relatively small level of field development and operations activity would be accommodated by existing law enforcement and emergency management resources.

4.11.1.1.7 Fiscal Effects

The Proposed Action would generate tax revenues including:

local ad valorem property taxes on production and certain field facilities;
sales and uses taxes to the State of Wyoming, Carbon County and its incorporated municipalities;
mineral royalties to the federal government, a portion of which are returned to the State and local governments; and
state severance taxes.

Ad valorem and severance taxes and federal mineral royalties are calculated using gas prices contained in the January 2001 Wyoming Consensus Revenue Estimating Group (CREG) projections ($3.00/MCF for 2002 and $2.25 MCF thereafter).

4.11.1.1.7.1 Ad Valorem Taxes

The Proposed Action would generate ad valorem property tax to Carbon County, the Wyoming School Foundation Fund, Carbon County Schools and various taxing districts within the county. Ad valorem taxes would be generated from two sources: (1) the fair market value of methane produced and sold; and (2) the value of certain capital facilities within the well fields (all underground facilities associated with wells are exempt by state statute). Well field facilities are depreciated after the first year of production.

Constant 1999 Carbon County mill levies were used to prepare these estimates. In reality some mill levies are set each year by the Carbon County Commissioners, officials of the various special and school districts and the state; 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, therefore the revenues associated with these levies would be received the year following these estimates.

According to estimates provided by the proponent, gas production peaks in the second year of production and declines thereafter over the projected life of the project. Consequently, production-related ad valorem property tax revenues associated with the Proposed Action would be highest

in the third year of production, and diminish annually thereafter.

Under the assumptions described above, ad valorem tax revenues from production and facilities would total $1.4 million over the life of the project, including about $277,000 for the county and its districts based on 12 mills, $23,000 to the weed and pest district based on 1 mill, $1.04 million for schools based on 45 mills (12 for the State School Fund, 6 for the countywide school levy and 27 for the school district levy and other school taxes) and $79,000 for a variety of special districts (museum, cemetery, water conservancy and conservation) based on levies totaling 3.42 mills.

Table 4-1. Estimated Ad Valorem Property Tax Revenues Tax over the life of the Proposed Action.

Carbon County (12 mills)	Weed & Pest (1 mill)	Total Schools (45 mills)	Special Districts (3.42 mills)	Total
$277,000	$23,000	$1,040,000	$79,000	$1,400,000

Source: Blankenship Consulting LLC based on production estimates provided by Double Eagle. All estimates rounded.

4.11.1.1.7.2 Federal 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 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. Actual Mineral Royalty revenues collected would vary based on actual production levels, gas sales prices, and production and transportation costs.

Table 4-2. Estimated Federal Mineral Royalties and Severance Tax over the life of the Proposed Action.

Federal Mineral Royalties	Wyoming Severance Tax
$2,358,000	$990,000

Source: Blankenship Consulting LLC based on production estimates provided by Double Eagle. All estimates rounded.

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 uses revenues from this fund for a variety of purposes (e.g., General Fund, Water Development Fund, Mineral Trust Fund, and Budget Reserve) and returns a portion to counties and municipalities. Estimated severance tax revenues are displayed in Table 4-2. Actual severance tax revenues would vary based on actual production levels, gas sales prices, and 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.

4.11.1.1.7.3 Sales and Use Tax

Wyoming levies a four percent sales and use tax on the gross receipts of tangible goods and certain services (drilling services are exempted). The state returns 28 percent of the revenue (less administrative costs) to the county and municipalities where the taxes were collected. Carbon County also levies a one percent local option sales and use tax which is distributed to the county and its municipalities. A one percent facilities tax, which is used for capital facilities in the county, is set to expire before the Proposed Action would take effect and has not been included in this assessment.

During the field development phase of the Proposed Action, an estimated $438,000 would be spent for goods and services subject to state and local sales and use taxes. This amount would generate about $12,600 for the State of Wyoming and about $9,200 for Carbon County and its municipalities.

4.11.1.1.8 Local Attitudes and Opinions

The 1996 resident survey conducted for the Carbon County Land Use Plan (discussed in Section 3.11.6) did not specifically address CBM development, but it provides a basis for assessing attitudes and opinions about issues associated with the Proposed Action. For example, it is reasonable to assume that survey respondents would have similar attitudes about CBM development activities that are similar to traditional natural gas development activities (i.e., seismic exploration, drilling, field development and production).

However, the importance that survey respondents placed on water conservation and the availability of water to support future land use suggests that the produced water aspects of CBM development could be of concern to them. Successful implementation of the produced water discharge program described in Section 2.1.3.5 may mitigate those concerns.

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, somewhat higher in every community but Rawlins and Saratoga) suggests that development of CBM resources would be generally supported by residents of the Little Snake River Valley, as long as they perceive that such development does not damage water resources or wildlife habitat, or degrade the quality of recreation resources in the area. The conclusions of the analyses conducted for this assessment are that impacts to water, wildlife and recreational resources would not be significant. If these conclusions are correct, the Proposed Action should not generate high levels of dissatisfaction among Carbon County residents. Conversely, if unanticipated impacts to water resources, wildlife habitat or recreation resources occur, resident dissatisfaction with the Proposed Action could be high.

4.11.1.1.9 Environmental Justice

The Proposed Action would not directly effect the social, cultural, or economic well-being and health of minorities or low income groups. The CCPA is relatively distant from population centers, so no populations would be subjected to physical impacts from the Proposed Action.

4.11.1.2 Alternative A - No Action

Implementation of the No Action alternative would result in socioeconomic conditions similar to but less than those described above.

4.12 TRANSPORTATION

4.12.1 Impacts

4.12.1.1 Proposed Action

4.12.1.1.1 Federal and State Highways

The Proposed Action would generate increases in traffic volumes on highways providing access to the project area and on county and operator-maintained roads within the project area. These increases would result from the movement of project-related workers, equipment and materials to and from the project area to perform drilling, field development, well service, field operations and reclamation activities.

Table 2-1 in Chapter 2 shows the estimated average number of trips associated with various well field activities. According to information provided by the proponent, drill rigs, water trucks and other items of heavy equipment would be transported to the CCPA and remain within the project area until drilling is completed. Materials and supplies would be delivered on a weekly basis and stockpiled within the project area at a staging area. Drilling and completion crews and other personnel would commute to the project area daily, except for drilling engineers who would stay at a trailer at the drill site during the work week. Based on these plans and the estimates contained in the table, the Proposed Action would generate between 15 to 20 round trips per day over a 45 day period during drilling and field development. After the drilling and field development phase is completed, Proposed Action-related traffic would average one or two trips per day, with slightly higher peak periods when maintenance activities are performed on wells and facilities.

Based on these assumptions and estimates, the incremental increase in area traffic associated with the Proposed Action would not result in a significant deterioration of level of service for I-80 or SH 789 (Rounds 2000).

Given the relatively small increment of traffic and the relatively short duration of the drilling and field development phase, it is unlikely that the Proposed Action would result in a measurable increase in accident rates on federal and state highways; during the operations phase, the probability of an increase in accident rates attributable to the Proposed Action is negligible.

4.12.1.1.2 County Roads

The Proposed Action would result in increases in traffic on the county roads that provide access to the CCPA (CCR 605 and CCR 608). The relatively small, short-term increases in traffic are unlikely to result in significant deterioration of the roads or substantial increases in accidents. The primary effects of Proposed Action-related traffic on county and BLM roads would be to accelerate road maintenance requirements. The cost associated with accelerated road maintenance requirements on county roads may be offset by the Proposed Action-related revenues generated to county government, which are described in Section 4.11.

Increased traffic would generate an increase in the potential for vehicle/stock accidents, although

the slower speeds required by the condition of county roads tend to minimize the frequency of such accidents (Warren 2000). Coordination with livestock operators during sensitive periods (e.g., cattle movements and calving season) and implementation of measures described in Chapter 2 could further reduce potential for vehicle/stock accidents.

4.12.1.1.3 Internal Roads

Section 2.1.2.1 (Access Road Construction) describes the measure proposed by the proponent to develop the transportation network necessary to access wells and ancillary facilities within the CCPA. Based on these proposals, an estimated 2.3 miles of new roads would be constructed within the project area. The proponent would be responsible for constructing and maintaining new and improved roads within the project area, therefore no fiscal impacts are anticipated for the BLM or Carbon County.

4.12.1.2 Alternative A - No Action

Under this alternative approximately 2.0 miles of road have been previously approved for construction. The implementation of this alternative would require continued use of Federal, State and county roads for access, resulting in similar types of impacts as those described under the Proposed Action, but of a lesser magnitude.

4.13 HEALTH AND SAFETY

4.13.1 Impacts

4.13.1.1 Proposed Action

Health and safety impacts of the Proposed would include a relatively low risk to project workers from industrial accidents, firearm accidents and 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 and a negligible increase during field operations.

Occupational Hazards

Two types of workers would be employed by the Proposed Action: oil and gas workers, who had a 1998 annual accident rate of 4.0 per 100 workers, and special trade contractors, who had a non-fatal accident rate of 8.9 per 100 workers (U.S. Department of Labor, Bureau of Labor Statistics 1998). These rates compare with an overall private industry average for all occupations of 6.2 per 100 workers.

There has been recent concern among CBM drillers that worker safety standards and training used for conventional oil and gas activities may not be appropriate for the CBM industry (Rock Springs Rocket Miner 2001). During 2000, five workers died and six others were seriously injured in CBM-related accidents in Campbell County, Wyoming. The Wyoming OHSA Worker's Safety Division is meeting with CBM company officials to consider changes in worker safety standards and revised training requirements.

During the 45-day drilling and field development phase of the project when a peak of 36 workers may be employed, the statistical probability of injuries is low. During field development, the annual statistical probability of injuries is minimal, given the low level of employment (one worker).

The US BLM, OSHA, USDOT, WOGCC, and OHSA each regulate certain safety aspects of oil and gas development. Adherence to relevant safety regulations on the part of the Proponent and enforcement by the respective agencies would reduce the probability of accidents. Additionally, given the remote nature of the project area 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 line within the project area would increase the chance of a pipeline failure. Accidents rates for gas transmission pipelines are historically low. Nationwide, injuries associated with gas transmission pipelines averaged 14 per year from 1990 through 1996, fatalities averaged one per year and incidents such as ruptures averaged 79 per year (U.S. Department of Transportation 1998). Therefore, the relatively small amount of new pipeline associated with the Proposed Action, coupled with the low probability of failure and the remoteness of the project area would result in minimal risk to public health and safety. Signing of pipeline ROW's 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.

Other Risks and Hazards

Highway safety impacts are discussed in Section 4.12 (Transportation). Sanitation and hazardous material impacts would be avoided or reduced by the implementation of the mitigation measures outlined in Section 2.1.9.2.16.

The potential for firearms-related accidents would occur primarily during hunting season. If drilling and field development occurs during this season the substantial activity in the project area would encourage hunters to seek more isolated areas thus reducing the potential for accidents. During operations, the relatively few personnel on site would result in minimal risk of firearms-related accidents.

The risk of fire in the project area would increase under the Proposed Action. This is an unavoidable impact 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 in increase in risk to area fire suppression personal associated with the Proposed Action.

Based on the foregoing assessment, risks to public health and safety should not increase as a result of the Proposed Action.

4.13.1.2 Alternative A - No Action

Under the No Action alternative, health and safety risks would be the similar to those described under the Proposed Action, but of a lesser magnitude.

4.14 NOISE

4.14.1 Impacts

4.14.1.1 Proposed Action

Noise associated with construction and natural gas production operations can create a disturbance that affects human safety (at extreme levels) or comfort as well as modifies animal behavior. Determining activities that exceed the maximum standards is not a simple issue since perception of sound varies with intensity and pitch of the source, air density, humidity, wind direction, screening/focusing by topography or vegetation, and distance to the observer. Noise levels in excess of the 55 dBA maximum standards can occur at construction and production operations. Under typical conditions, excess levels decline below the level of significance (55 dBA) at 3,500 feet from the source. Construction-related impacts would be short-term, lasting as long as construction activities were ongoing at well sites, access roads, pipelines, and other ancillary facilities such as compressor sites. Noise would be created over a longer term at the individual well sites as a result of production facilities.

Given the low human population densities in the project area, construction and development operations described under the Proposed Action would be sufficiently distant from residences that none would likely be affected by construction or development operations. Overall noise produced by construction and support services equipment during peak activity periods would be moderate because of its dispersed and short-term nature.

4.14.1.2 Alternative A - No Action

Implementation of the No Action Alternative would result in impacts similar to those described under the Proposed Action, but of a lesser magnitude.

4.15 CUMULATIVE IMPACTS

Cumulative impacts are those that would result from the incremental impacts of the Proposed Action when added to past, present, and RFFA's. Reasonably foreseeable development is that development likely to occur within the CCPA, or cumulative impact assessment area (CIA) within the next 5 years. CIA areas vary between resources and are generally based on relevant landscapes, resources, projects, and/or jurisdictional boundaries.

The only major resource development currently proposed near the project area is the exploration activity allowed under the Interim Drilling Policy for the Atlantic Rim Coalbed Methane area. The interim drilling policy allows a maximum of 200 coalbed methane wells within the Atlantic Rim project area, for research and exploratory purposes, during the interim period in which the Atlantic Rim EIS is prepared. Wells will only be allowed in the nine pods the operators have proposed and a maximum of only 24 coalbed methane wells will be allowed within any pod, regardless of multiple

zones to be evaluated. Surface-disturbing activities for these 200 wells may affect an estimated 650 acres, including an estimated 60 miles of new road access (new roads associated with the interim drilling program will likely be in the form of spur roads from the existing road network) and an estimated 100 miles of water and gas flowlines. If productive, and following reclamation, long-term disturbance associated with the 200 well interim drilling program would likely affect an estimated 200 acres for the LOP. Total distance between Pod 1 and Pod 9 is about 40 miles. The distances between the individual pods vary, from 1 ½ miles between pods 2 and 3, to over 6 miles between pods 7 and 8 (see Figure 1-2).

The Cow Creek pod is part of Pod #6 of the 200 well interim drilling program. PEDCO intends to drill 10 wells in the Sun Dog Unit of Pod #6, as part of the interim drilling program. These wells have been analyzed in a separate EA due to development by a separate operator using different methods of water disposal.

Past or existing actions on or in the vicinity of the CCPA that continue today and have major influences on the area include the road network; oil and gas wells; ranching/livestock facilities (i.e. fences, stock watering facilities, ranch houses, power lines, a pipeline etc.); and previously approved CBM wells and associated facilities.

The CIA area for soils, vegetation and wetlands, and water resources is the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim project area. To date, 109 wells have been drilled within this area. Of that total, 59 oil and gas wells have been plugged and abandoned and are probably within various stages of reclamation; 37 oil and gas wells are in various stages of completion, resulting in approximately 337 acres of long-term disturbance (related facilities disturbance included); and 13 CBM and water injection wells, and related facilities, have been drilled, resulting in approximately 13 acres of long-term disturbance. Pods 5, 6, 7, and 8 of the interim drilling program are located within this CIA area and would account for approximately 93 acres of additional long-term disturbance. The existing disturbance of 359 acres resulting from current oil and gas activities, added to the approximate 93 acres associated with the four pods under the 200 CBM well interim drilling program proposed for the Atlantic Rim area totals 452 acres (0.2 percent) of long-term oil and gas related disturbance within the 219,500-acre Muddy Creek CIA area. Within the entire 310,335-acre Atlantic Rim Project Area, a total of 165 wells have been drilled. Of these wells, 80 have been plugged and abandoned and are in various stages of reclamation. The 165 well total includes those wells described within the Muddy Creek watershed.

Table 4-3 provides a summary of the cumulative impacts analysis requirements for each of the resource values in the other eight pods associated with interim development in Pod 6.

4.15.1 Geology/Minerals/Paleontology

Existing, proposed, and reasonably foreseeable actions would not affect landslide deposits and would be unlikely to trigger geologic hazards such as landslides, mudslides, debris flows, or slumps, no incremental increase in cumulative impacts associated with geologic hazards would occur. If the terms of the interim drilling policy are followed and proper well pad and facility siting, construction, and reclamation techniques are used the cumulative impacts to the surface geologic environment would be minimized. Proposed and RFFA's would require the restoration of disturbed lands to predisturbance conditions and as such would minimize topographic alterations. Standard stipulations and project- and site-specific construction and reclamation procedures would be required for additional development on federal lands and these measures would further minimize cumulative impacts of surface geologic environment.

Table 4-3. Cumulative Impacts Analysis Matrix - Cumulative Impacts Associated with the Cow Creek Pod (Pod 6).

RESOURCE VALUE	POD1	POD2	POD3	POD4	POD5	POD7	POD8	POD9	DISCUSSION
Geology	X	X	X	X	X	X	X	X	All wells completed in the Almond Formation of the Mesaverde Group
Air Quality	X	X	X	X	X	X	X	X	All in Laramie Air Basin
Soils	O	O	O	O	X	X	X	0	Limit impact discussion to the Muddy Creek CIA area
Surface water	O	O	O	O	X	X	X	O	Pod 6 located in Muddy Creek CIA area; Pod 6 would have no impacts to other watersheds
Ground water	X	X	X	X	X	X	X	X	Production of ground water for all pods from Almond Formation
Vegetation	O	O	O	O	X	X	X	O	Limit impact discussion to the Muddy Creek CIA area
Range Resources	O	O	O	O	X	X	O	O	Pods 5, 6, 7 in the Doty Mountain Allotment
Wildlife	X	X	X	X	X	X	X	X	Greater sage grouse habitat in all pods, no surface occupancy within 1/4 mile of leks & within greater sage grouse crucial wintering areas. No drilling in prairie dog towns without black-footed ferret clearance
Crucial WR	O	O	O	O	O	X	X	X	Cow Creek & Blue Sky pods - pronghorn CWR; Pods 8 & 9 - mule deer CWR
Recreation	X	X	X	X	X	X	X	X	Minimal displacement of hunters & recreationists
Visual	X	X	X	X	X	X	X	X	Minimal displacement of recreationists
Cultural	O	O	O	O	O	O	O	O	Block surveys required in each pod, with additional mitigation; no cumulative relationship
Socioeconomic	X	X	X	X	X	X	X	X	All pods within the same socioeconomic area
Transportation	X	X	X	X	X	X	X	X	Increased traffic
Health and Safety	X	X	X	X	X	X	X	X	Major related health and safety issues related to travel
Noise	O	O	O	O	O	O	O	O	Localized affect on wildlife

X - Discussed in the EA; O - Not discussed in the EA (no cumulative relationship)

With the exception of CBM, no major surface mineral resources would be impacted by the implementation of the RFFA's. Protection of subsurface mineral resources is provided by the BLM and WDEQ casing and well bore cementing policy.

No cumulative adverse impacts are expected to occur to potential fossil resources beyond those discussed in Section 4.1.1.1 as a result of the Proposed Action in combination with existing, proposed, and reasonably foreseeable actions. Adoption of mitigation measures prescribed in that section could foster cumulative beneficial impacts of the project by either resulting in the discovery of new fossil resources or providing paleontologists with evidence of absence of such resources in the area.

4.15.2 Air Quality

Cumulative impacts from emissions resulting from the implementation of past oil and gas projects and the proposed 200 well program would be much the same as those found on similar oil and gas projects such as Continental Divide. Emissions from oil and gas facilities approved prior to 1999 were included in the 3,000 well air quality analysis prepared for the Continental Divide EIS, of which only 2,130 wells were approved. The emissions from the 200 well interim drilling program would still be covered under the air quality model completed for the Continental Divide project.

4.15.3 Soils

The CIA area for soils includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. Cumulative impacts include soil impacts from on-going exploration and development activities, recently constructed projects, and RFFA's, as described in Section 4.15. Cumulative long-term disturbance of 452 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek Drainage CIA area. This amount of cumulative impacts upon the soil resources would be minimal, provided that all mitigation and avoidance measures are implemented**.**

4.15.4 Water Resources

The water resources CIA area includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. Existing and future disturbance consists of approximately 26.7 acres, or 0.01 percent of the Muddy Creek Drainage CIA area. The area of possible water impacts related to the full development of the local watershed containing the Cow Creek pod is 2,720 acres, or 1.2 percent of the CIA area. This cumulative disturbance would minimally impact surface water or ground-water quantity or quality.

The impacts predicted to occur are based upon the current knowledge of the geology, CBM resources and groundwater hydrology in the area. Both methane and water production rates from future CBM wells, and specifics related to groundwater injection, cannot be accurately predicted. These variables could potentially affect the configuration of field production, gas processing, and gas and water conveyance facilities; however, none of these changes are expected to measurably affect the conclusions presented herein. Federal regulations provide for additional analysis if substantial changes in resource conditions would alter the conclusions reached herein.

Cumulative impacts to surface water resources would be maximized shortly after the start of construction activities, decreasing in time due to reclamation efforts, then stabilizing during the production/operation period when routine maintenance of wells and ancillary facilities takes place.

Additionally, all roads, well locations and facility infrastructure would be regularly inspected and maintained to minimize erosion, sedimentation and surface water quality impairment.

Impacts to groundwater within the project area are not anticipated. The springs in the area are classic "contact" springs which result from permeable rocks overlying rocks of much lower permeability. In the Atlantic Rim project area, the permeable Browns Park Formation overlies the less permeable Almond Formation, which is a member of the Mesaverde Group. Water easily percolates through the Browns Park, and is perched on the lower permeability clay and shales of the Almond. Where this contact is exposed by erosion, a line of springs can result. The source of the springs is infiltrating precipitation, and this source would not be removed by pumpage of the underlying coal seams. For these reasons pumping water from Almond Formation coal seams during exploration drilling within the ARPA would likely have little impact on the ability of these springs to produce water.

Due to thick confining layers, wells completed in water-bearing strata above or below the Almond coal seams are not likely to be impacted. Wells completed in the Almond Formation coal seams in close proximity (less than one mile) to the pod could be impacted.

Cumulative impacts to the groundwater resources within the Mesaverde Group would be limited to a temporary decline in hydrostatic head in coal seams within the Almond Formation resulting from development of the Cow Creek pod and subsequent pods associated with the interim drilling program. For purposes of this EA, existing impacts to groundwater resources within the Mesaverde Group resulting from prior development are so limited as to be non-existent.

Current and future oil and gas exploration and development activities in the project area must comply with federal and state environmental regulations. Therefore, impacts to groundwater quantity or quality on a cumulative scale are not expected. This is particularly true given the fact that wells would be completed in accordance with Onshore Order No. 2 and the recent BLM guidelines that reduce the potential for groundwater contamination.

4.15.5 Vegetation and Wetlands

The CIA area for vegetation and wetlands includes the 219,500-acre portion of the Muddy Creek Watershed which overlaps the Atlantic Rim Project Area. The CIA area includes impacts to vegetation and wetlands from on-going exploration and development activities, recently constructed projects, and RFFA's.

Cumulative long-term disturbance of 452 acres would be approximately 0.2 percent of the 219,500-acre Muddy Creek Drainage CIA area. This amount of vegetation loss would be minimal, provided that all mitigation and avoidance measures are implemented. Water discharged from the leaking well casing (well 1X-12) and additional discharge from CBM wells developed for this project will continue to provide flow in the channel upstream from the LSRCD reservoir. The wetland characteristics associated with perennial stream flow will continue to develop along this section of the stream's course. Additionally, as the LSRCD reservoir ages, wetland characteristics will continue to evolve at this site. This evolution will eventually result in a functional wetland system having hydric soils that will likely support a stable and reasonably well developed emergent and aquatic vegetation community by the end of this project.

The LSRCD reservoir currently exhibits few wetland qualities, although wetland characteristics are expected to develop over the life of the project. Wetlands have the ability to assimilate sediments and pollutants. This ability results in the release of waters having quality that may be much

improved over that entering the wetland. Wetlands also provide habitats for waterfowl and other shore birds, as well as amphibians. The limited number of naturally occurring wetlands within the Muddy Creek CIA will be enhanced by the development of the LSRCD reservoir. Although the LSRCD reservoir was developed for livestock watering and as a catchment basin for discharged water from the Double Eagle 1X-12 well, it may ultimately provide a temporary additional benefit of creating wetland habitat in the arid environment associated with the project area.

The distribution of plant species of concern is likely limited within the Atlantic Rim area due to a lack of suitable habitat for most of the species. The required application of existing FWS and BLM monitoring and mitigation measures is expected to provide adequate protection for threatened, endangered, and special status plant species. Thus, impacts to Special Status Species are expected to be minimal.

4.15.6 Range Resources and Other Land Uses

4.15.6.1 Range Resources

Pods 5, 6, and 7 of the 200 well interim drilling program are located within the Doty Mountain Grazing Allotment. Based on the known LOP disturbance to Pod 6 (including the CCPA and PEDCO's Sun Dog Unit) and an average per pod for Pods 5 and 7, the total LOP disturbance would be approximately 69 acres, as a result of CBM drilling operations on the three pods. The approximate 69 acres of long-term disturbance equates to a reduction of six AUM's (0.09 percent) from the total of 6,974 available, which would be a minimal impact.

4.15.6.2 Other Land Use

Potential cumulative impacts to other land uses are limited to recreation resources and wildlife habitat, which are discussed under the sections dealing with those resources.

4.15.7 Wildlife and Fish

General Wildlife. The CIA area varies with species, as indicated within the respective analyses. The disturbance of wildlife habitat resulting from implementation of the interim drilling program of the nine pods would reduce habitat availability and effectiveness for a variety of common mammals, birds and their predators. Initial phases of surface disturbance would result in some direct mortality to small mammals, displacement of songbirds, along with a slight increase in mortality from increased vehicle use in the areas of the nine pods. Due to the relatively high production potential of these species and the relatively small amount of habitat disturbed (0.006% of the Atlantic Rim project area), small mammal and songbird populations would quickly rebound to pre-disturbance levels following reclamation, and no long-term impacts to these populations are expected.

Although habitat for waterfowl and other shorebirds is limited on the pods, the habitat that exists is often a result of human development creating a surface discharge source from wells or manmade impoundments. As the wetland features evolve, they may provide waterfowl and shorebird nesting and nursery habitat in the future. However, while the developed wetland areas may prove attractive to wildlife, the system is designed to retain produced waters and allow their evaporation and infiltration. As evaporation continues over time, the increasing salt content of these waters may eventually reduce their suitability for waterfowl and shorebird use. Application of mitigation measures for protection of water resources identified in Sections 2.1.9.2.5 and

2.1.9.2.6 in this assessment should prevent any adverse impacts to waterfowl or other shorebirds or their habitat.

Big Game. Activities associated with the construction phase of each of the nine pods in the interim drilling program would likely temporarily displace antelope, mule deer, and elk; however, once construction is completed they would likely habituate and return to pre-disturbance activity patterns. Elk winter range does not occur on any of the pods and should not be affected by project activities. Pronghorn CWR occurs within the Cow Creek and Blue Sky pods; however, no disturbance within the CWR of the Cow Creek pod is proposed. The proportion of pronghorn CWR within the Baggs Herd Unit that would be affected over the short-term and long-term, would be 0.03 and 0.008 percent, respectively. Mule deer CWR occurs on Pods 8 and 9. The proportion of mule deer CWR within the Baggs Herd Unit that would be affected over the short-term and long-term, would be 0.05 and 0.01 percent, respectively. Construction activities on CWR would be limited to May 1 - Nov 14. The performance of proposed actions on the nine pods is not expected to block the movement of big game animals between seasonal ranges. The distance between pods ranges from approximately 1.5 to 5.0 miles. Elk may avoid development areas by ½ mile or line-of-sight. However, big game species will likely habituate to the physical presence of the gas wells and predictable, non-threatening human activity associated with well maintenance (Knight 1981, Segerstrom 1982, Reeve 1984, Easterly et al. 1988). Cumulative impacts on the animal movements are expected to be minimal. Provided that mitigation measures contained in Chapter 2 and the Interim Drilling Policy are implemented, cumulative impacts to big game populations within their respective herd units are expected to be minimal.

Upland Game Birds. Greater sage grouse occupy the area of the nine pods year-round and make seasonal use of the habitats. One crucial winter habitat unit and two leks occur on Pod #1, and a portion of Pod #8 lies within the 1/4-mile radius of a lek. Approximately 11,274 acres (56.4 percent of the total surface area of the nine pods) overlap the 2-mile radius of the historical leks in the area. Therefore, approximately 368 (3.3%) and 113 (1.0%) acres, respectively, of potential greater sage grouse nesting habitat would be affected by short-term and long-term disturbances associated with the production activities. Considering the vast amount of potential nesting habitat available, the 113-acre loss would be minimal. Greater sage grouse within Sierra Madre Upland Game Management Unit (Area 25) would only be minimally impacted from the cumulative LOP-200-acre disturbance associated with the Proposed Action of the nine pods, provided the implementation of interim drilling guidelines, seasonal restrictions, reclamation, and mitigation measures provided are followed.

Raptors. Although no active raptor nests were located on the nine pods during 2001 aerial surveys, implementation of protection measures identified in Chapter 2, Section 4.7.1.1.4, and the IDP are expected to protect the raptor populations within the 9-pod interim drilling area. Therefore, only minimal cumulative impacts to raptors within Muddy Creek Watershed are likely to occur.

Black-footed Ferrets. Acreages and burrow densities that are adequate to support black-footed ferrets (200 or more acres with 8 or more burrows per acre) occur on three of the pods on the project area (Cow Creek, Sun Dog and Blue Sky). Black-footed ferret surveys have been conducted on two of these pods and no ferrets or ferret sign were found. The Sun Dog pod was surveyed in October of 2000 and September of 2001. Blue Sky pod was surveyed in August of 2001. Because of the fact that black-footed ferret surveys are required (per interim drilling guidelines) on all prairie dog towns to be disturbed that can support a ferret, no impacts to this species are expected as the result of the proposed 200 well interim drilling activities.

Fish. Four sensitive fish species have the potential to occur downstream in the Muddy Creek

watershed seasonally for spawning and/or rearing, and the Little Snake River. Three of the four sensitive species (roundtail chub, bluehead sucker, and flannelmouth sucker) are documented to occur within the Muddy Creek watershed, approximately seven miles downstream from the project area. Additionally, Colorado River cutthroat trout are known to occur farther downstream in the Little Snake River. Four endangered species (Colorado pikeminnow, bonytail chub, humpback chub, and razorback sucker) may also potentially occur downstream in the Little Snake River, but it is highly unlikely. Thus, suitable habitat for spawning, age-0, juveniles, and adults of each of these species may be present in both the Muddy Creek watershed and the Little Snake River, both of which are within the zone of downstream influence of waters produced on the CCPA.

Permitted disturbances associated with the exploratory CBM pod development and other development within the Muddy Creek watershed would employ erosion control measures and construction techniques suitable to limit offsite soil movement and downstream degradation of fisheries habitat due to sediment inputs. Similar measures to prevent offsite movement of disturbed soils caused by construction activities (WDEQ 2001) and prevent organic fluid spills from entering water courses and reaching fish producing waters will ensure implementation of the proposed action is not likely to adversely effect sensitive fish species in Dry Cow Creek, farther downstream in Muddy Creek, or in the Little Snake River. Crossings of any streams having potential to support sensitive fish species will be designed to allow migratory passage following methods identified by Watts (1974). In addition, any stream crossings of the downstream section of Muddy Creek, constructed to access the project area, would be located and constructed to ensure passage for upstream spawning migrations of these sensitive native fishes. All crossing construction would be limited to no-flow periods for ephemeral or intermittent drainages. Additionally, crossing designs would be approved by a BLM fishery biologist prior to installation.

Water used in drilling and construction activities would be obtained from deep wells drilled into aquifers that are geologically isolated from the Little Snake River and not generally associated with surface water expression in the Muddy Creek watershed. Thus, “contact” between the surface springs and deep water aquifers planned for use during this project is not anticipated. Therefore, no surface water depletions that would affect sensitive, threatened, or endangered fish species would occur. If the Proposed Action leads to surface water depletion in either Muddy Creek or the Little Snake River (perennial tributaries to the Colorado River falling under the Colorado River Compact), adverse impacts to the sensitive species may occur, and potential impacts to the four downstream Endangered species would require the initiation of consultation with the FWS.

The proposed development in the pod is not expected to result in reductions in sensitive, threatened, or endangered adult fish numbers, nor their exclusion from, or degradation to their spawning areas within the Muddy Creek watershed or in downstream waters of the Little Snake River. Permitted disturbances associated with the exploratory CBM pod development and other development within the Muddy Creek watershed would employ erosion control measures and construction techniques suitable to limit offsite soil movement and downstream degradation of fisheries habitat due to sediment inputs. Similar measures are anticipated to avoid onsite organic compound spills and to prevent them from entering ephemeral drainages and being carried downstream to fish producing waters.

Development of the LSRCD reservoir and continued flows provided by CBM produced water in the inflow channel for this reservoir may provide some new long-term habitat for fish species within the CCPA. To avoid impacts to downstream fisheries, no downstream discharge from the LSRCD reservoir would occur. Although no downstream flow is planned, limited seepage from the dam does occur, creating a wetted condition in portions of the channel immediately downstream from the dam. The wetted channel results from seepage at the dam’s outlet structure and is a pre-

existing, localized condition. This site will be closely monitored to identify any seepage increase. If measurable discharge occurs downstream from the dam, it must be reported and a water sample for testing must be collected at the POC. All water reaching the POC must meet the stringent standards of the Double Eagle NPDES discharge permit. Overall, the project is not expected to have a negative impact on fish species of concern (sensitive, threatened, or endangered) found downstream from the CCPA, since all CBM produced water would be contained in the LSRCD reservoir.

Overall, impacts upon sensitive, threatened, or endangered adult fish numbers are expected to be minimal, provided that mitigation measures contained in this document, the RMP, and the Interim Drilling Policy are implemented. Additionally, the required application of existing FWS and BLM monitoring and mitigation measures to the proposed CBM interim drilling program is expected to provide adequate protection for sensitive, threatened, endangered, and special status species.

4.15.8 Recreation

BLM does not have statistics on historical use of the project area by recreation category which could be used to determine trends in cumulative impacts on recreation use and displacement. Cumulatively, overall impacts to the recreation resource are expected to be minimal with some temporary displacement of hunters and recreationists during the short-term drilling periods. Some long-term displacement of hunters and non-consumptive users may occur, and there may be reduced levels of satisfaction for those who might continue to use the area. Some long-term benefits for recreation may be realized within the CCPA as well, since the LSRCD reservoir is planned to provide a long-term recreational fishery.

4.15.9 Visual Resources

As discussed in Chapter 3, existing visual qualities in the CCPA and adjacent lands have already been affected by ongoing natural gas development, including road building and pipeline construction. Existing, proposed, or reasonably forseeable development would add to the level of impact to visual resources in the immediate area. The composite experience of those traveling through the area, particularly on back roads, is one of a modified landscape. Contrasts in line, form, color and texture from development activities begin to dominate the viewers experience. These conditions would increase the likelihood that viewers, particularly back country recreationists, would be dissatisfied with the visual component of their recreation experience. However, the cumulative impact of existing, proposed, or reasonably forseeable development on visual resources would still be consistent with the current VRM Class 3 designation with implementation of mitigation measures proposed by Double Eagle in Chapter 2.

4.15.10 Cultural Resources

Cultural resources on public lands, including archaeological sites and historic properties, are protected by federal law and regulations. Current CBM operations must comply with these protective regulations, and BLM has required the completion of cultural resource inventories prior to surface-disturbing activities. These inventories have been used to identify sites potentially

eligible for inclusion on the National Register of Historic Places and to identify sites which BLM has required past exploration and development activities to avoid.

Because Class III cultural resource inventories have been completed on the CCPA, the potential for increased impacts on cultural artifacts would be minimized. By avoiding known cultural and historical sites during the layout of drill sites, access roads, and pipeline corridors, the potential for incremental increases in cumulative impacts would be avoided. Completion of cultural resource inventories would have a beneficial, cumulative impact on the level of cultural information about the project area. Some unintentional damage to subsurface resources could occur during grading or excavation activities. However, implementation of resource protection and mitigation measures described in Chapter 2, Section 2.1.8.2.15 would protect such resources upon discovery.

4.15.11 Socioeconomics

Southwest Wyoming is currently experiencing an increase in the pace and level of natural gas development. Drilling and field development is occurring in areas near the CCPA including Continental Divide/Wamsutter II, South Baggs, Mulligan Draw, Creston/Blue Gap, Hay Reservoir and potentially, Desolation Flats. While this surge in development will result in increased employment, income and tax revenues in the region, it will also result in increased housing demand and increased demand for local and state government facilities and services. Rawlins is also experiencing some growth associated with the opening of a new prison facility.

Communities such as Rawlins and Rock Springs are still below peak population levels of the 1980's and have infrastructure and housing to accommodate some population growth. Smaller communities near the CCPA, such as Wamsutter, are struggling to accommodate population growth associated with development of the currently approved natural gas fields identified above.

Neither the relatively small, short-term drilling and field development workforce or the minimal operations employment and activity associated with the existing, proposed, or reasonably forseeable development would add appreciably to cumulative housing and local government service demand in the area. Drilling and field development associated with these activities would be completed some time before the initiation of the proposed Atlantic Rim CBM project.

If the current accelerated pace of drilling and field development in southwest Wyoming continues, the potential for degradation of the quality of recreation resources in the area would increase. If Carbon County residents perceive that degradation of recreation resources has occurred, levels of dissatisfaction among some residents and area visitors would correspondingly increase.

4.15.12 Transportation

Increased oil and gas development in western Carbon County and eastern Sweetwater County will result in increased traffic on affected segments of I-80 and WSH 789. The condition of these highways is adequate to accommodate existing levels of traffic and some increases (Rounds 2000).

Currently known cumulative impacts on CCR 605 and CCR 608 would be limited to grazing and recreation activities described in Chapter 3, and occasional traffic associated with oil and gas exploration activities. The increased traffic associated with drilling and field development of the interim drilling program would accelerate maintenance requirements; however, associated costs may be offset by project-related revenues generated, which are described in Section 4.11.

4.15.13 Health and Safety

Cumulative health and safety impacts would be limited to those associated with the 200 well interim drilling proposal and existing grazing and recreation activities. Occasional traffic and activity associated with oil and gas exploration activities would generate small increases in risks to project workers and the public. Cumulative impacts to health and safety conditions are anticipated to be similar to those described for the Proposed Action.

4.15.14 Noise

Noise would result from on-going construction, drilling, and CBM operations during the life of the project. Increased traffic on existing transportation system roads within the project area would occur, thus adding to existing traffic noise. Given the current and anticipated low traffic volumes, and dispersed nature of traffic and CBM operations within the CCPA, the projected additions to cumulative, traffic-related noise impacts would be minimal.