CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter discloses the potential environmental consequences that may result from implementing the Proposed Action or Alternative 1 (No Action Alternative), 2, or 3. The effect or impact a consequence would have on the quality of the human environment is also discussed. For instance, the consequence of an action may be to greatly increase the number of roads in an area. If the number of roads in an area is increased, opportunities for road-based recreation would be increased but opportunities for primitive recreational activities and solitude would be decreased. Evaluation of the impact would depend on an individual's (or a group's) preferred use of that area.

If the West Hay Creek LBA tract is leased to the applicant as a maintenance tract under the Proposed Action, the permit area for the adjacent Buckskin Mine would not have to be amended to include the new lease area before it could be disturbed by mining activities. If all of the additional lands being considered for leasing under Alternative 2 are included in the tract, additional lands would need to be amended to the current permit area to establish layback areas, allow for highwall reduction, and other mine-related activities (construction of diversions, flood and sediment control structures, roads, and stockpiles). Table 4-1 shows the area to be mined and disturbance area for the existing Buckskin Mine (which represents the No Action Alternative), and how the mine area would change under the Proposed Action, Alternative 2, and Alternative 3. Portions of the LBA tract that are contiguous to the existing leases will be disturbed under the current mining plans in order to recover the coal in the existing leases. The environmental consequences of implementing the Proposed Action, Alternative 2, or Alternative 3 would be similar in nature; but, the Proposed Action would have less impact because it would disturb a smaller area than Alternatives 2 or 3.

Surface mining and reclamation have been ongoing in the PRB for over two decades. During this time, effective mining and reclamation technologies have been developed and continue to be refined. Mining and reclamation operations are regulated under SMCRA and Wyoming statutes. WDEQ technically reviews all mine permit application packages to ensure that the mining and reclamation plans comply with all state permitting requirements and that the proposed coal mining operations comply with the performance standards of the DOI-approved Wyoming program. BLM attaches special stipulations to all coal leases (appendix D), and there are a number of federal and state permit approvals that are required in order to conduct surface mining operations (appendix A). The regulations are designed to ensure that surface coal mining impacts are mitigated. The impact assessment that follows considers all measures required by federal and state regulatory authorities as part of the Proposed Action and alternatives.

TABLE 4-1
COMPARISON OF EXISTING AND PROPOSED DISTURBANCE

	No Action Alternative (existing leases)	Proposed Action	Alternative 2	Alternative 3
Additional lease area (acres)	C	838.1	1,014.3	869.3
Total lease area[1]	4,949	5,787.6	5,96. 5,963.8	5,818.8
Increase in lease area	---	16.9%	20.5%	17.6%
Estimated total disturbance area (acres)[2]	5,099	5,929	6,089	5,929
Increase in estimated disturbance area	---	16%	19%	16%
Estimated recoverable coal remaining as of 1/2001[3] (mmt)	434	564	584	564
Increase in estimated recoverable coal as of 1/2001	---	30%	35%	30%

[1]Includes federal coal leases only; does not include state and private coal within the permit area.

[2]The area to be mined plus area disturbed for mine facilities, access roads, haul roads, railroad facilities, and stockpiles. For the Proposed Action and alternatives, disturbance is estimated based on the portion of boundary outside the current affected area boundary, plus lease acreage area, plus 20 acres for disturbance of fee coal in the N½SW½SE½ of section 17, plus a 500-foot buffer around the northern and western perimeters.

[3]Extractable coal tons x recovery factor. For the West Hay Creek LBA tract, extractable coal = 145 millions tons (Proposed Action), 165 million tons (Alternative 2) or 145 million tons (Alternative 3) and Triton's estimated recovery factor of 90 to 92%, based on historic operations. Table 2-1 in chapter 2 contains additional information on extractable coal and recoverable coal.

DIRECT AND INDIRECT IMPACTS OF THE PROPOSED ACTION

Impacts can range from beneficial to adverse, and they can be a primary result of an action (direct) or a secondary result (indirect). They can be permanent, long-term (persisting beyond the end of mine life and reclamation), or short-term (persisting during mining and reclamation and through the time the reclamation bond is released). Impacts also vary in terms of significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

Topography and Physiography

Surface coal mining would permanently alter the topography of the LBA tract, if it is leased. Topsoil would be removed from the land and stockpiled or placed directly on recontoured areas. Overburden would be blasted and stockpiled or placed directly into the already mined pit and coal would be removed. The existing topography on the LBA tract would be substantially changed during mining. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. If necessary, Hay Creek would be diverted into temporary channels or blocked to prevent pits from being flooded.

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography of the West Hay Creek LBA tract ranges from relatively flat to gently rolling hills, with an average slope of about seven percent. As a result, the expected post-mining topography would be gentler and more uniform than the pre-mining topography. Following reclamation, the average surface elevation would be approximately 75 feet lower due to coal removal. (The removal of the coal would be partially offset by the swelling that occurs when the overburden and interburden are blasted and removed.) The land surface would be restored to the approximate original contour or to a configuration approved by WDEQ/LQD when the mining and reclamation permit for the existing mine is revised to include coal removal from the LBA tract. .

Direct adverse impacts resulting from topographic moderation include a reduction in microhabitats (cutbank slopes) for some wildlife species and a reduction in habitat diversity, especially in slope-dependent shrub communities and associated habitat. A potential indirect impact may be a long-term reduction in big game carrying capacity. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and result in a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur as a result of higher near-surface bulk density of the reclaimed soils. It may also increase vegetative productivity, and potentially accelerate recharge of groundwater. The approximate original drainage pattern would be restored, and stock ponds and playas would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would adequately support anticipated land use.

These impacts are occurring on the existing Buckskin Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action or Alternatives 2 or 3, the approximate area that would be permanently topographically changed would increase as shown in table 4-1.

Geology and Minerals

Within the West Hay Creek LBA tract, mining would remove an average of 204 feet of overburden, 15 feet of interburden, and 106 feet of coal on about 838 acres under the Proposed Action. Mining would remove an average of 195 feet of overburden, 18 feet of interburden, and 105 feet of coal on about 1,014 acres under the Alternative 2 tract configuration. Under Alternative 3, mining would remove an average of 205 feet of overburden, 15 feet of interburden, and 106 feet of coal on about 869 acres. Results are similar between Proposed Action and alternatives because of the similarity in boundary configurations.

These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternatives 2 and 3. Table 4-2 compares the estimated coal, overburden, and interburden thicknesses for the existing Buckskin Mine lease area with estimated coal, overburden, and interburden thickness for the West Hay Creek LBA tract as applied for, and Alternatives 2 and 3.

TABLE 4-2
COMPARISON OF COAL, OVERBURDEN, AND INTERBURDEN THICKNESSES

	No Action Alternative (existing leases)	Proposed Action (as applied for LBA tract)	Alternative 2	Alternative 3
Average Overburden Thickness (feet)	198	204	195	205
Average Coal Thickness (feet)	105	106	105	106
Average Interburden Thickness (feet)	22	15	18	15

The replaced overburden and interburden would be a relatively identical (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 230 feet thick under the Proposed Action and Alternatives 2 and 3. Approximately 130 million additional tons of coal would be recovered under the Proposed Action, compared to 150 million tons under Alternative 2, or 130 million tons under Alternative 3.

The geology from the base of the coal to the land surface would be permanently changed on the LBA tract under the Proposed Action or the alternatives. The subsurface characteristics of these lands would be radically changed by mining. The replaced overburden and interburden (spoil) would be a mixture of the geologically distinct layers of sandstone, siltstone, and shales that currently exist. The resulting physical characteristics would also be significantly altered.

Drilling and sampling programs are conducted by all mine operators to identify overburden material that may be unsuitable for reclamation (material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high concentrations of certain constituents such as selenium or adverse pH levels). As part of the mine permitting process, each mine operator develops a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. Each mine operator also develops backfill monitoring plans as part of the mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing Buckskin Mine and would be developed for the West Hay Creek LBA tract if it is leased.

During mining, other minerals present on the tract could not be developed but some could be developed after mining. There are no conventional oil and gas wells within the LBA tract. Therefore, options such as plugging during mining and reestablishing after mining or establishing a value for the remaining reserves are not an issue at this time.

Coal mining affects CBM development by removing the coal in which the CBM resource occurs. CBM resources that are not recovered before mining would be irretrievably lost when the coal is removed. Seam dewatering in advance of mining also draws down coal seam water levels and reduces the hydrostatic pressure, which may allow CBM to desorb and escape from the coal bed. As discussed in chapter 3, there were seven wells completed on the LBA tract as of October 28, 2002 that were capable of production, and there are 15 remaining undrilled 40-acre spacing units on the LBA tract. CBM could be produced from the existing wells, and other wells could be drilled during the time it takes to lease and permit the LBA tract and, on a case by case basis, until mining activity approaches each well.

For the purposes of this draft EIS, the BLM's Wyoming State Office, Reservoir Management Group (WSO-RMG) reviewed the existing CBM resource and production data in this area. A limited amount of production data is available to estimate well life and reserves for existing or future CBM wells in the West Hay Creek LBA area. The majority of CBM wells in the area do not have enough production history to support production decline curve analysis. A few wells in the township do exhibit sustained decline rates and are suitable for this purpose. These include several wells located in section 18, T. 52 N., R. 72 W., where the LBA is located. These wells were used to develop a model production decline curve which can be used for generalized production and reserve forecasts.

The model decline data suggest that typical CBM wells located in much of this area might be expected to ultimately recover approximately 132,000 mcf of producible reserves. A typical economic well life might be approximately six years. Because of the complexity of CBM occurrence and reservoir character and performance, along with the uncertain extent of seam dewatering due to mining and CBM production, these forecasts may overestimate CBM resources within the LBA tract. Decline curve analysis based solely on the wells located in section 18, where dewatering has occurred, project recoverable reserves of approximately 54,800 mcf per well and an approximate 2.5-year economic well life. While still economic, these reserves are substantially less than the projected reserves for other parts of the township. The lower forecasts may be most representative of the CBM reserves within the West Hay Creek LBA. Based on the reserve estimates derived from this decline curve analysis, the entire LBA parcel could be expected to contain an estimated 1.205,732 mcf of producible reserves in twenty-two 40-acre spacing units.

CBM resources or initial gas in place can also be estimated using volumetric methods. The WSO-RMG has prepared detailed CBM resource analyses in support of coal leasing actions and other program activities at other localities in the PRB mining area. Coal seam gas-in-place depends on a number of factors, including coal rank, coal lithology and, significantly for the purposes of these analyses, methane adsorptive capacity of the coals in question. Methane adsorption analyses describe the volume of methane that can be adsorbed by a specific sample of coal across a varying range of temperature and pressure conditions. This pressure/volume relationship can be represented by an equation and curve known as an adsorption isotherm, which can be used to predict gas content based on pressure. Although gas content can vary widely from sample to sample depending on other properties of the coal, the adsorption data provide a generalized means of predicting coalbed methane adsorptive capacity, or potential initial gas in place, based on pressure.

The WSO-RMG has developed preliminary CBM reservoir models based on these principles to estimate CBM gas content and in-place resources in the mining areas and elsewhere in the Powder River Basin. These analyses use a variety of data including methane adsorption data collected cooperatively by BLM's WSO-RMG and the USGS, coal geology from publicly available coal drill holes and hydrologic data from groundwater monitoring wells reported to the public by the Gillette Area Groundwater Monitoring Organization (GAGMO). Only publicly available data sources were used to prepare this report.

Some uncertainty exists in the GAGMO water monitoring data and the estimated hydrostatic pressures in this area because specific premining water levels were not available. GAGMO estimated 1980 water levels in this area from an unspecified 1980 water level map (reference not provided) rather than actual monitoring well measurements. As a result, the initial pressures based on the 1980 water level, and the derived change from 1980 to 2000 could be in error. The latest data publicly available from GAGMO is for the year 2000. These measurements were used to represent current conditions even though groundwater drawdown has continued since that time.

These uncertainties notwithstanding, the data and model were used to calculate and map estimated coal gas content (in standard cubic feet per ton) across T. 52 N., R. 72 W. and the West Hay Creek LBA area. Premining (1980) and current (year 2000) calculations and maps were made to evaluate the original and current reservoir conditions and the effects over time. Average current gas content was estimated for the LBA tract from the 2000 gas content map. An estimate of CBM gas-in-place was prepared using the coal reserves (in tons) reported in the LBA application and the estimated coal gas content (standard cubic feet per ton) for the tract.

The weighted average current gas content for the LBA parcel was estimated to be 11.74 scf/ton and average initial gas content in 1980 was estimated to be 13.65 scf/ton. The proposed LBA parcel contains an estimated 145 million tons of coal in place. Based on these values, total current CBM gas-in-place for the LBA tract is estimated to be 1,702,300 mcf. Initial (1980) gas in place is similarly estimated to be 1,979,250 mcf. This estimate compares favorably with the recoverable reserves estimate using decline curve analysis. However, the reserves projected by both methods are estimates and are subject to a number of remaining uncertainties in assessing CBM resources.

Implicit in this analysis is the observation that coal mining and mine-related dewatering affects CBM resources and development potential. Water production from the coal seams is required to reduce hydrostatic pressure in the coal seams so that methane can desorb from the coals for production. Mine-related dewatering of the coal seams has the same effect of reducing hydrostatic pressure and methane desorbtion. The preliminary CBM reservoir models indicate that depletion of the hydrostatic pressures and methane resources has occurred adjacent to mining areas since not long after mining began.

Based on the methane adsorption/pressure analyses, the preliminary model shows that 10% to 20% of the original in-place CBM resources in the West Hay Creek LBA area have been depleted since 1980. This effect will be enhanced as mining proceeds toward the LBA area and will continue whether or not the LBA is leased or mined. The short productive life inferred for CBM wells in the LBA suggests that, if wells were completed and produced in the near future, substantial portions of the remaining CBM reserves could be produced before mining occurs within the LBA.

Soils

Under the currently approved mining and reclamation plan, approximately 5,099 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Buckskin Mine (table 4-1). Disturbance related to coal mining would directly affect an additional 830 acres of soil resources on and adjacent to the LBA tract under the Proposed Action, up to 990 acres under Alternative 2, or 830 acres under Alternative 3. The reclaimed soils would have different physical, biological, and chemical properties than the premining soils. They would be more uniform in type, thickness, and texture. Average topsoil thickness would be 14 to 18 inches across the entire reclaimed surface. Soil chemistry and soil nutrient distribution would be more uniform, and average topsoil

quality would be improved because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land. The replaced topsoil would support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

Specific impacts to soil resources would include an increase in the near-surface bulk density of the reclaimed soil resources. As a result, the average soil infiltration rates would generally decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation would potentially decrease runoff, which would tend to offset this potential increase in runoff due to decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering action would form new soil structure in the reclaimed soils, and infiltration rates would gradually return to premining levels. The reclaimed landscape would contain stable landforms and drainage systems that would support the postmining land uses. Reconstructed stream channels and floodplains would be designed and established to be erosionally stable.

Direct biological impacts to soil resources would include a short-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts for soil resources that are stockpiled before placement.

Sediment control structures would be built to trap eroded soil; revegetation would reduce wind erosion. Soil or overburden materials containing potentially harmful chemical constituents (such as selenium) would be specially handled. These measures are required by state regulations and are considered part of the Proposed Action and alternatives.

Air Quality

This section deals with how the air quality impacts related to mining the LBA tract would be expected to differ from air quality impacts associated with existing approved mining in this area. For the purpose of impact assessment, mining the West Hay Creek LBA tract is considered to be a logical consequence of leasing the tract. Thus, it is actually the impacts of mining on ambient air quality that are addressed in this section. The impacts of mining the tract, in conjunction with other activities, on air quality in the area are addressed in the “Cumulative Impact Section” in this chapter.

As discussed in chapter 3, a Wyoming air permit application is required to demonstrate that BACT is used to control emissions, and that the proposed activities will not cause or significantly contribute to the ambient air quality standards being exceeded. The demonstration of compliance is typically made with emission inventories and dispersion modeling. Impacts to air quality from mining the West Hay Creek LBA tract can be inferred from the impact demonstrations for currently permitted mining in the vicinity. Impacts would primarily result from emissions of particulates and NO_2.

Particulates include solid particles and liquid droplets that can be suspended in air. Historical regional and site-specific particulate levels are discussed in chapter 3. Particulates, especially fine particles, have been linked to numerous respiratory-related illnesses and can adversely affect individuals with pre-existing heart or lung disease. They are also a major cause of visibility impairment in many parts of the United States. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes. As discussed in chapter 3, PM_{10} is currently the regulated particulate pollutant in Wyoming. PM_{10} is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems

NO_2 is a product of incomplete combustion at sources such as gasoline and diesel burning engines or from mine blasting activities. Gaseous NO_2 is reddish-brown, heavier than air, and has a pungent odor. It is highly reactive and combines with water to form nitric acid and nitric oxide. "Nitrogen dioxide gas may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes and skin" (EPA 2001). Acute exposure may cause death by damaging the pulmonary system. "Chronic or repeated exposure to lower concentrations of NO_2 may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections" (EPA 2001).

There is no NAAQS for NO_2 for periods shorter than one year. Concern about the potential health risk associated with short-term exposure to NO_2 from blasting emissions prompted a study conducted in August 1999 and completed in April 2000 by the WMA with participation from the WDEQ/LQD and WDEQ/AQD.

The study involved collection of 15-minute average NO_2 concentrations in areas accessible to the public near PRB coal mining operations. It was designed to help evaluate possible exposure of the public to NO_2 emissions resulting from blasting activity at surface coal mines. Six monitor locations were selected "…based on their proximity to mining activity and accessibility to the public. Roads adjacent to mining activity were felt to be areas where the public exposure would most likely occur. Locations were also chosen based on dominant wind direction, and to represent areas having the greatest chance of being impacted by several mining operations" (WMA 2000).

The report presents ambient NO_2 concentrations in the vicinity of the mines, associated blasting information, meteorological data as well as why certain decisions were made in the design of the study. A brief summary of the findings follows.

- Approximately 95% of the valid data points were readings of 0 ppm (0 $\mu g/m^3$) NO_2.

- The maximum 15-minute average valid values observed for each of the six monitors ranged from 0 to 1.65 ppm (0-3,102 $\mu g/m^3$) NO_2.

- Where readings greater than 0 ppm did occur there was a strong correlation between NO_2 readings and temperatures. This correlation indicates that the NO_2 readings may have been inflated due to temperature considerations.

NIOSH, OSHA, and EPA short-term exposure criteria help put these numbers into perspective. NIOSH's recommended "immediately dangerous to life and health" level is 20 ppm (37,600 µg/m^3). OSHA's short-term exposure limit, a 15-minute time-weighted average, is 5 ppm (9,400 µg/m^3). The EPA's significant harm level, a one-hour average, is two ppm (3,760 µg/m^3). However, according to EPA "…the exact concentrations at which NO_2 will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response" (EPA 2001).

There are no state or federal rules that declare the public or employees must stay back a certain distance from mine blasting operations in order to limit their exposure to NO_2. Pursuant to an order by the WDEQ, a study was developed to assist the WDEQ establish a safe setback distance from blasting operations at PRB mines. The study, co-sponsored by all of the coal mining companies in the PRB, was overseen and compiled by McVehil-Monnett Associates, Inc. of Englewood, Colorado. The analysis was released in July 2002, and it was based on the results of 76 mine blasts fully measured by Thunder Basin Coal Company (TBCC) at the Black Thunder Mine over a 14-month period of time. The measurements were used to develop a formula to calculate safe setback distances for varying amounts of explosives, wind speeds, and type of blast (coal, overburden conventional, or overburden cast). According to the study, a minimum setback distance of 750 feet (coal) to 1,000 feet (overburden) will protect the public from exposure to NO_2 *(The Sheridan Press* 2002).

The analysis released in July 2002 also included a toxicological study by Dr. Edward Faeder, consultant to TBCC, on human health impacts from short-term exposure to NO_2. In reviewing this study, EPA expressed significant concern with this report (EPA 2002a). According to EPA's review, Dr. Faeder's report recommends that a 10-minute exposure to a level of 5 ppm would be "protective of even sensitive subsets of the normal population if the exposure frequency is 1-3 times a year," while EPA's professional judgment is that "if a concentration of 0.5 ppm were not exceeded, healthy persons would not experience adverse health effects and the most sensitive persons would probably not experience adverse health effects from NO_2." The National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances has recommended that the Wyoming Environmental Quality Council consider a 10-minute exposure to a level of 0.5 ppm as a Level 1 exposure. A Level-1 exposure level is one that would likely result in reversible physical effects *(Casper Star Tribune* 2003a).

Air quality impacts from the Proposed Action, Alternative 2, and Alternative 3 would not be expected to be substantially different. As shown on table 2-1 in chapter 2, if the West Hay Creek LBA tract is leased and mined as proposed, Triton estimates that annual production at the Buckskin Mine would be 25 million tons for an additional 5 or 6 years under the Proposed Action and Alternatives 2 and 3. If the West Hay Creek LBA tract is not leased (the No Action alternative), post-2002 coal production is expected to be 25 mmtpy for about 12 years. In 2000, the Buckskin Mine produced 15.8 million tons; in 2001 the mine produced approximately 19.1 million tons.

PM_{10} and TSP data collected from 1995 through 2001 at air quality monitoring stations located upwind and downwind of the Buckskin Mine are shown in figure 3-6 in chapter 3. These data indicate that the average annual TSP levels at both the predominantly upwind and predominantly downwind sites did not exceed the TSP standard from 1995 through 1999, nor was the current PM_{10} standard exceeded during that time.

WDEQ/AQD issued an air quality permit (MD-707) for the Buckskin Mine on February 15, 2002. This air quality permit authorizes a maximum coal production rate of 27.5 mmtpy and, is based on the results of computer modeling that predicted no violation of air quality standards, and demonstrated that emissions would have no significant cumulative effect when added to emissions from neighboring sources (Triton 2002). Figure 4-1, which was prepared using the MD-707 air quality modeling analysis, illustrates the maximum modeled annual average PM_{10} concentrations in 2005, which is the predicted worst-case scenario year based on maximum particulate emissions from the Buckskin Mine and adjacent emission sources. Figure 4-1 indicates that at a coal removal rate of 27.5 mmtpy, the highest predicted annual mean PM_{10} concentration is 36.90$\mu g/m^3$ (including 15 $\mu g/m^3$ background concentration) at the model receptor location shown. The predicted PM_{10} concentrations at all other model receptor locations are less than this value. Short-term concentrations above 50 $\mu g/m^3$ are predicted in the active pit areas. The state standard requires that annual average particulate concentrations above 50 $\mu g/m^3$ not be exceeded at a mine's permit boundary.

The MD-707 application presented an emissions inventory for all sources within the Buckskin Mine, from neighboring sources (Dry Fork Mine, Eagle Butte Mine, Rawhide Mine, Wyodak Mine, ENCOAL, and the Wyodak and Neil Simpson 1 and 2 power plants) and proposed neighboring sources (Two Elk Unit 1 power plant and ENCOAL power plant) for each year of mine life. These sources were input to the dispersion modeling analysis to determine potential air quality impacts in the vicinity. Several proposed projects discussed elsewhere in this EIS, such as the DM&E Railroad expansion, Wygen II power plant, Two Elk Unit 2, and the Middle Bear power plant were not included in the air quality model's emissions inventory. WDEQ/AQD approved the list proposed sources at the time of modeling.

Modeling and permit approval is done with the understanding that BACT will be applied. For the Buckskin Mine, BACT includes watering and/or chemical stabilization on haul roads and access roads; watering topsoil removal and laydown areas; minimizing

overshoot and stemming in blasting areas; minimizing fall distance in overburden and coal removal areas; prompt and contemporaneous reclamation; stilling sheds for coal truck dumps; and covered conveyors, silos, water sprays, baghouses, and other dust control systems for coal handling and storage.

A surface coal mine is not a named facility under Wyoming's PSD regulations and therefore is not considered a Amajor emitting facility@ unless it has the potential to emit 250 tons or more per year of any regulated pollutant. Fugitive dust emissions are not considered in determining potential to emit. Because the maximum annual mass emission rate of PM_{10} or NO_X from all point sources at the Buckskin Mine will be less than 250 tons per year (NO_X is negligible, and PM_{10} from all point sources is 88.3 tons per year), the mine was not subject to an increment analyses under PSD regulations.

If the West Hay Creek LBA tract is leased and mined as proposed, the average annual PM_{10} levels are expected to remain within the current air quality standards with the coal production projected to occur under either of the alternatives based on the Buckskin Mine's air quality monitoring information and modeling analyses summarized above. Haul distances from the pit to the crushing facilities would be increased, so dust emissions may increase in proportion to the increased haul distance. Fugitive dust and gaseous pollutant emissions would be expected to remain within levels allowed by the current permit. If Triton acquires the LBA tract, they would mine it and their existing leases using basically the same equipment with similar BACT emission controls. The PM_{10} concentrations predicted along the edges of the existing Buckskin Mine permit area may be shifted to the northward depending on the model year selected. If the tract is leased as proposed, mining at the Buckskin Mine would be extended from five years (under the Proposed Action and Alternative 3) to six years (under Alternative 2). As a result, there would be a continuation of the impacts that are occurring as a result of the currently permitted mining operations.

Figure 4-1: Modeled Maximum PM_{10} and NO_x Concentrations at Buckskin Mine LNCM Boundary, Year 2005 Worst-Case Scenario Resulting ……..

If Triton acquires the West Hay Creek LBA tract, they would be required to modify their WDEQ/AQD air quality permit to include the LBA tract before it could be mined. If the projected maximum production rate remains at or below the modeled rate of 27.5 mmtpy and emissions from all considered sources do not increase, modeling may or may not be required for the revision.

As discussed in chapter 3, NO_2 is created by some of the emission-producing activities in the vicinity of the LBA tract. To date, there have been no complaints to the mine or the WDEQ about clouds produced from blasting activities at the Buckskin Mine. Based on the size and nature of their blasting, the WDEQ has not directed the mine to take any steps to mitigate or prevent blasting clouds. Some mines have been directed by WDEQ to take steps designed to mitigate the effects of NO_2 emissions occurring from overburden blasting. The steps that may be required include: public notifications (in the form of warning signs along public roadways for example); temporary closure of public roadways near a mine during and after a blast; establishment of safe set-back distances from blasting areas; prohibiting blasting when wind direction is toward a neighbor; prohibiting blasting during temperature inversions; establishment of monitoring plans; estimation of NO_2 concentrations; and development of blasting procedures that will protect public safety and health.

Currently, Triton anticipates that coal production would remain unchanged from projected 2004 levels if they acquire the West Hay Creek LBA tract. Therefore, current mining techniques and blasting procedures would be expected to continue. If the West Hay Creek LBA tract is leased as a maintenance tract, the blasting processes and required mitigation measures would be reviewed when the mining and reclamation permit is amended to include the new lease. At that point, the blasting plan would be reviewed and modified to incorporate the procedures and protection measures that are in effect at that time.

Air quality impacts resulting from, or associated with, mining operations would be limited primarily to the operational life of the mine. If the West Hay Creek tract is leased and mined as proposed, the elevated levels of particulate matter in the vicinity of the mining operations would continue, as would the elevated concentrations of gaseous emissions due to fuel combustion. Compliance with all state and federal air quality standards would be maintained. As with current operations, mining would occur near Wyoming 14-16, the Collins Road and the McGee Road making dust visible to the public. The required mitigation measures would minimize this impact.

The nearest mandatory Class I area is Wind Cave National Park, located approximately 115 miles east of the LBA tract. The Northern Cheyenne Reservation in southern Montana, located approximately 80 miles northwest of the LBA tract, is a tribally-designated Class I area. Mines are not considered to be major emitting facilities in accordance with section 24 of WDEQ/AQD rules and regulations. Therefore, the state of Wyoming does not require mines to evaluate their impacts on that Class I area. However, BLM evaluates such issues for leasing. For this EIS regional air quality impacts are evaluated under cumulative impacts.

Water Resources

Groundwater

Mining the LBA tract would impact the groundwater resource quantity in two ways: 1) the coal aquifers and any overburden aquifers on the mined land would be removed and replaced with unconsolidated spoils; and 2) water levels in the coal and overburden aquifers adjacent to the existing approved mining operations would continue to be depressed as a result of seepage and dewatering from the open cut on the LBA tract. The area subject to lower water levels would be increased roughly in proportion to the increase in area affected by mining.

In addition to these two direct impacts, there would be some co-mingling of the overburden aquifer with the coal aquifer along the margins of the mining area. Locally, this would result in an alteration of water chemistry in the coal aquifer.

Mining the LBA tract would remove shallow aquifers on an additional area ranging from 830 acres (Proposed Action and Alternative 3), up to as much as 990 acres (Alternative 2) and replace the separate aquifer units with spoil composed of an unlayered mixture of the shale, siltstone, and sand that make up the existing Wasatch Formation overburden and Fort Union Formation interburden. Impacts to the local groundwater system resulting from mining include completely dewatering the coal, overburden and interburden within the area of coal removal, and extending drawdowns some distance away from the active mine area. The extent that drawdowns will propagate away from the mine pits is a function of the water-bearing properties of the aquifer materials. In materials with high transmissivity and low storage capacity, drawdowns will extend further from the pit face than in materials with lower transmissivity and higher storage capacity. In general, due to the geologic makeup of the Wasatch Formation overburden (discontinuous sands in a matrix of shale), overburden drawdowns do not extend great distances from the active mine pit (Hydro Engineering 1997, 1998, 1999). Of the six overburden wells monitored by Triton during 2001, no substantial water level changes were observed.

Because of the regional continuity and higher transmissivity within the Wyodak coal seam, drawdowns propagate much further in the coal aquifer than in the overburden. Several coal wells within the vicinity of Buckskin Mine have shown little or no changes since 1994 while several wells (16-12B-C4, 20-2C-C5C, 24-13A-5C, 25-7C-5C, and 29-4C-5C) have experienced rapid drawdowns during the same time period. The Buckskin Mine's permit document suggests that future mining is expected to encounter relatively little groundwater remaining in the coal seams, primarily as a result of CBM activities.

In 2001 Triton monitored water levels in six wells in overburden, 22 monitor wells in the Anderson and Canyon coal seams, four reclaimed alluvial wells, and five wells completed in backfill spoils. Water levels and maps showing drawdowns in the immediate vicinity of the pit are included in each year's annual report to WDEQ/LQD

(Triton 2001).

Triton originally used the MODFLOW model to predict the extent of water drawdown in the Anderson and Canyon coal seams as a result of mining at the Buckskin Mine. The results of the groundwater modeling are reported in mine plan addendum MP-B of the Buckskin Mine 500-T6 permit document. However, the current mine permit describes the groundwater drawdown calculation predicted by MODFLOW for the coal aquifers as a result of mining have been rendered obsolete by the dewatering effects of CBM wells operating since the mid-1990s in areas within and contiguous to Buckskin Mine.

Predicted drawdowns from the MODFLOW model over the life of mine are shown on figure 4-2. These predictions are approximate and were based on extrapolation of Triton's earlier predictions by extending the drawdowns westward and northward by the dimensions of the West Hay Creek tract. More precise predictions of the extent of drawdowns may be required in order to obtain a WDEQ/LQD permit for mining, if the West Hay Creek LBA tract is leased.

Wyoming SEO records indicate a total of 625 permitted water wells located within 3 miles of the LBA tract. Many of these (267 wells) are owned by coal mining companies and are used for groundwater monitoring and water supply. Of the remaining 358 non mine-related wells within the search area, approximately 92% are permitted for stock watering, 41% are permitted for miscellaneous use, 40% are permitted for CBM development, 9% are permitted for domestic use, and 2% were permitted for monitoring. Other uses amounted to less than 1%. Most of these wells have been permitted for multiple uses.

Some of these wells will likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining operations occurring at Buckskin and the adjacent mines. In compliance with SMCRA and Wyoming regulations, mine operators are required to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality; this mitigation is part of the action alternatives. The most probable source of replacement water would be one of the aquifers underlying the coal.

Before they acquired the Belco exchange tract, Triton determined that the effects of mining their existing coal leases could impact approximately 24 wells belonging to neighboring groundwater users. These wells are listed on table MP5-1 of the Buckskin Mine permit. As of January, 2000, there were no known adverse impacts to any private groundwater well.

Figure 4-2: Life of Mine Drawdown Map, Resulting From Proposed Action.

If the West Hay Creek LBA tract is leased, the mine operator would be required to update the list of potentially impacted wells and predict impacts to these and other water-supply wells within the five-foot drawdown contour as part of the permitting process. The operator would be required to commit to replacing these water supplies with water of equivalent quality and quantity if they are affected by mining.

The subcoal Fort Union aquifers are not removed or disturbed by coal mining, so they are not directly impacted by coal mining activity. Triton has two water supply wells completed in aquifers below the coal. If the LBA tract is leased by the applicant, water would be produced from these wells for a longer period of time, but Triton would not require additional subcoal wells to mine the LBA tract.

Mining would also impact groundwater quality; the TDS in the water resaturating the backfill is generally higher than the TDS in the groundwater before mining. This is due to the exposure of fresh overburden surfaces to groundwater that moves through the reclaimed spoils. Research conducted by the Montana Bureau of Mines and Geology on the coal fields of the northern PRB (Van Voast and Reiten 1988) indicates that, upon initial saturation, mine backfill is generally high in TDS and contains soluble salts of calcium, magnesium, and sodium sulfates. As the backfill resaturates, the soluble salts are leached by groundwater inflow and TDS concentrations tend to decrease with time, indicating that the long-term groundwater quality in mined and off-site lands would not be compromised (Van Voast and Reiten 1988).

Groundwater quality within the backfill aquifer at the West Hay Creek LBA tract would be expected to be similar to the groundwater quality measured in existing wells completed in the backfill at the Buckskin Mine. To date, 12 wells have been installed to monitor water level and water quality in backfilled spoils at the Buckskin Mine. In 2000, the TDS concentrations in the three sampled backfill wells were 1,272 mg/L, 3,996 mg/L and 8,826 mg/L. TDS concentrations observed in the Buckskin Mine backfill monitoring wells are generally higher than those found in the undisturbed Wasatch Formation overburden or Wyodak coal aquifers. Using data compiled from ten surface coal mines in the eastern PRB, Martin et al. (1988) concluded that backfill groundwater quality improves markedly after the backfill is leached with one pore volume of water. The same conclusions were reached by Van Voast and Reiten (1988) after analyzing data from the Decker and Colstrip Mine areas in the northern PRB. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to range from 3,000 to 6,000 mg/L. Water chemistry is expected to be similar to the premining Wasatch Formation aquifer and meet Wyoming Class III standards for use as stock water.

The hydraulic properties of the backfill aquifer reported in Buckskin permit documents are within the range reported for both the Wasatch Formation overburden and Wyodak coal. At the Buckskin Mine, one backfill drawdown test has been performed, and the hydraulic conductivity was 2.67 feet per day. These results provide a preliminary indication that Buckskin Mine spoils will readily resaturate as postmining potentiometric

elevations recover in the surrounding undisturbed aquifers and the spoils will be capable of supplying sufficient yields to wells constructed for stock watering uses.

Direct and indirect impacts to the groundwater system resulting from mining the LBA tract would add to the cumulative impacts that will occur due to mining existing leases, which is discussed in the cumulative impact section.

Surface Water

Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tract as a result of the destruction and reconstruction of drainage channels as mining progresses. Erosion rates could reach high values on the disturbed area because of vegetation removal. However, both state and federal regulations require that all surface runoff from mined lands be treated as necessary to meet effluent standards. Generally, the surface runoff sediment is deposited in ponds or other sediment-control devices inside the permit area.

Due to its location in the headwater area of Hay Creek and the existing topography, runoff within the LBA tract is not expected to be significant. During mining, hydrologic control will most likely consist of allowing runoff to accrue to the mine pit, where it will be treated and discharged according to the standards of WDEQ/WQD. Large flood control reservoirs are not anticipated for the LBA tract, but it may be necessary to build a diversion for Hay Creek.

Sediment produced by large storms (greater than the 10-year, 24-hour storm) could adversely impact downstream areas. Since the tract would be mined as an extension of the existing Buckskin Mine under Alternatives 2 and 3, there would not be a large increase in the amount of area disturbed and not reclaimed at any given time. WDEQ/LQD would also require a monitoring program to assure that ponds would always have adequate space reserved for sediment accumulation.

The loss of soil structure would act to increase runoff rates on the LBA tract in reclaimed areas. The general decrease in average slope in reclaimed areas would tend to counteract the potential for an increase in runoff. Soil structure would gradually reform over time, and vegetation (after successful reclamation) would provide erosion protection from raindrop impact, retard surface flows, and control runoff at approximately premining levels.

After mining and reclamation are complete, surface water flow, quality, and sediment discharge from the LBA tract would approximate premining conditions. The impacts described above would be similar for both the Proposed Action and Alternatives 2 and 3, and they are similar to the expected impacts for currently permitted mining.

Alluvial Valley Floors (AVFs)

The West Hay Creek LBA tract has been evaluated for the presence of AVFs. There are no AVFs within the LBA tract. The nearest declared AVF is located on Rawhide Creek south of the LBA tract within the current Buckskin Mine WDEQ/LQD permit area. That portion of the AVF within Buckskin Mine's permit area has been mined and reclaimed in accordance with their approved reclamation plan. Mining within the LBA tract is not expected to impact lands within the Rawhide Creek drainage. Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVFs through mining of the LBA tract.

Wetlands

As discussed in chapter 3, Buckskin Mine has completed a wetlands inventory and subsequently received COE approval of the inventory in April 2001. This inventory identified the acres of jurisdictional wetlands within the entire Buckskin Mine permit boundary, including all lands within the West Hay Creek LBA tract under the proposed action and Alternatives 2 and 3. A total of 17.51 acres of jurisdictional wetlands comprised of 9.82 acres of riverine-emergent marsh and 7.69 acres of riverine-wet meadow were identified within the analyses area. Existing wetlands located in the LBA tract would be impacted by mining operations. COE requires replacement of all impacted jurisdictional wetlands in accordance with section 404 of the Clean Water Act. Replacement of functional wetlands on privately owned surface may occur in accordance with agreements with the private landowners; no federal surface lands are included in the West Hay Creek LBA tract. During the period of time after mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not duplicate the exact functions and landscape features of the premine wetlands, but replacement would be in accordance with the requirements of section 404 of the Clean Water Act, as determined by COE.

As a result of recent court directives, playas may no longer be identified as jurisdictional waters of the U.S. under section 404 of the Clean Water Act. A total of 10 of these nonjurisdictional wetland features, all formed in unconsolidated sandy residuum that precludes all but the briefest periods of water storage, occupy only 7.6 acres within the analysis area. Although COE may not require their replacement as a result of the recent court directive, Triton may continue establishing playa/depressional features within the reclaimed topography if the LBA tract is mined as an extension of the existing operation. If no special segregation and placement of overburden and soils is necessary, reclamation costs incurred to restore playa/depressional features are not increased. However, if special handling of materials is necessary the reclamation costs generally increase on a site-specific basis.

Vegetation

Under the Proposed Action, mining the LBA tract would progressively remove the native vegetation on about 830 additional acres on and near the LBA tract. Up to 990 additional acres would be disturbed under Alternative 2, while acreage disturbed under Alternative 3 would be approximately the same as the Proposed Action. Short-term impacts associated with this vegetation removal would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-term impacts include loss of habitat for some wildlife species as a result of reduced species diversity, particularly big sagebrush, on reclaimed lands. However, grassland-dependent wildlife species and livestock would benefit from the increased grass cover and production.

Reclamation, including revegetation of these lands, would occur at the same time as mining on adjacent lands (for example, reclamation would begin once an area is mined). Estimates of the time elapsed from topsoil stripping through reseeding of any given area range from two to four years. This would be longer for areas occupied by stockpiles, haul-roads, sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. No new life-of-mine facilities would be located on the LBA tract under the Proposed Action or Alternatives 2 and 3, in which the LBA tract would be mined as an extension of the existing Buckskin Mine. Grazing and farming restrictions prior to mining and during reclamation would remove up to 100% of the LBA area from livestock grazing and agricultural crop production. This reduction in vegetative production would not seriously affect livestock and farm production in the region. Long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. Wildlife use of the area would not be restricted throughout the operations.

Re-established vegetation would be dominated by species mandated in the reclamation seed mixtures approved by WDEQ. The majority of the approved grassland and shrubland species are native to the LBA tract. The premining agricultural lands may be established as haylands, pasturelands, or croplands to replace the premining land uses. Initially, the reclaimed grassland would be dominated by grassland vegetation that would be less diverse than the premining vegetation. At least 20% of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Estimates for the time it would take to restore shrubs to premining density levels range from 20 to 100 years. An indirect impact of this vegetative change could be decreased big game habitat carrying capacity. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond (a minimum of ten years), a diverse, productive, and permanent vegetative cover would be established on the LBA tract. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, and the proposed postmining land use (wildlife habitat rangeland and agricultural lands) should be achieved even with the changes in vegetation composition and diversity.

On average, about 150 acres of surface disturbance per year of mining would occur on the LBA tract at the proposed rate of production regardless of which action alternative is selected. By the time mining ceases, over 75% of these disturbed lands would have been reseeded. The remaining 25% would be reseeded during the following two to three years as the life-of-mine facilities areas are reclaimed.

The reclamation plans for the existing mine include steps to control invasion by weedy (invasive nonnative) plant species. The reclamation plans for the West Hay Creek LBA tract would also include steps to control invasion from such species. Native vegetation from surrounding areas would gradually invade and become established on the reclaimed land.

The climatic record of the western US suggests that droughts could occur periodically during the life of the mine. Such droughts would severely hamper revegetation efforts, since lack of sufficient moisture would reduce germination and could damage newly established plants. Same-aged vegetation would be more susceptible to disease than would plants of various ages. Severe thunderstorms could also adversely affect newly seeded areas. Once a stable vegetative cover is established, these events would have similar impacts as would occur on native vegetation.

Changes expected in the surface water network as a result of mining and reclamation would affect the reestablishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum slope would be 20% in accordance with WDEQ policy. The average reclaimed slope will not be known until WDEQ's technical review of the permit revision application is complete. No significant changes in average slope are predicted.

Following reclamation, the LBA tract would be primarily a variety of mixed prairie grasslands with graminoid/forb-dominated areas, shrublands, and haylands. The overall species diversity would be reduced, especially for the shrub component.

Jurisdictional wetlands would fall under the jurisdiction of the COE. Detailed wetland mitigation plans would be developed at the permitting stage to ensure no net loss of jurisdictional wetlands on the project area. Functional wetlands may be restored in accordance with the requirements of the surface landowner; there are no public lands included in the West Hay Creek LBA tract.

The decrease in plant diversity would not seriously affect productivity of the reclaimed areas regardless of the alternative selected. The proposed postmining land use (wildlife habitat and rangeland) would be achieved even with the changes in vegetative species composition and diversity.

Threatened, Endangered and Candidate Plant Species

These are discussed in appendix G.

Wildlife

Local wildlife populations are directly and indirectly impacted by mining. These impacts are both short-term (until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include road kills by mine-related traffic, restrictions on wildlife movement created by fences, spoil piles and pits, and displacement of wildlife from active mining areas. Displaced animals may find equally suitable habitat that is not occupied by other animals, occupy suitable habitat that is already being used by other individuals, or occupy poorer quality habitat than that from which they were displaced. In the second and third situations, the animals may suffer from increased competition with other animals and are less likely to survive and reproduce. The indirect impacts are longer term and may include a reduction in big game carrying capacity and microhabitats on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

These impacts are currently occurring on the existing leases as mining occurs. If the LBA tract is leased under the Proposed Action, Alternative 2, or Alternative 3, the area of mining disturbance would be extended onto the LBA tract and mining would be extended by five to six years at the Buckskin Mine.

Under the Proposed Action, Alternative 2, or Alternative 3, big game would be displaced from portions of the LBA tract to adjacent ranges during mining. Pronghorn would be most affected; but none of the area within 2 miles of the LBA tract has been classified as crucial or critical pronghorn habitat. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. Big game displacement would be incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game residing in the adjacent areas could be impacted by increased competition with displaced animals. Noise, dust, and associated human presence would cause some localized avoidance of foraging areas adjacent to mining activities. On the existing leases, big game have continued to occupy areas adjacent to and within active mine operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can move to undisturbed areas. Big game movement would be more restricted due to additional fences, spoil piles, and pits related to mining. During winter storms, pronghorn may not be able to negotiate these barriers. WDEQ guidelines require fencing to be designed to permit pronghorn passage to the extent possible.

Recently, the WGFD reviewed monitoring data collected on mine sites for big game species and the monitoring requirements for big game species on those mine sites. Their findings concluded that the monitoring had demonstrated the lack of impacts to big game on existing mine sites. No severe mine-caused mortalities have occurred, and no long-lasting impacts on big game have been noted on existing mine sites. The WGFD recommended that big game monitoring be discontinued on all existing mine

sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which apply to the LBA tract.

Road kills related to mine traffic would be extended in the area by five to six years.

After mining and reclamation, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density, would cause a decrease in carrying capacity and diversity on the LBA tract. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent.

Medium-sized mammals (such as rabbits, coyotes, and foxes) would be temporarily displaced to other habitats by mining, potentially resulting in increased competition and mortality. However, these animals would rebound on reclaimed areas, as forage developed and small mammal prey species recolonized. Direct losses of small mammals would be higher than for other wildlife, since the mobility of small mammals is limited and many retreat into burrows when disturbed. Therefore, populations of such prey animals as voles and mice would decline during mining. However, these animals have a high reproductive potential and tend to re-invade and adapt to reclaimed areas quickly. A research project for small mammals and birds concluded that reclamation objectives to encourage the recolonization of small mammal communities are being achieved on mined lands within the PRB (Shelley 1992). The study evaluated sites at five mines.

Sage grouse are yearlong residents and are found on lands within and adjacent to the LBA tract. The impacts from mining the LBA tract would be the loss of nesting habitat and disturbance to breeding activities when the mining operations are within proximity to the birds= strutting ground. Monitoring sage grouse activities indicates that the birds frequently change lek sites. It is likely that if mining activities disturb a lek, sage grouse would use an alternate lek site for breeding activities. Sage grouse may experience lower productivity on these alternate lek sites. Should sage grouse establish a lek on the proposed lease area, the lessee would be required to take appropriate mitigation steps prior to mining. Effort will also be made to reestablish shrubs on reclaimed lands, grade reclaimed lands to create swales and depressions, and continue monitoring sage grouse activity in the area before, during, and after mining. These and other measures will be further developed in the WDEQ/LQD permit to mine application.

Mining the LBA tract would not impact regional raptor populations; however, individual birds or pairs may be impacted. Due to limited suitable nesting habitat (cliffs and tall trees), very few raptor species have been observed nesting on or near the proposed lease area. A total of five raptor species (the burrowing owl, great horned owl, ferruginous hawk, red-tailed hawk and golden eagle) have been identified nesting within 2 miles of the LBA tract. In 2002 three nest sites in this area were active, and all were occupied by red-tailed hawks. Mining activity could cause raptors to abandon nests near the disturbance. The FWS recommends a species-specific buffer around all raptor nests. The FWS and the WDEQ/LQD approval would be required before mining could occur within buffer zones for future or adjacent active raptor nests. The Buckskin Mine

annually monitors territorial occupancy and nest productivity. Raptor nesting activity has frequently occurred in active mining and construction areas, and Buckskin Mine has successfully executed state-of-the-art mitigation techniques to protect nest productivity. There is an approved raptor mitigation plan for the existing Buckskin Mine. This monitoring and mitigation plan, as required by the FWS and WDEQ/LQD, would be amended to include the West Hay Creek LBA tract if it is leased. Mining near raptor territories would minimally impact availability of raptor forage species. At the adjacent Buckskin Ranch Mine, lack of nesting habitat, not a lack of forage area, has been determined to be the most important factor limiting raptor density. During mining, nesting habitat is created by the excavation process (highwalls), as well as through enhancement efforts (nest platforms and boxes). After mining, the reclamation plan would reestablish the ground cover necessary for the return of a suitable prey base.

Displaced songbirds would have to compete for available adjacent territories and resources when their habitats are disturbed by mining operations. Where adjacent habitat is at carrying capacity, this competition would result in some mortality. Losses would also occur when habitat disturbance coincides with egg incubation and rearing of young. Impacts of habitat loss would be short-term for grassland species but would last longer for tree- and shrub-dependent species. Concurrent reclamation would minimize these impacts. A diverse seed mixture planted in a mosaic with a shrubland phase would provide food, cover, and edge effect. Other habitat enhancement practices include the restoration of diverse land forms, direct topsoil replacement, and the construction of brush piles, snags and rock piles. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was slightly less than on adjacent undisturbed areas, although their overall numbers were greater (Shelley 1992). Waterfowl and shorebird habitat on the LBA tract is minimal, and production of these species is limited. Mining the LBA tract would have a negligible effect on migrating and breeding waterfowl. Sedimentation ponds created during mining would provide interim habitat for these fauna. WDEQ and the COE would also require mitigation of any disturbed wetlands during reclamation, which would minimize impacts. If the replaced wetlands on the West Hay Creek LBA tract do not duplicate the exact function and/or landscape features of the premine wetlands, waterfowl and shorebirds could be beneficially or adversely affected as a result.

Habitat for fish (fat-hear minnows and green sunfish) in McGee Reservoir would be lost during mining and reclamation

The impacts discussed above would apply to all alternatives. If the West Hay Creek LBA tract is leased, the assessment of impacts to wildlife that would be caused by mining the LBA tract would be addressed as part of the review of the mine permit application by the WGFD and the WDEQ/LQD as part of the WDEQ/LQD's mining and reclamation permit approval process.

Threatened, Endangered, and Proposed Wildlife Species

These are discussed in appendix G.

Land Use and Recreation

The major environmental consequences of leasing and mining the West Hay Creek LBA tract on land use would be reduction of livestock grazing, loss of wildlife habitat, loss of agricultural cropland, hayland, and pastureland, and curtailment of oil and gas development on about 830 additional acres (Proposed Action and Alternative 3), or up to 930 acres (Alternative 2) during active mining. Wildlife (particularly big game) and livestock (cattle and sheep) use would be displaced while the tract is being mined and reclaimed.

Federal oil and gas ownership and federal oil and gas lessee information are presented in figure 3-15 and table 3-10 in chapter 3. If a coal lease is issued for the West Hay Creek LBA tract, all of the oil and gas production and transportation facilities on the lease would have to be removed from the surface to the base on the coal prior to mining. Wells that are completed in producing zones below the coal would be capped in accordance with the requirements for abandoning wells.

BLM has issued a policy statement on conflicts between CBM and coal development (BLM 2000). That policy advocates optimizing the recovery of both coal and CBM resources to ensure that the public receives a reasonable return for the publicly owned resources. CBM is not currently being produced on the West Hay Creek LBA tract, but production is likely in the future. If a coal lease is issued and CBM production is planned, Triton would negotiate with the oil and gas lessees on how to resolve the conflict. Royalties would be lost to both the state and federal governments if conventional oil and gas wells are abandoned prematurely, if the CBM is not recovered prior to mining, or if coal is not recovered due to conflicts. State and federal governments can also lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

None of the lands included in the LBA tract under any of the alternatives are managed by the FS, so no federal land would be removed from public access if the tract is leased.

Hunting on the LBA tract would be eliminated during mining and reclamation. Pronghorn and mule deer occur on and adjacent to the tract. Sage grouse, mourning dove, waterfowl, rabbit, and coyote also inhabit the tract.

Following reclamation, the land would be suitable for grazing, wildlife, and agricultural uses, which are the historic land uses. There are no BLM or FS public lands included in the LBA tract, but the reclamation standards required by SMCRA and Wyoming state law meet the standards and guidelines for healthy rangelands for public lands administered by the BLM in Wyoming. Following reclamation bond release, management of the privately-owned surface would revert to the private surface owner.

Cultural Resources

All portions of the Proposed Action and Alternative 3 areas and buffer zone were subjected to a Class III inventory and assessment in 1999.

Table 3-11 summarizes the distribution of cultural sites by type. Data recovery plans are required for those sites recommended eligible to the NRHP following testing and consultation with the SHPO. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites should be protected from disturbance.

Full consultation with SHPO must be completed before the MLA mining plan can be approved. At that time, those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment. Impacts to eligible or unevaluated cultural resources cannot be permitted. If unevaluated sites cannot be avoided, they must be evaluated before mining occurs. If eligible sites cannot be avoided, a data recovery plan must be implemented prior to disturbance. Ineligible properties may be destroyed without further work.

The eligible site on the West Hay Creek LBA tract which cannot be avoided or which has not already been subjected to data recovery action would be carried forward in the mining and reclamation plan as requiring protective stipulations until a testing, mitigation or data recovery plan is developed to address the impacts to the sites. The lead federal and state agencies would consult with Wyoming SHPO on the development of such plans and the manner in which they are carried out.

Cultural resources adjacent to the mine areas may be impacted as a result of increased access to the areas. There may be increased vandalism and unauthorized collecting associated with recreational activity and other pursuits outside of and adjacent to mine permit areas.

Native American Concerns

No sites of Native American religious or cultural importance have been identified on the LBA tract. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

Paleontological Resources

No unique or significant paleontological resources have been identified on the LBA tract, and the likelihood of encountering significant paleontological resources is small. Lease and permit conditions require that should previously unknown, potentially significant paleontological sites be discovered, work in that area shall stop and measures be taken to assess and protect the site (appendix D).

Visual Resources

Mining activities on most of the West Hay Creek LBA tract would not be visible from any major travel routes and would be partly concealed by surrounding terrain. Mining of some parts of the LBA tract may be visible from US 14-16.

Mining would affect landscapes classified by BLM as Class IV. Landscape character would not be significantly changed following reclamation. No unique visual resources have been identified on or near the West Hay Creek LBA tract.

Reclaimed terrain would be almost indistinguishable from the surrounding undisturbed terrain. Slopes might appear smoother (less intricately dissected) than undisturbed terrain to the north and west, and sagebrush would not be as abundant for several years. Within a few years after reclamation, the mined land would not be distinguishable from the surrounding undisturbed terrain except by someone very familiar with landforms and vegetation.

Noise

Noise levels on the LBA tract would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since the LBA tract would be mined as an extension of existing operations under the action alternatives, no rail car loading would take place. The Noise Control Act of 1972 indicates that a 24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact. OSM prepared a noise impact report for the Caballo Rojo Mine (OSM 1980) which determined that the noise level from crushers and a conveyor would not exceed 45 dBA at a distance of 1,500 feet. Explosives would be used during mining to fragment the overburden and coal and facilitate their excavation. The air overpressure created by such blasting is estimated to be 123 dBA at the location of the blast. At a distance of approximately 1,230 feet, the intensity of this blast would be reduced to 40 dBA. Since the nearest occupied dwelling is just over ½ mile from the LBA tract, there should be no major noise impacts. The nearest occupied dwelling to the existing Buckskin Mine permit boundary is approximately ½ mile away.

Because of the remoteness of the site and because mining is already ongoing in the area, noise would have little off-site effect. Wildlife in the immediate vicinity of mining may be adversely affected; however, observations at other surface coal mines in the area indicate that wildlife generally adapt to increased noise associated with active coal mining. After mining and reclamation are completed, noise would return to premining levels.

Transportation Facilities

No new or reconstructed transportation facilities would be required under the Proposed Action or alternatives. Essentially all of the coal mined on the LBA tract would be transported by rail. Vehicular traffic to and from the mine would continue at existing or slightly higher levels for an additional 5 to 6 years, depending on which alternative is selected.

One active pipeline currently crosses the northwest corner of the LBA tract analysis area. Any relocation of pipelines would be handled according to specific agreements between the coal lessee and the pipeline owners. The Wyoming Department of Transportation routinely monitors traffic volumes on area highways, and if traffic exceeds design standards improvements are made. Burlington Northern-Santa Fe has upgraded and will continue to upgrade their rail capacities to handle the increasing coal volume projected from the PRB with or without leasing the proposed LBA tract.

Socioeconomics

Leasing and subsequent mining of the LBA tract would extend the life of the already permitted Buckskin Mine by 5 to 6 years, depending on which alternative is selected.

Although spot coal prices showed significant increases during 2001, recent spot coal prices have declined. WGS is currently predicting that average coal prices will increase slightly over the next 5 to 6 years (WGS 2002a). Conservatively assuming a price of $4.00 per ton, the total revenue from the sale of the recoverable coal from the LBA tract would total $520 million for the Proposed Action (130 million tons of coal), up to $600 million for Alternative 2 (150 million tons of coal), or $520 million for Alternative 3 (130 million tons of coal). Some of this money from the sale of this federal coal would be paid to federal, state, and local governments in the form of taxes and federal production royalties.

If the tract is leased, the federal government would collect a royalty at the time the coal is sold. This royalty is 12.5% of the sale price of the coal. At a coal price of $4.00 per ton, this would amount to approximately $65 million under the Proposed Action, up to $75 million under Alternative 2, or $65 million under Alternative 3. This money would be split equally between the state and federal governments. The federal government would also collect black lung and reclamation taxes based on the sale of the coal.

According to a study done by the University of Wyoming (UW 1994), the state of Wyoming received about $1.10 per ton from the sale of PRB coal produced in 1991. The taxes and royalties included in this calculation were severance taxes, ad valorem taxes, sales and use taxes, and the state's share of federal royalty payments on production. Under this scenario, the estimated total direct return to the state of Wyoming from the production of this federal coal, in current dollars, would be $143 million under the Proposed Action, $165 million under Alternative 2, or $143 million under Alternative 3. This figure includes half of the federal royalty discussed above.

Projected state and federal revenues from the proposed action and alternatives is presented in table 2-1 in chapter 2.

The federal government also receives a bonus payment at the time the federal coal is leased. Bonus payments on the federal coal leases issued in the Powder River Basin since 1990 have ranged from 11.1¢ per ton to 70.6¢ per ton. This range of bonus payments would represent a potential bonus payment range of $14.4 million to $105.9 million for the estimated federal coal tonnage in the West Hay Creek LBA Tract. The actual amount the federal government would receive would depend on the alternative selected and the actual bonus bid if the tract is leased. The bonus payment would be payable over five years and would be divided equally with the state of Wyoming.

If the LBA tract is leased and annual coal production is increased to 25 million tons as projected, Triton anticipates that the average number of employees at the Buckskin Mine would remain 225 over the 5 to 6 years the tract is being mined. These 225 persons represent about 1% percent of the 22,360 persons in the 2001 labor force in Campbell County (Wyoming Department of Employment, Employment Resources Division 2002). No additional demands on the existing infrastructure or services would be expected because no influx of new residents would be needed to fill new jobs. The economic stability of the community of Gillette would benefit by having the Buckskin Mine active for an additional 5 to 6years.

Issues relating to the social, cultural, and economic well-being and health of minorities and low-income groups are termed environmental justice issues. In reviewing the impacts of the Proposed Action and Alternatives 2 and 3 on socioeconomic resources, surface water and groundwater quality, air quality, hazardous materials, or other elements of the human environment in this chapter, it was determined that potentially adverse impacts do not disproportionately affect Native American tribes, minority groups, or low-income groups.

With regard to environmental justice issues affecting Native American tribes or groups, the general analysis area contains no tribal lands or Native American communities. No treaty rights or Native American trust resources are known to exist for this area.

Implementing any of the alternatives would have no effects on environmental justice issues, including the social, cultural, and economic well-being and health of minorities and low income groups within the general analysis area.

Hazardous and Solid Waste

If Triton acquires the West Hay Creek LBA tract, the wastes that would be generated in the course of mining the tract would be similar to the wastes that are currently being generated by the existing mining operation. The procedures that are used for handling hazardous and solid waste at the existing Buckskin Mine are described in chapter 2. Wastes generated by mining the LBA tract would be handled in accordance with the existing regulations using the procedures currently in use at the Buckskin Mine.

DIRECT AND INDIRECT IMPACTS OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, the coal lease application would be rejected; the area contained in the application would not be offered for lease at this time. The tract could be nominated for lease again in the future but, for the purposes of this analysis, the No Action Alternative assumes that these lands would never be mined. However, the approved mining operations for the existing Buckskin Mine would not be changed if this alternative is chosen. The impacts described on the preceding pages and in table 2-2 to topography and physiography, geology and minerals, soils, air quality, water resources, alluvial valley floors, wetlands, vegetation, wildlife, threatened, endangered and candidate species, land use and recreation, cultural resources, Native American concerns, paleontological resources, visual resources, noise, transportation, and socioeconomics would occur on the existing Buckskin coal leases under the No Action Alternative, but these impacts would not be extended onto those portions of the LBA tract which will not be affected under the current plan.

The general nature and magnitude of cumulative impacts as summarized in table 2-3 that would occur from implementation of the Proposed Action or Alternatives 2 or 3, would not be substantially different under the No-Action Alternative. Coal removal and the associated disturbance and impacts would not occur on the 830, 990 or 830 additional acres disturbed in the Proposed Action, Alternative 2, or Alternative 3, respectively. Portions of the West Hay Creek LBA tract adjacent to the existing Buckskin Mine would be disturbed to recover the coal in the existing leases. The economic benefits that would be derived from mining the LBA tract during an additional five to six years of mining would be lost. If a decision is made not to lease this tract at this time, it could be leased and mined as a maintenance lease in the future while the existing adjacent mines are in operation. If it is not leased while the existing adjacent mines are in operation, it may or may not be leased in the future.

The tract being evaluated in this EIS does not include enough coal reserves to be leased and mined by a new operation; however, the coal reserves included in the tract could potentially be combined with unleased federal coal to the north and west to create a larger tract in the future.

REGULATORY COMPLIANCE, MITIGATION, AND MONITORING

In the case of surface coal mining, SMCRA and state law require mitigation and monitoring designed to ensure that reclamation standards are met following mining. The major mitigation measures and monitoring measures that are required by state or federal regulation are summarized in table 4-3. More specific information about some of these mitigation and monitoring measures and their results at the North Antelope/Rochelle Complex, Black Thunder, North Rochelle, and Antelope Mines are described in the following sections of this document.

Measures that are required by regulation are considered to be part of the Proposed Action and Alternatives 2 and 3. These requirements, mitigation plans, and monitoring

plans are in place for the No Action Alternative, as part of the current approved mining and reclamation plan for the existing Buckskin Mine. If the West Hay Creek LBA tract is leased, these requirements, mitigation plans, and monitoring plans would be included in the mining and reclamation plan revision that would be required for the LBA tract if it is leased. This mining and reclamation plan would have to be approved before mining could occur on the tract, regardless of who acquires the tract. The major mitigation measures and monitoring measures that are required by state or federal regulation are summarized in table 4-3. More specific information about some of these mitigation and monitoring measures that are in place for the existing Buckskin Mine and would be extended on the LBA tract, if it is leased, are described in chapter 3 and in earlier sections of this chapter.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, BLM can include additional mitigation measures, in the form of stipulations on the new lease, within the limits of its regulatory authority. In general, the levels of mitigation and monitoring required for surface coal mining by SMCRA and Wyoming state law are more extensive than those required for other surface disturbing activities; however, concerns are periodically identified that are not monitored or mitigated under existing procedures.

An example of this type of issue is the concern about the release of NO_x from blasting, and the resulting formation of low-lying orange clouds that can be carried outside the mine permit areas by wind. After this was identified as a potential health concern in the area of the Wyoming PRB surface coal mines, a monitoring program measuring NO_2 concentrations in areas accessible to the public near PRB coal mining operations was conducted in 1999. In addition, WDEQ has directed some PRB mines to take steps designed to mitigate the effects of NO_2 emissions occurring from overburden blasting. The steps that may be required include: notifying the public via warning signs along public roadways for example, temporarily closing public roadways near a mine during and after a blast; establishing safe set-back distances from blasting areas; prohibiting blasting when wind direction is toward a neighbor; prohibiting blasting during temperature inversions; establishing monitoring plans; estimating NO_2 concentrations; and developing blasting procedures that will protect public safety and health.

After reviewing the required mitigation and monitoring in the current Buckskin Mine's mining and reclamation permit and the historical monitoring results in the mine's annual reports, the BLM has not identified additional special stipulations that should be added to the BLM lease or areas where additional or increased monitoring measures are recommended.

TABLE 4-3 REQUIRED MITIGATION AND MONITORING MEASURES REQUIRED FOR ALL ALTERNATIVES		
RESOURCE	**REGULATORY COMPLIANCE OR MITIGATION REQUIRED BY STIPULATIONS OR REQUIRED BY STATE OR FEDERAL LAW[1]**	**MONITORING[1]**
Topography & Physiography	Restoring to approximate original contour or other approved topographic configuration.	LQD checks as-built vs. approved topography with each annual report.
Geology & Minerals	Identifying and selectively placing or mixing chemically or physically unsuitable overburden materials to minimize adverse effects to vegetation or groundwater.	LQD requires monitoring in advance of mining to detect unsuitable overburden.
Soil	Salvaging soil suitable to support plant growth for use in reclamation; Protecting soil stockpiles from disturbance and erosional influences; Selectively placing at least 4 ft of suitable overburden on the graded spoil surface below replaced topsoil to meet guidelines for vegetation root zones.	Monitoring vegetation growth on reclaimed areas to determine need for soil amendments. Sampling regraded overburden for compliance with root zone criteria.
Air Quality	Dispersion modeling of mining plans for annual average particulate pollution impacts on ambient air; Using particulate pollution control technologies; Using work practices designed to minimize fugitive particulate emissions; Using EPA- or state-mandated BACT, including: Fabric filtration or wet scrubbing of coal storage silo and conveyor vents, Watering or using chemical dust suppression on haul roads and exposed soils, Containment of truck dumps and primary crushers; Covering of conveyors, Prompt revegetation of exposed soils.	On-site air quality monitoring for PM_{10} or TSP; Off-site ambient monitoring for PM_{10} or TSP; On-site compliance inspections.
Surface Water	Building and maintaining sediment control ponds or other devices during mining; Restoring approximate original drainage patterns during reclamation; Restoring stock ponds and playas during reclamation.	Monitoring storage capacity in sediment ponds; monitoring quality of discharges; monitoring stream flows and water quality.
Groundwater Quantity	Evaluating cumulative impacts to water quantity associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quantity.	Monitoring wells track water levels in overburden, coal, interburden, underburden, and backfill.

TABLE 4-3 REQUIRED MITIGATION AND MONITORING MEASURES REQUIRED FOR ALL ALTERNATIVES		
RESOURCE	**REGULATORY COMPLIANCE OR MITIGATION REQUIRED BY STIPULATIONS OR REQUIRED BY STATE OR FEDERAL LAW[1]**	**MONITORING[1]**
Alluvial Valley Floors	Identifying all alluvial valley floors that would be affected by mining; Determining significance to agriculture of all identified alluvial valley floors affected by mining (WDEQ); Protecting downstream alluvial valley floors during mining; Restoring essential hydrologic function of all alluvial valley floors affected by mining.	Monitoring to determine restoration of essential hydrologic functions of any declared AVF.
Wetlands	Identifying all wetlands that would be affected by mining; Identifying jurisdictional wetlands (COE); Replacing all jurisdictional wetlands that would be disturbed by mining Replacing functional wetlands as required by surface managing agency or surface land owner.	Monitoring reclaimed wetlands using same procedures used to identify premining jurisdictional wetlands.
Vegetation	Permanently revegetate reclaimed areas according to a comprehensive revegetation plan using approved permanent reclamation seed mixtures consisting predominantly of species native to the area; Reclaiming 20% of reclaimed area with native shrubs at a density of one per square meter; Controlling erosion on reclaimed lands prior to seeding with final seed mixture using mulching, cover crops, or other approved measures; Chemically and mechanically controlling weed infestation; Direct hauling of topsoil, whenever possible; Selectively planting shrubs in riparian areas; Planting sagebrush; Creating depressions and rock piles; Using special planting procedures around rock piles; Posting reclamation bond covering the cost of reclamation.	Monitoring revegetation growth and diversity until release of final reclamation bond (minimum 10 years). Monitoring erosion to determine need for corrective action during establishment of vegetation. Using controlled grazing during revegetation evaluation to determine suitability for postmining land uses.

TABLE 4-3 REQUIRED MITIGATION AND MONITORING MEASURES REQUIRED FOR ALL ALTERNATIVES		
RESOURCE	**REGULATORY COMPLIANCE OR MITIGATION REQUIRED BY STIPULATIONS OR REQUIRED BY STATE OR FEDERAL LAW[1]**	**MONITORING[1]**
Wildlife	Restoring premining topography to the maximum extent possible; Planting a diverse mixture of grasses, forbs and shrubs in configurations beneficial to wildlife; Designing fences to permit wildlife passage; Raptor-proofing power transmission poles; Creating artificial raptor nest sites; Increasing habitat diversity by creating rock clusters and shallow depressions on reclaimed land; Cottonwood plantings along reclaimed drainages; Replacing drainages, wetlands and alluvial valley floors disturbed by mining; Reducing vehicle speed limits to minimize mortality; Instructing employees not to harass or disturb wildlife; Preparing raptor mitigation plans.	Baseline and annual wildlife monitoring surveys; Monitoring for MBHFI.
Threatened, Endangered, & Proposed Species	Avoiding bald eagle disturbance; Restoring bald eagle foraging areas disturbed by mining; Restoring mountain plover habitat disturbed by mining; Using raptor safe power lines; Surveying for Ute ladies' tresses; Surveying for mountain plover; Searching for black-footed ferrets if prairie dogs move onto tract.	Baseline and annual wildlife monitoring surveys.
Cultural Resources	Conducting Class I and III surveys to identify cultural properties on all state and federal lands and on private lands affected by federal undertakings; Consulting with SHPO to evaluate eligibility of cultural properties for the NRHP; Avoiding or recovering data from significant cultural properties identified by surveys, according to an approved plan; Notifying appropriate federal personnel if historic or prehistoric materials are uncovered during mining operations; Instructing employees of the importance of and regulatory obligations to protect cultural resources.	Monitoring mining activities during topsoil stripping; cessation of activities and notification of authorities if unidentified sites are encountered during topsoil removal.
Land Use	Suitably restoring reclaimed area for historic uses (grazing and wildlife).	Monitoring controlled grazing prior to bond release evaluation.

TABLE 4-3 REQUIRED MITIGATION AND MONITORING MEASURES REQUIRED FOR ALL ALTERNATIVES		
RESOURCE	**REGULATORY COMPLIANCE OR MITIGATION REQUIRED BY STIPULATIONS OR REQUIRED BY STATE OR FEDERAL LAW[1]**	**MONITORING[1]**
Native American Concerns	Notifying Native American tribes with known interest in this area of leasing action and request for help in identifying potentially significant religious or cultural sites.	No specific monitoring program.
Paleontological Resources	Notifying appropriate federal personnel if potentially significant paleontological sites are discovered during mining.	No specific monitoring program.
Visual Resources	Restoring landscape character during reclamation through return to approximate original contour and revegetation with native species.	No specific monitoring program.
Noise	Protecting employees from hearing loss.	MSHA inspections.
Transportation Facilities	Relocating existing pipelines, if necessary, in accordance with specific agreement between pipeline owner and coal lessee.	No specific monitoring program.
Socioeconomics	Paying royalty and taxes as required by federal, state, and local regulations.	Surveying and reporting to document volume of coal removed.
Hazardous & Solid Waste	Disposing of solid waste and sewage within permit boundaries according to approved plans; Storing and recycling used oil; Maintaining of files containing Material Safety Data Sheets for all chemicals, compounds, and/or substances used during course of mining; Ensuring that all production, use, storage, transport, and disposal of hazardous waste is in accordance with applicable existing or hereafter promulgated federal, state, and government requirements; Complying with emergency reporting requirements for releases of hazardous materials as established in CERCLA, as amended; Preparing and implementing spill prevention control and countermeasure plans, spill response plans, inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended; Preparing emergency response plans.	No specific monitoring other than required by these other regulations and response plans.

RESIDUAL IMPACTS

Residual impacts are unavoidable impacts that cannot be mitigated and would therefore remain following mining and reclamation.

Topography and Physiography

Topographic moderation is a permanent consequence of mining. The indirect impacts on wildlife habitat diversity would also be considered permanent.

Geology and Minerals

Geology from the base of the coal to the surface would be subject to significant, permanent change. CBM resources not recovered prior to mining would be permanently lost.

Soils

Existing soils would be mixed and redistributed, and soil-forming processes would be disturbed by mining. This would result in long-term alteration of soil characteristics.

Air Quality

No residual impacts to air quality would occur following mining.

Water Resources

The area where groundwater drawdowns and replacement of coal and overburden with spoils occur would be increased under the alternatives compared to what would occur without the addition of the LBA tract. The postmining backfill may take in excess of 100 years to reach equilibrium water levels and water quality. Less time would be required near the mining boundaries. Water level and water quality in the backfill would be suitable to provide water to wells for livestock use, but it would be different from premining conditions.

Alluvial Valley Floors

No residual impacts to alluvial valley floors would occur following mining.

Wetlands

Replaced wetlands (jurisdictional or functional) may not duplicate the exact function and landscape features of the premining wetland, but all wetland replacement plans would be approved by COE.

Vegetation

Reclaimed vegetative communities may never completely match the surrounding native plant community.

Wildlife

Although the LBA tract would be reclaimed to be as near original condition as possible, there would be some residual wildlife impacts. The topographic moderation would result in a permanent loss of habitat diversity and a potential decrease in slope-dependent shrub communities. This would reduce the carrying capacity of the land for shrub-dependent species.

Threatened, Endangered, and Proposed Wildlife Species

No residual impacts to T&E or proposed species are expected.

Land Use and Recreation

No residual impacts to land use and recreation are expected.

Cultural Resources

Cultural sites that are determined to be eligible for the NRHP and that cannot be avoided would be destroyed by surface coal mining after data from those sites is recovered. Sites not eligible for the NRHP would be lost.

Native American Concerns

No residual impacts to Native American concerns have been identified.

Paleontological Resources

No residual impacts to significant paleontological resources are expected.

Visual Resources

No residual impacts to visual resources are expected.

Noise

No residual impacts to noise are expected.

Transportation Facilities

No residual impacts to transportation facilities are expected.

Socioeconomics

No residual impacts to socioeconomics are expected.

CUMULATIVE IMPACTS

Cumulative impacts result from the incremental impacts of an action added to other past, present, and reasonably foreseeable future actions, regardless of who is responsible for such actions. Cumulative impacts can result from individually minor, but collectively significant, actions occurring over time.

This section briefly summarizes the cumulative impacts that are occurring as a result of existing development in the area being mined and considers how those impacts would change if the West Hay Creek LBA tract is leased and mined and if other proposed development in the area occurs. Projects that have proceeded beyond preliminary planning phases include:

1) construction and operation of the Two Elk power plant, which has been proposed east of the Black Thunder Mine;

2) construction of Wygen II power plant which has been proposed at the Wyodak Mine site;

3) the construction of the proposed DM&E Railroad line; and

4) the ongoing development of CBM resources north and west of the area of active coal mining.

Since decertification of the Powder River Federal Coal Region in 1990, the BLM's Wyoming State Office has held 15 competitive coal lease sales and issued 11 new federal coal leases containing approximately 3.178 billion tons of coal using the LBA process (table 1-1 in chapter 1). This leasing process has undergone the scrutiny of two appeals to the Interior Board of Land Appeals and one audit by the General Accounting Office.

The Wyoming BLM has pending applications for nine additional maintenance tracts for existing mines containing about 2.3 billion tons of coal (table 1-2). All of the pending applications have been reviewed and recommended for processing by the PRRCT.

BLM completed one exchange in the Wyoming portion of the PRB in 2000, authorized by Public Law 95-554. EOG Resources (formerly Belco) received a federal lease for a 106-million ton portion of the Hay Creek tract adjacent to the Buckskin Mine in exchange for the rights to a 170-million ton coal lease near Buffalo, Wyoming that is unmineable due to construction of Interstate 90 (BLM 1999b). Triton acquired this lease, which is southeast of and adjacent to the West Hay Creek LBA tract, from EOG

Resources and has amended their mining and reclamation permit to include mining the federal coal included in this lease. A coal exchange proposed by Pittsburg and Midway Coal Mining Company is also currently being evaluated. Under this exchange, federal coal in Sheridan County, Wyoming would be exchanged for privately owned lands and minerals in Lincoln, Carbon, and Sheridan counties, Wyoming.

Four regional EISs evaluating surface coal development in the PRB in Wyoming were previously prepared. They are:

> *Final Environmental Impact Statement, Eastern Powder River Basin of Wyoming*, BLM, October 1974;
>
> *Final Environmental Impact Statement, Proposed Development of Coal Resources in the Eastern Powder River Basin of Wyoming*, BLM, March 1979;
>
> *Final Powder River Regional Coal Environmental Impact Statement,* BLM, December, 1981; and
>
> *Draft Environmental Impact Statement for Round II Coal Lease Sale in the Powder River Region*, BLM, January 1984.

Since 1989, coal production in the Powder River Basin has increased by an average of 6.8% per year. The increasing state production is primarily due to increasing sales of low-sulfur, low-cost coal to electric utilities who must comply with phase I requirements of Title III of the 1990 Clean Air Act Amendments. Electric utilities account for 97% of Wyoming's coal sales. In 2001, approximately 30% of the coal mined in the United States came from the PRB.

The mines currently operating in Campbell and northern Converse counties are shown in figure 1-1. Their current status and ownership are shown in table 4-4. There have been numerous changes in mine ownership during the last decade, and this has resulted in mine consolidations and mine closings within the basin.

The mines are located just west of the outcrop of the Wyodak coal, where the coal is at the shallowest depth. The mines in Campbell and Converse counties currently produce over 95% of the coal produced in Wyoming each year. Table 4-5 summarizes predicted coal mining activity (from the 1979 and 1981 regional EISs) with actual activity that has occurred since the EISs were prepared.

Campbell and Converse counties= oil production decreased 57% (from 32.8 million barrels in 1992 to14.3 million barrels of oil in 2001) (WOGCC 2000). Oil production throughout Wyoming is expected to continue to decline (WGS 2002). This can be attributed to low exploration and production drilling levels and the fact that old oil fields with declining production are responsible for most of Wyoming’s oil production.

Natural gas production has been increasing, particularly in Campbell County, due to the development of shallow CBM resources west of the coal mines. CBM exploration and development is currently ongoing throughout the PRB in Wyoming, and it is estimated that as of January 2002 there were more than 12,000 wells in place. Most of these wells have been drilled in Campbell County

Since the early 1990s, the Wyoming BLM has completed numerous EAs and two EISs analyzing CBM projects. The most recent of these is the four-volume *Final EIS and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project,* which was completed in January 2003. The project area for this EIS includes almost eight million acres of mixed federal, state, and private lands within the Wyoming portion of the PRB. This EIS analyzes the cumulative impacts of reasonably foreseeable CBM and conventional oil and gas development. It will be used to update the BLM planning documents in the area of proposed CBM development. The impacts of drilling, completing, operating, and reclaiming almost 39,400 new federal, state, and private CBM wells in addition to the roughly 12,100 federal, state, and private CBM wells already drilled or permitted for the project area is analyzed. The draft EIS also analyzes the impacts of developing 3,200 new conventional oil and gas wells, as well as constructing, operating, and reclaiming various ancillary facilities needed to support the new CBM and conventional wells (BLM 2002). CBM resources were not being developed when the regional coal EISs (BLM 1974, 1979, 1981, 1984) were prepared.

CBM wells can be drilled on private and state oil and gas leases after approval by the WOGCC and the Wyoming SEO. BLM must analyze the individual and cumulative environmental impacts of all drilling (federal, state, and private), as required by NEPA, before CBM drilling on the federal oil and gas leases can be authorized. BLM does not authorize drilling on state or private leases but must consider the impacts from those wells in their NEPA analyses. In many areas of the PRB the coal estate is federally owned, but the oil and gas estate is privately owned. A June 7, 1999 Supreme Court decision (98-830) assigned the rights to develop CBM on a piece of land to the owner of the oil and gas estate.

Other mineral development levels in the Wyoming PRB are currently lower than predicted in the EISs. In the 1970s, significant uranium development was anticipated in southwest Campbell County and northwest Converse County. This development did not materialize because the price of uranium dropped in the early 1980s. There are currently two *in situ* uranium operations in Converse and Johnson counties, but no mines and no mills. There were three active *in situ* operations in the PRB in 1999, but one of them, located in southeastern Johnson County, has since ceased operations. The spot market price of uranium has ranged from a low of $7.10 per pound of yellowcake in December 2000 to $9.90 per pound in July 2002.

TABLE 4-4
STATUS OF WYOMING POWDER RIVER BASIN COAL MINES

2000 Mine	1994 Mine Operator	Coal Production [1] 1993 Actual[2]	1994 Permitted	2001 Mine Operator	Coal Production [1] 2001 Actual[3]	2002 Permitted[4]	Status/Comments
Buckskin	SMC (Zeigler)	11.18	24.0	Triton Coal Co.	19.10	27.5	Active
Clovis Point	Kerr-McGee	0	4.0	Wyodak Resources	0.00	0	Mine shut down/leases relinquished or sold; facilities sold; Wyodak has AQD permit
Dry Fork	Phillips/WFA	3.28	15.0	WFA	4.00	15	Active
Eagle Butte	Cyprus-Amax	16.70	29.6	RAG American	24.80	35	Active
Fort Union	Fort Union Ltd	0.06	9.3	Kennecott/Kfx	0.00	9.4	Inactive
	Carter (Exxon)	9.86	24.0	Peabody	0.00	24	Active in 2002
	Wyodak Resources	3.03	10.0	Wyodak Resources	3.50	12	Active
NORTHERN MINE GROUP TOTALS		**44.11**	**115.9**		**51.40**	**122.9**	
Belle Ayr	Cyprus-Amax	15.59	25	RAG American	11.80	45	Active
Caballo/N. Caballo	Carter (Exxon)/ Western Energy	15.42	40	Peabody	27.10	40	Active/Caballo Mine + former Rocky Butte & West Rocky Butte leases
Cordero Rojo	Kennecott/ Drummond	21.01	44	Kennecott	43.50	65	Active/Cordero + Caballo Rojo Mines
Coal Creek	ARCO	0.11	18	Arch	0.00	18	Inactive
CENTRAL MINE GROUP TOTALS		**52.13**	**127**		**82.40**	**168**	
Antelope	Kennecott	7.29	12	Kennecott	24.60	30	Active
Black Thunder	ARCO	34.32	36	Arch	67.60	100	Active
Jacobs Ranch	Kerr-McGee	18.39	25	Kennecott	29.30	50	Active
N. Antelope/ Rochelle	Peabody	32.94	50	Peabody	74.80	105	Active/North Antelope Mine + Rochelle Mine
N. Rochelle	SMC (Zeigler)	0.02	8	Triton Coal Co.	23.90	35	Active/facilities constructed in 1998-99
SOUTHERN MINE GROUP TOTALS		**92.96**	**131**		**220.20**	**320**	
TOTALS FOR 3 MINE GROUPS		**189.2**	**373.9**		**354.00**	**577.4**	

[1]Actual production (million tons) on left, WDEQ/AQD permitted production (million tons) on right.
[2]Source: WGS 1994.
[3]Source: BLM website.
[4]Source: BLM website, with WDEQ Air Quality Division permitted rates as of August 7, 2001.

TABLE 4-5
COAL PRODUCTION AND DEVELOPMENT,
CAMPBELL AND CONVERSE COUNTIES, WYOMING

	Coal Production (mmt)	Number of Active Coal Mines	Number of Existing Power Plants	Number of Active Coal Enhancement Facilities	Direct Coal Employment	Average Price-NE Wyoming
1979 predictions for 1990	174.3	15	2	1	3,889	na
1981 predictions for 1990	318.4	37	3	1	11,900	na
Actual 1990	162.6	18	3	1	2,862	$6.86
Actual 1994	216.9	19	4	1	3,126	$5.62
Actual 1995	246.5	19	4	1	3,177	$5.60
Actual 1996	261.1	18	4	2	3,274	$5.40
Actual 1997	264.1	18	4	2	3,164	$5.03
Actual 1998	297.5	16	4	2	3,348	$4.73
Actual 1999	319.9	15[1]	4	2	3,362	$4.66

Existing Power Plants:	PP&L Dave Johnson, PP&L Wyodak, Black Hills Simpson #1, and Black Hills Simpson #2, Wygen I
Proposed New Power Plants	NAPG Two Elk, NAPG Two Elk Unit Two, Zeigler ENCOAL, Calpine & Black Hills Wygen II and NAPG Middle Bear
Existing Coal Enhancement:	ENCOAL-Buckskin (inactive), KFx-Fort Union (active), and Wyodak Earthco (active)

[1]Includes the Dave Johnson Mine which is not included in table 4-4.

Sources: BLM 1979, 1981; WGS 1996-1999, and Wyoming State Inspector of Mines Annual Reports, 1990-1999.

Scoria is quarried for use as road surfacing material primarily by coal mines but also by a few excavation and construction firms. Bentonite is mined in parts of the Wyoming PRB but not in Campbell or Converse counties.

The proposed West Hay Creek LBA tract is situated at the north end of a nearly continuous corridor of five operating coal mines (Buckskin, Eagle Butte, Rawhide, Dry Fork, and Wyodak) in northern Campbell County, Wyoming. The Fort Union Mine is currently inactive. This northern mine corridor is approximately 15 miles long and 5

miles wide. Production of coal in this northern mine group began in 1977, excluding the Wyodak Mine which has been operation since 1923. The current maximum permitted production rate for these five mines is 86 million tons per year (table 4-4). One maintenance lease and one lease exchange, including approximately 1,658 acres of federal coal, have been issued to mines in this northern group since decertification (Eagle Butte LBA and EOG (Belco Lease Exchange) table 1-1). There are two pending maintenance leases containing approximately 2,483 acres of federal coal in the northern group of mines (West Hay Creek, West Extension, table 1-2).

CBM wells have been drilled around the Buckskin, Rawhide, and Eagle Butte mines. CBM drilling and production is expected to continue in the areas around the coal mines and on the LBAs. Due to the proximity of the coal mining and CBM production operations, cumulative impacts to groundwater, surface water, air quality, and wildlife are likely to occur as more CBM resources are developed adjacent to existing surface coal mines. These potential impacts are discussed in the cumulative impact discussion for these resources.

In addition to the ongoing coal mining and leasing and the CBM development, other projects planned in the vicinity of the northern mine group include the construction of theWygen II coal-fired power plant which has been proposed at the Black Hills Corporation energy complex near the Wyodak Mine site. The power plant could be expected to have overlapping impacts with the impacts of mining the West Hay Creek LBA tract.

Most of the other projects planned in the PRB are located some distance south of the LBA tract near the middle and southern portion of the basin. These include the construction and operation of the North American Power Group's Two Elk and Two Elk Unit 2 power plants east of the Black Thunder Mine; construction and operation by North American Power Group of a 500-megawatt coal fired power plant at the Cordero Rojo Complex; and construction and use of the proposed DM&E rail line. One project, the ENCOAL facility, which at one time was scheduled for construction at the North Rochelle Mine, has been indefinitely delayed. The impacts of mining the West Hay Creek LBA tract would not be expected to overlap with the impacts of building and operating these projects.

Black Hills Energy Capital, Inc., the independent power subsidiary of Black Hills Corporation, initiated the permitting process to build the 500-Mw Wygen II power plant in 2002. The proposed plant would adjoin its other generating plant (Wygen I) near Gillette. It would be similar in features to the existing 360-Mw Wyodak power plant at the same location. Construction could begin on the Wygen II plant in 2003 *(Gillette News-Record* 2003), and it could be operational by mid-2005 (Black Hills Corporation 2001).

The Surface Transportation Board preliminarily approved the DM&E Railroad expansion plan (to build 280 miles of new track in the PRB and to rehabilitate approximately 600 miles of track across South Dakota and Minnesota) on December 11, 1998. The

approval was made pending the completion of an analysis of the environmental impacts of the project. The Surface Transportation Board released the DEIS for public comment in September 2000; the FEIS for the DM&E expansion project was issued November 19, 2001. On January 30, 2002 the Surface Transportation Board announced its final approval for the DM&E PRB expansion project, subject to a number of environmental mitigation conditions and the requirement that DM&E use an environmentally preferable route that avoids sensitive areas along the Cheyenne River. DM&E's originally proposed route in Wyoming generally followed along the Cheyenne River valley.

DM&E had originally proposed to start construction in 1999 and complete the new railroad line in 2001; however, final approval and construction could not take place until after the environmental analysis was completed. DM&E must still obtain permits or approvals from other agencies including the BLM, USFS, and COE. Several lawsuits were filed against the proposal following the Surface Transportation Board's approval of the project (WGS 2002b).

The rate of reclamation is one aspect of the surface coal mining operations where the actual levels reached in 1990 and 1995 did not meet the levels predicted for 1990 and 1995 in the regional EISs. According to the "Annual Evaluation Summary Report for the Coal Regulatory Program Administered by the Land Quality Division of the Wyoming Department of Environmental Quality for Evaluation Year 2002" (OSM 2002), the cumulative number of acres that have been disturbed by surface mining operations in Wyoming equaled 100,096. The cumulative number of acres reclaimed equaled 33,403, which equates to a ratio of reclamation to disturbance of 0.34 on a statewide basis in 2002. According to the report cited above, the Casper Field Office of OSM reviewed the contemporaneous reclamation/backfilling and grading schedules for nine mining operations in 2002 to provide an overall general picture of the reclamation trends in relation to the mining progression. In the annual evaluation report for 2002, the OSM Casper Field Office indicated it is concerned that At the rate at which lands are being reclaimed in Wyoming is decreasing when compared to the rate of disturbance, approximately 3 to 1,thereby creating a backlog of lands needing reclamation, contributing to a delay in contemporaneous reclamation and subsequent bond release.@ As a result of this concern, the OSM's Casper Field Office plans to continue to evaluate this part of the Wyoming surface mining program.

OSM tracks the ratio of acres of permanent reclamation each year to acres of net disturbance available for reclamation each year. Areas not available for reclamation include things such as stockpiles, active pits, access roads, haul roads, railroad rights-of-way, coal preparation and loading sites, offices, shops, sediment ponds, and other long-term approved uses. For the 2002 evaluation year, there was a 17% increase in reclamation and a 14% increase in newly disturbed lands in Wyoming. Most of the newly disturbed area was for long-term facilities such as those described above. OSM determined that the ratio of reclamation to net disturbance for the 2002 evaluation year was 1.68. When the ratio is greater than 1.0, the reclamation is greater than the net disturbance. Since 1990, the ratio of reclamation to net disturbance has ranged from a low of 0.40 in 1997 to a high of 1.68 in 2002 (OSM 2002).

Some of the factors that affect achievement of contemporaneous reclamation standards include changing strip ratios which create material surpluses or deficits, using stockpiles to provide material to fill final pit voids or to store new pit boxcut material, changing the direction of mining pits to conform to lease configuration, changing plans to accommodate production growth, and changes in technology or mining method.

Currently, WDEQ/LQD suggests to operators that only large, contiguous areas such as drainage basins be considered for bond release, with the assurance that the area will not be disturbed in the future. Because many mine plans cross a drainage basin several times during the life of mine, final reclamation of some drainage basins may not occur until late in the life of mine.

For the northern group of mines, approximately 24% of the area of disturbance has been backfilled and graded. At the Buckskin Mine, 253 acres were disturbed in 2001 and 119 acres were seeded to the permanent vegetation species. The Buckskin Mine was one of the nine operations reviewed by the OSM's Casper Field Office, and they found a ratio of backfilled, graded and seeded land to disturbed land of 0.32 for the mine.

Topography and Physiography

Following surface coal mining and reclamation, topography will be modified in an elongated corridor east of and paralleling Wyoming 59 from just north of Gillette, Wyoming, south for about 75 miles. The topography in the PRB is characterized by relatively flat or rolling topography. After reclamation, these characteristics will be emphasized in the reclaimed area. In general, in the mining corridor, premining features that were more topographically unique (steeper hills and gullies, and rock outcrops) will generally be smoothed. The premining topography of the West Hay Creek LBA tract is flat to gently rolling, and for this tract, the expected post-mining topography is expected to be similar to the premining topography. The overall reduction in topographic diversity in the mining corridor may lower the carrying capacity for big game in the reclaimed areas; however, big game ranges are generally very large and mining activities are not usually located in habitats defined as crucial. The overall flattening and smoothing of the topography would result in increased infiltration of surface water and reduced peak flows from the drainages. These changes would not be significant because the streams typically flow from west to east across the area rather than north to south along the entire corridor. Therefore, only a small part of each stream's drainage area would be disturbed. There would be no significant cumulative impacts to topography and physiography due to the proximity of CBM development, and the proposed railroad line power plants to the coal mining operations in this area because the construction and operation of those projects would cause minimal topographic and/or physiographic changes.

Geology and Minerals

The PRB coalfield encompasses an area of about 12,000 square miles. Finley and Goolsby (2000) estimate that approximately 587 billion tons of coal in beds thicker than 20 feet and deeper than 200 feet are found in the basin. The remaining strippable Wyodak coal reserves (with 200 feet or less of overburden) are estimated at 15.5 billion short tons (WGS 2002a). Converse County has a total area of 4,050 square miles of which slightly less than 1% is within current permit boundaries. Campbell County has a total area of about 4,760 square miles, of which approximately 4% is within current mine permit boundaries. Coal mining in this area disturbs about 3,000 acres annually. In the PRB, the coal reserves currently leased represent a small percentage of the total coal reserves but a large percentage of the shallowest (hence the most economical to recover) coal reserves. Within the five operating northern mines and the inactive Fort Union Mine, approximately 24,715 acres of federal coal are currently leased. This is about a 10% increase over the 22,483 acres of federal coal that were leased in the northern group of mines in 1990, before decertification. Actual coal production from 1993 to 2001 for the northern group increased about 17%, compared to a production increase of 58% for the middle group of mines and 137% for the southern group of mines over the same time period.

Under the Proposed Action, approximately 838 additional acres of federal coal would be leased, which would represent a 3% increase in the area of leased federal coal in the northern group of mines. The area of disturbance associated with mining these leases, which would be greater than the leases themselves, is discussed in other parts of this document.

Coal and CBM are nonrenewable resources which form as organic matter decays and undergo chemical changes over geologic time. The CBM and coal resources that are removed to generate heat and power would not be available for use in the future. No potential damages to the coal resulting from removal of the CBM and water prior to mining have been identified. The CBM operators generally do not completely dewater the coal beds to produce the CBM because that could damage fractures in the coal and limit CBM production. Construction of the proposed railroad line and power plants would not impact the geology or mineral resources in the area, so there would be no overlapping impacts related to these projects.

Soils

The five operating northern mines would disturb approximately 25,300 acres throughout their combined lives. (Together they would disturb about 350 to 500 acres annually during active mining at the currently planned mining rates.) If the West Hay Creek LBA tract is leased and mined, the disturbance area in the northern group of mines would increase to approximately 26,300 acres. This would represent an additional 4% increase in disturbance. Assuming ten years from initial disturbance to use of a parcel of reclaimed land by domestic livestock, approximately 3,500 to 5,000 acres would be unavailable for such use at any given time during active mining. The replaced topsoil

would support a stable and productive native vegetation community adequate in quantity and quality to support planned postmining land uses (rangeland and wildlife habitat).

Additional, although less extensive, soil disturbance would be associated with proposed CBM development west of the mines. There would be less extensive soil disturbance associated with the construction of the proposed power plants and railroad line, which would be located south of the West Hay Creek LBA tract, if they are constructed as proposed.

Air Quality

The EPA CALPUFF dispersion model was used with meteorological data generated by the MM5 (mesoscale model) and CALMET models to perform air pollutant dispersion modeling to quantify potential PM_{10} and SO_2 impacts related to proposed oil and gas development, including CBM development, in the PRB in northeastern Wyoming and southeastern Montana. The modeling was conducted to analyze potential air quality impacts from the oil and gas development alternatives being considered in the Wyoming *Final EIS and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project* (BLM2003a) and the Montana *Final Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans* (BLM2003b). These documents will be referred to as the "Wyoming PRB Oil and Gas Project EIS" and the "Montana Statewide EIS," respectively, in the following discussion. The Wyoming project area for this air quality analysis includes Campbell, Sheridan, Johnson, and northern Converse counties. The Montana project area for this air quality analysis includes all of Carter, Powder River, Big Horn, Yellowstone, Carbon, Stillwater, Sweetgrass, Wheatland, Golden Valley, Musselshell, and Treasure counties and portions of Rosebud and Custer counties. The West Hay Creek LBA tract analysis area is located in northern Campbell County, Wyoming, which lies in the eastern part of the Wyoming project area.

Surface coal mining operations in Montana and Wyoming were included in the air quality impact assessment as nonproject sources (other reasonably foreseeable emission sources). Coal-related data supplied by the Wyoming and Montana BLM offices for the analysis include estimated coal production volume (based on coal demand forecasts), annual acreage disturbance, and approximate location of mining activity for active mines (based on the currently approved mining and reclamation plan for each mine) in Wyoming and Montana during the years when the overlapping impacts of oil and gas development and other development were estimated to be the greatest.

Construction emissions related to the proposed oil and gas development would occur during potential road and well pad construction, well drilling, and well completion testing. During well completion testing, natural gas may be flared and exhausted. Since the burned natural gas is "sweet" (does not contain sulfur compounds), no objectionable odors are likely to occur.

Maximum potential near-field particulate matter emissions from traffic on unpaved roads and during well pad construction were used to predict the maximum 24-hour and annual average PM_{10} concentrations. Maximum air pollutant emissions from each well would be temporary (occurring during a short construction period) and would occur in isolation, without significantly interacting with adjacent well locations. Particulate matter emissions from well pad and resource road construction would be minimized by applying water. The control efficiency of the dust suppression was computed at 50% during construction. During production and maintenance, the oil and gas operators would not routinely employ dust abatement procedures on roads within the Wyoming PRB Oil and Gas EIS project area.

This analysis was prepared solely under the requirements of NEPA to assess and disclose reasonably foreseeable impacts to the public and BLM and USFS decision makers. The air quality impact assessment was based on the best available engineering data and assumptions, meteorology data, and dispersion modeling procedures, as well as professional and scientific judgment. However, where specific data or procedures were not available, reasonable assumptions were incorporated. For example, the air quality impact assessment for Alternative 1 of the Wyoming PRB Oil and Gas Project EIS assumed that all CBM wells would go into production (no dry holes), then operate at full production levels (no shut-ins) for about 7 years, with an overall 20 year life of project (LOP). Potential direct project, indirect, and cumulative air quality impacts were analyzed to predict maximum potential near-field ambient air pollutant concentrations and potential hazardous air pollutant (HAP) impacts, as well as to determine maximum far-field ambient air pollutant concentrations, visibility, and atmospheric deposition (acid rain) impacts. The methodologies used to predict and interpret potential air quality impacts are described in the appendix E.

Air pollution impacts are limited by state, tribal and federal regulations, standards, and implementation plans established under the CAA and administered by the applicable air quality regulatory agencies (including WDEQ/AQD or the EPA). Although not applicable to the oil and gas development alternatives that were analyzed, the Departments of Environmental Quality for Montana, South Dakota, and Nebraska have similar jurisdiction over potential air pollutant emission sources in their respective states, which can have a cumulative impact with WDEQ/AQD approved sources. Air quality regulations require proposed new, or modified existing air pollutant emission sources (including CBM compression facilities) undergo a permitting review before their construction can begin. Therefore, the applicable air quality regulatory agencies have the primary authority and responsibility to review permit applications and to require emission permits, fees, and control devices, prior to construction and/or operations related to oil and gas development.

Congress (through the CAA section 116) also authorized local, state, and tribal air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than federal requirements. As discussed in chapter 1, BLM would not authorize mining by issuing leases for tracts considered in this EIS, but the impacts of mining the coal are considered because it is a logical consequence of issuing a lease.

The West Hay Creek LBA tract was applied for by an existing mine with an air quality permit approved by WDEQ/AQD. If the LBA tract is leased as a maintenance tract to the Buckskin Mine, the mine would have to modify its existing approved air quality permit. That modified permit would have to be approved before the LBA tract could be mined. Additional site-specific air quality analysis would be performed, and additional emission control measures (including a BACT analysis and determination) may be required by the applicable air quality regulatory agencies to ensure protection of air quality.

In cases where BLM does authorize operations, such as approving a permit to drill an oil and gas well, under both FLPMA and the CAA, BLM cannot authorize any activity which does not comply with all applicable local, state, tribal, and federal air quality laws, statues, regulations, standards, and implementation plans. An extensive air quality impact assessment technical support document was prepared to analyze potential impacts from the development alternatives, as well as other reasonably foreseeable emission sources, and is available for review (Argonne 2002).

The significance criteria for potential air quality impacts include state, tribal, and federally enforced legal requirements to ensure air pollutant concentrations will remain within specific allowable levels. These requirements include the NAAQS and WAAQS which set maximum limits for several air pollutants, and PSD increments which limit the incremental increase of certain air pollutants (including NO_2, PM_{10}, and SO_2) above legally defined baseline concentration levels. These legal limits were presented in table 3-1 in chapter 3.

Where legal limits have not been established, BLM uses the best available scientific information to identify thresholds of significant impacts. Thresholds have been identified for HAP exposure, incremental cancer risks, potential atmospheric deposition impacts to sensitive lakes, and a “just noticeable change” in potential visibility impacts.

Impacts Common to All Alternatives

The air quality impact analysis used market demand predictions in order to estimate levels of coal production in the PRB for modeling purposes. There is enough coal leased to the existing mines in the PRB to supply this market demand during the time of maximum CBM development activity in the PRB, which is the time when the maximum overlapping impacts to air quality would occur. As a result, the cumulative impacts predicted by the PRB air quality impact assessment would be the same under the Proposed Action and all of the alternatives for leasing or not leasing federal coal considered in this EIS. Under the No Action alternative (Alternative 1- not leasing the coal included in the West Hay Creek LBA tract) considered in this EIS, the currently approved mining operations on the existing Buckskin Mine leases would proceed as permitted. Under the Proposed Action and alternatives considered in this EIS, the mining operations would move onto the newly leased tract. The period of time that the mine would be in operation at the currently approved rate would be extended

As discussed in chapter 3, the major air pollutants emitted from surface coal mining activities are fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, loading, and hauling overburden and coal and the large areas of disturbed land all produce dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM_{10}) is the major significant pollutant from coal mine point sources. The measures that are being used to control air pollutant emissions from existing approved mining operations include baghouse dust collection systems, PECs, or atomizers/foggers, paving mine access roads, applying water and chemical dust suppressants on all haul roads used by trucks and/or scrapers, limiting haul truck speeds, limiting material drop heights for shovels and draglines (bucket to truck bed or backfill), using permanent and temporary revegetation of disturbed areas to minimize wind erosion, and using stilling sheds at coal truck dumps. In addition, some of the mines are participating in the control of fugitive emissions from some nearby unpaved county roads by applying dust suppressants. These measures would be applied under all of the alternatives being considered in this EIS.

Air quality impacts related to oil and gas development would occur during construction (due to potential surface disturbance by earth-moving equipment, vehicle traffic fugitive dust, well testing, as well as drilling rig and vehicle engine exhaust) and production (including non-CBM well production equipment, booster (field) and pipeline (sales) compression engine exhausts). The amount of air pollutant emissions during construction would be controlled by watering disturbed soils, and by air pollutant emission limitations imposed by applicable air quality regulatory agencies. Maximum construction impacts from fugitive dust (24 hour PM_{10}) are estimated to be 55 $\mu g/m^3$, about one third of the applicable WAAQS. Actual air quality impacts depend on the amount, duration, location, and emission characteristics of potential emissions sources, as well as meteorological conditions (wind speed and direction, precipitation, and relative humidity).

The HAP impact analysis was based on a maximum assumed six-unit reciprocating compressor engine station, applicable for all proposed Wyoming PRB Oil and Gas Project EIS alternatives, as described in the air quality appendix (appendix E). Since neither the WDEQ-AQD nor EPA have established HAP standards, predicted 8-hour HAP concentrations were compared to a range of 8-hour state maximum acceptable ambient concentration levels (EPA 1997a). Formaldehyde was the only HAP predicted to exceed even the lowest threshold level. The maximum predicted cumulative 8-hour formaldehyde impact was 11.9 $\mu g/m^3$, which is within the threshold range of 4.5 $\mu g/m^3$ (Pinnellas County Air Pollution Control Board, Florida), to 71 $\mu g/m^3$ (State of Nevada, Division of Environmental Protection, Air Quality Control). The maximum formaldehyde concentration was predicted to occur at 85 meters (less then 300 feet) adjacent to a compressor station. As the distance from the emission source increases, the predicted concentrations decrease rapidly.

Further analysis was conducted to determine the possible incremental cancer-risk over a 70-year lifetime for a most likely exposure (MLE) to residents, and to a maximally

exposed individual (MEI), such as compressor station workers. These cancer risks were calculated based on the maximum predicted annual concentrations, EPA's unit risk factors for carcinogenic compounds (EPA 1997b), and an adjustment for time spent at home or on the job. This analysis assumed that residential exposure would be 20 years (well over the national nine-year average duration a family lives at a residence) and worker exposure would be 20 years (the full LOP). In addition, it was assumed that family members would be exposed to the maximum formaldehyde concentrations 64% of the day, and to one quarter of this concentration for the remaining 36% of the day.

The resulting incremental cancer risks were calculated to be 1.6×10^{-6} (MLE) and 2.2×10^{-6} (MEI). Both of these values fall near the lower end of the 1 to 100×10^{-6} threshold. The MLE and MEI cancer risks would fall below this threshold at 310 and 460 meters away from the emission source, respectively. This distance would be even less for smaller compressor stations.

When reviewing the predicted near- and far-field impacts, it is important to understand that assumptions were made regarding potential resource development, emissions, meteorology, atmospheric transport and chemistry, and atmospheric deposition. For example, there is uncertainty regarding ultimate development (number of wells, equipment to be used, specific locations of wells, etc).

The following assumptions were used in the analysis:

- Total predicted short-term air pollutant impact concentrations were assumed to be the sum of the assumed background concentration, plus the predicted maximum cumulative modeled concentrations, which may occur under different meteorological conditions.

- Assumed background air pollution concentrations were assumed to occur throughout the 20-year LOP at all locations in the region, even though monitoring is primarily conducted in urban or industrial areas rather than rural areas. The uniform background PM_{10} levels for each state are assumed to be representative of the background conditions for the entire modeled area of the PRB, based on monitoring data gathered throughout northeastern Wyoming and southeastern Montana.

- The maximum predicted air quality impacts occur only in the vicinity of the anticipated emission sources. Actual impacts would likely be less at distances beyond the predicted points of maximum impact.

- All emission sources were assumed to operate at their reasonably foreseeable maximum emission rates simultaneously throughout the LOP. Given the number of sources included in this analysis, the co-probability of such a scenario actually occurring over an entire year (or even 24-hours) is small.

- In developing the emissions inventory and model, there is uncertainty regarding ultimate development (number of wells, equipment to be used, specific locations, etc.) Most (90%) proposed CBM wells and 30% of conventional wells were assumed to be fully operational and remain operating (no shut ins) throughout the LOP.

- The total proposed booster (field) and pipeline (sales) compression engines were assumed to operate at their rated capacities continuously throughout the LOP (no phased increases or reductions). In reality, compression equipment would be added or removed incrementally as required by the well field operation, compressor engines would operate below full horsepower ratings, and it is unlikely all compressor stations would operate at maximum levels simultaneously.

- The HAP analyses assumed a 9,900 horsepower, six-unit, reciprocating compressor engine station would operate at full load and at maximum emission levels continuously throughout the LOP.

- The emissions inventory and model use peak years of construction and peak years of operations, which would not occur throughout the entire development region at the same time. However, it is possible that conditions close to this could occur in some isolated areas.

- The emissions inventory and model assumed a NO_x emission rate for compressor engines of 1.5 g/hp-hr in Montana and 1.0 g/hp-hr in Wyoming. Since BACT is decided on a case-by-case basis, actual emission rates could be decided to be less or more than this level by the Departments of Environmental Quality in Wyoming or Montana, and on Indian lands by EPA, for field and sales compressor engines. Actual NO_x emission rates may range from 0.7 to 2 g/hp-hr.

- There are no applicable local, state, tribal, or federal acid deposition standards. In the absence of applicable standards, the acid deposition analysis assumed that a “limit of acceptable change” is a 10% change in acid neutralizing capacity (ANC) for lakes with a background ANC greater than 25 µeq/l; or a 1 µeq/l change in ANC for lakes with a background ANC less than 25 µeq/l, and would be a reasonably foreseeable significant adverse impact. Further, the atmospheric deposition impact analysis assumed no other ecosystem components would affect lake chemistry for a full year (assuming no chemical buffering due to interaction with vegetation or soil materials).

- The visibility impact analysis assumed that a 1.0 dv “just noticeable change” would be a reasonably foreseeable significant adverse impact, although there are no applicable local, state, tribal, or federal regulatory visibility standards. However, some FLMs are using 0.5 dv as a screening threshold for significance.

- Mitigation measures are included in the emissions inventory and model that may not be achievable in all circumstances. However, actual mitigation decided by the developers and local and state authorities may be greater or less than those assumed in the analysis. For example, maintaining a construction road speed limit of 15 mph may be reasonable in a construction zone but difficult to enforce elsewhere. Full (100%) mitigation of fugitive dust from disturbed lands may not be achievable. Further, 50% reduction in fugitive emissions is assumed based on construction road wetting on the unimproved access road to the pad and at the pad, but this level of effectiveness is characterized as the maximum possible. Wetting was assumed for maintenance traffic, which is not likely to occur, but this is considered to be a small effect because of limited traffic.

- Induced or secondary growth related to increases in vehicle miles traveled (believed to be on the order of 10% overall) is not included in the emissions inventory and model. Not all fugitive dust emissions (including county and other collector roads) have been included in the emissions inventory and model.

- Fugitive dust emissions from roads are treated as area sources rather than line sources in the model, which may reduce or increase the predicted ambient concentrations at maximum concentration receptor points near the source, depending on the inputs to the model (meteorology, terrain, etc.) By not placing modeled receptors close to emission sources (wells and roads), the model may not capture higher ambient concentrations near these sources. A more refined, regulatory model may yield higher concentrations at locations near fugitive dust sources.

- For comparisons to the PSD Class I and II increments, the emissions inventory and model included only CBM and nonproject sources. Other existing increment consuming sources such as Campbell County coal mines were not included in this comparison, as the air quality analysis does not represent a regulatory PSD increment consumption analysis. A regulatory PSD increment consumption analysis needs to identify and consider all PSD increment consuming sources to determine the level of PSD Class II increment consumption. Monitoring data in Wyoming has indicated an upward trend in PM concentrations in Campbell County since 1999, which coincides with CBM development but is also exacerbated by prolonged drought in the region.

Given these assumptions, the predicted impacts represent an estimate of potential air quality impacts.

Before actual coal or oil and gas development could occur, the applicable air quality regulatory agencies (including the state, tribe, or EPA) would review specific air pollutant emissions preconstruction permit applications that examine source-specific air quality impacts. As part of these permits (depending on source size), the air quality regulatory agencies could require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality

analyses would be performed to ensure protection of air quality.

Impacts from Temporary Generators

The exact number of temporary natural gas and diesel generators for gas pipeline compressor stations cannot be predicted, but at any one time there may be as many as 400 portable diesel generators and 70 portable gas generators operating. Typical emission factors (in grams per horsepower per hour (g/hp-hr)) for these generators are shown in table 4–6. Table 4–7 shows the potential ground-level concentrations resulting from operation of these temporary generators.

TABLE 4-6
EMISSION FACTORS FOR TEMPORARY GENERATION FOR OIL AND GAS PIPELINE COMPRESSORS

Pollutant	Emission Factor Range (g/hp-hr)
Carbon monoxide	0.3 – 2.0
Oxides of nitrogen	0.7 – 1.5
$PM_{2.5}$	0.03 – 0.07
Sulfur dioxide	0.002
Volatile organic compounds	0.5 – 1.0
Formaldehyde	0.05 – 0.2

TABLE 4-7
NEAR-FIELD CONCENTRATIONS FROM A SINGLE TEMPORARY GENERATOR FOR OIL AND GAS PIPELINE COMPRESSORS

Pollutant	Averaging Time	Concentration Range ($\mu g/m^3$)	WAAQS ($\mu g/m^3$)
Carbon monoxide	1-hour	55.3 – 403.1	40,000
	8-hour	33.2 – 242.9	10,000
Nitrogen dioxide	Annual	1.9 – 7.5	100
$PM_{2.5}$	24-hour	1.5 – 5.3	65
	Annual	0.1 – 0.4	15
Sulfur dioxide	3-hour	0.2 – 0.4	1,300
	24-hour	0.09 – 0.3	260
	Annual	0.007 – 0.013	60

Predicted Air Quality Impacts

The Wyoming PRB Oil and Gas Project EIS evaluates four alternatives. Alternative 1 is the Proposed Action, which assumes that there would be 39,400 new CBM wells in the Wyoming PRB by 2012 in addition to the 12,000 existing wells. The Proposed Action also assumes drilling of an estimated 3,200 conventional oil and gas wells in the same time period. Alternatives 2a and 2b evaluate alternate emission levels and water handling scenarios. Under Alternative 3 (the No Action Alternative), drilling would not occur on federal oil and gas leases but would continue on state and private oil and gas leases. BLM estimates that approximately 15,500 new CBM wells would be developed on state and private lands by 2012 under this alternative, in addition to the 12,000 existing wells. For the purposes of this EIS, the range of potential impacts predicted by the cumulative air quality analysis for all the three oil and gas action alternatives are shown in the following tables, as well as the potential impacts predicted under the No Action Alternative. Please refer to the Wyoming PRB Oil and Gas Project Final EIS (BLM 2003a) to see the individual result for each oil and gas alternative.

Wyoming PRB Oil and Gas EIS Alternatives 1, 2a, and 2b

Under all three oil and gas alternatives, potential direct project air quality impacts would not violate any local, state, tribal, or federal air quality standards under Alternative 1.

Based on extensive air quality modeling of potential direct project air quality impacts (Argonne 2002), localized short-term increases in CO, NO_x, PM_{10}, and SO_2 concentrations would occur, but all maximum concentrations are expected to be below applicable NAAQS and WAAQS. All maximum near-field direct project NO_2, PM_{10} and SO_2 concentrations are expected to be below applicable PSD Class II increments (table 4-8), and all maximum far-field direct project concentrations are expected to be below applicable PSD Class I increments (appendix E).

Although potential direct project impacts to even the most sensitive far-field lakes would not be significant, a “just noticeable change” in visibility was predicted to occur at from nine to eleven mandatory federal Class I areas, ranging up to five days at the Washakie Wilderness Area. The maximum potential direct project visibility impacts were predicted to occur on 14 to 20 days per year on the Crow Indian Reservation. A detailed description of the air quality impact analysis is presented in the air quality appendix (appendix E).

Wyoming PRB Oil and Gas EIS Alternative 3

Potential direct project air quality impacts would not violate any local, state, tribal, or federal air quality standards under Alternative 3 (No Action) of the Wyoming PRB Oil and Gas Project EIS. Based on extensive air quality modeling of potential direct project air quality impacts (Argonne 2002), localized short-term increases in CO, NO_x, PM_{10},

TABLE 4-8
RANGE OF PREDICTED MAXIMUM POTENTIAL NEAR-FIELD IMPACTS UNDER ALTERNATIVE 1, 2A, AND 2B OF THE WYOMING PRB OIL AND GAS PROJECT EIS
(with Montana Alternative E)

Pollutant	Averaging Time	Project ($\mu g/m^3$)	Nonproject ($\mu g/m^3$)[2]	Cumulative ($\mu g/m^3$)	PSD Class II ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)[1]	WAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	6 to 8	3	9 to 10	25	17	26 to 28	100	100
SO_2	Annual	<1	<1	1	20	3	4	60	80
	24 hour	2	2	3	91	8	11	260	365
	3 hour	3	5	5	512	8	13	1,300	1,300
PM_{10}	Annual	3	1	4	17	17	21	50	50
	24 hour	15 to 20	9	25 to 31	30	42	67to 73	150	150
$PM_{2.5}$	Annual	1 to 2	1	2		8	10	15	15
	24 hour	11 to 16	9	12 to 24		19	38to 43	65	65
CO	8 hour	77 to 156	124	132 to 156		1500	1624 to 1656	10,000	10,000
	1 hour	157 to 223	142	170 to 224		3500	3670 to 3724	40,000	40,000

[1]The contributions from each source represent maxima and do not necessarily occur at the same location. Therefore, the total concentrations will not always equal the sum of the monitored background, project, and nonproject concentrations.

[2]Nonproject sources include CBM sources in Montana and surface coal mining operations in Wyoming and Montana.

and SO_2 concentrations would occur, but all maximum concentrations are expected to be below applicable NAAQS and WAAQS. All maximum near-field direct project NO_2, PM_{10} and SO_2 concentrations are expected to be below applicable PSD Class II increments (table 4-9), and all maximum far-field direct project concentrations are expected to be below applicable PSD Class I increments (appendix E).

Although potential direct project impacts to even the most sensitive far-field lakes would not be significant, a "just noticeable change" in visibility was predicted to occur one day per year at the mandatory federal Class I Bridger, Fitzpatrick, and Washakie wilderness areas. The maximum potential direct project visibility impacts were predicted to occur on 10 days per year on the Crow Indian Reservation. A detailed description of the air quality impact analysis is presented in the air quality appendix.

Cumulative Impacts

Based on a separate assessment predicting potential far-field cumulative air quality impacts (Argonne 2002), the EPA CALMET/CALPUFF dispersion model system was used to predict maximum potential air quality impacts at downwind mandatory federal PSD Class I areas, and other sensitive receptors. This was done 1) to determine if the WAAQS, NAAQS, or PSD Class I increments might be exceeded; 2) to calculate potential nitrate and sulfate atmospheric deposition (and their related impacts) in sensitive lakes; and 3) to predict potential impacts to visibility (regional haze).

Meteorological information was assembled to characterize atmospheric transport and dispersion from several data sources, including: 1) 4 km gridded wind field values derived from the MM5 (mesoscale model) with continuous four-dimensional data assimilation; and 2) hourly surface observations (wind speed, wind direction, temperature, cloud cover, ceiling height, surface pressure, relative humidity, and precipitation).

For each Wyoming PRB Oil and Gas Project EIS alternative, potential air pollutant project sources were combined with nonproject sources to determine the total potential cumulative air quality impacts. This included potential cumulative sources from the Montana Statewide Draft Oil and Gas EIS sources. The range of potential cumulative impacts correspond to including either the Montana Alternative A (low) or the Montana Alternative B/C/E (high) emission sources. Coal mining operations in Wyoming and Montana were included as nonproject sources.

As described above, potential CO and NO_x emissions from reasonably foreseeable booster (field) and pipeline (sales) compressor stations, as well as $PM_{2.5}$, PM_{10}, and SO_2 emissions from construction equipment, were analyzed to predict potential maximum near-field PSD Class II impacts, as well as potential far-field impacts at 29 mandatory federal PSD Class I and other sensitive areas located in Wyoming, Montana, North and South Dakota, and Nebraska (Argonne 2002). Total concentrations are expected to be in compliance with applicable WAAQS and NAAQS (appendix E).

TABLE 4-9
PREDICTED MAXIMUM POTENTIAL NEAR-FIELD IMPACTS UNDER ALTERNATIVE 3 OF THE WYOMING PRB OIL AND GAS PROJECT EIS
(with Montana Alternative E)

Pollutant	Averaging Time	Project ($\mu g/m^3$)	Nonproject ($\mu g/m^3$)[2]	Cumulative ($\mu g/m^3$)	PSD Class II ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)[1]	WAAQS ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	3	3	6	25	17	23	100	100
SO_2	Annual	<1	<1	<1	20	3	3	60	80
	24 hour	1	2	2	91	8	10	260	365
	3 hour	1	5	5	512	8	13	1300	1300
PM_{10}	Annual	1	1	2	17	17	19	50	50
	24 hour	7	9	16	30	42	58	150	150
$PM_{2.5}$	Annual	<1	0.7	1		8	9	15	15
	24 hour	6	9	13		19	32	65	65
CO	8 hour	183	124	183		1500	1683	10,000	10,000
	1 hour	261	142	261		3500	3761	40,000	40,000

[1]The contributions from each source represent maxima and do not necessarily occur at the same location. Therefore, the Total concentrations will not always equal the sum of the monitored background, project, and nonproject concentrations.

[2]Nonproject sources include CBM sources in Montana and surface coal mines in Wyoming and Montana.

Table 4-10 presents the maximum predicted air pollutant concentrations at specified PSD Class I areas.

TABLE 4-10
MAXIMUM PREDICTED PSD CLASS I AREA
CUMULATIVE FAR-FIELD IMPACTS UNDER WYOMING PRB OIL AND GAS PROJECT EIS ALTERNATIVE 1 (PROPOSED ACTION) AND ALL WEST HAY CREEK LEASE APPLICATION EIS ALTERNATIVES

Pollutant	Averaging Period	Class I Area	Maximum Modeled Concentration (Cumulative)	PSD Class I Increment
Nitrogen dioxide	Annual	Northern Cheyenne Reservation	4.2	2.5
PM_{10}	24-hour	Northern Cheyenne Reservation	12.8	8
	Annual	Northern Cheyenne Reservation	1.7	4
Sulfur dioxide	3-hour	Northern Cheyenne Reservation	5.1	25
	24-hour	Absaroka-Beartooth Wilderness	2.4	5
	Annual	Northern Cheyenne Reservation	0.3	2

Source: Argonne 2002

Under all four alternatives (1, 2A, 2B, and 3) considered in the Wyoming PRB Oil and Gas Project EIS, potential nonproject and cumulative annual NO_2 concentrations (ranging from 4.1 to 4.2 µg/m^3) were predicted to be above the PSD Class I increment (2.5 µg/m^3) within the Northern Cheyenne Reservation. Under all four Wyoming PRB Oil and Gas Project EIS alternatives, potential project, and cumulative 24-hour PM_{10} concentrations (ranging from 10.7 to 12.8 µg/m^3) were above the PSD Class I increment (8 µg/m^3) within the Northern Cheyenne Reservation. Under Wyoming PRB Oil and Gas Project EIS alternatives 1, 2A, and 2B, cumulative 24-hour PM_{10} concentrations (ranging from 8.5 to 9.2 µg/m^3) were also predicted to be above the PSD Class I increment (8 µg/m^3) within the Washakie Wilderness Area. These impacts would be the same under all of the coal leasing alternatives considered in this EIS. As described in the air quality appendix (appendix E), other PSD Class I areas had predicted far-field impacts below applicable increments. All PSD Class II areas had predicted far-field impacts below applicable PSD increments. This NEPA analysis compares potential air quality impacts from the proposed Wyoming PRB Oil and Gas Project EIS alternatives to applicable ambient air quality standards and PSD increments. Comparisons to the

PSD Class I and II increments are intended to evaluate a threshold of concern for potential impacts, and do not represent a regulatory PSD increment consumption analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. For a new source review air quality permit application for a major source, the applicable air quality regulatory agencies may require a regulatory PSD increment analysis. More stringent emission controls beyond BACT may be stipulated in the air quality permits if impacts are predicted to be greater than the PSD Class I or Class II increments.

Several lakes within four FS-designated wilderness areas were identified as being sensitive to atmospheric deposition and for which the most recent and complete data have been collected. The FS has also identified the following limit of acceptable change regarding potential changes in lake chemistry: no more than a 10% change in ANC for those water bodies where the existing ANC is at or above 25 µeq/L; and no more than a one µeq/L change for those extremely sensitive water bodies where the existing ANC is below 25 µeq/L.

Based on a Rocky Mountain Region FS screening method (FS 2000), Table 4-11 demonstrates that potential impacts to most sensitive lakes would be below applicable significance thresholds. However, under all four Wyoming PRB Oil and Gas Project EIS alternatives (1, 2A, 2B, and 3), potential nonproject ANC impacts (1.3 µeq/L) were predicted to exceed the 1.0 µeq/L impact threshold at the very sensitive Upper Frozen Lake within the PSD Class I Bridger Wilderness Area. Cumulative ANC impacts ranged from 1.6 to 1.8 µeq/L. Nearly 12% to 27% of these impacts are due to direct contributions from Wyoming PRB Oil and Gas Project EIS alternatives 1, 2A, 2B, and 3 alone. In addition, under Wyoming PRB Oil and Gas Project EIS Alternative 1 and 2A, cumulative ANC impacts (up to 10.7%) were predicted to exceed the 10% impact threshold at Florence Lake within the PSD Class II Cloud Peak Wilderness Area. Nearly 29% and 27% of these impacts are due to direct contributions from Wyoming PRB Oil and Gas Project EIS Alternatives 1 and 2A, respectively. Potential impacts at all other sensitive lakes (and under all Wyoming PRB Oil and Gas Project EIS alternatives) were below the ANC threshold levels. No sensitive lakes were identified by either the NPS or FWS.

Since the development of the project and nonproject air pollutant emission sources constitute many small sources spread out over a very large area, discrete visible plumes are not likely to affect the mandatory federal PSD Class I areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Regional haze degradation is caused by fine particles and gases scattering and absorbing light. Potential changes to regional haze are calculated in terms of a perceptible “just noticeable change” (1.0 dv) in visibility when compared to background conditions.

TABLE 4-11
PREDICTED TOTAL CUMULATIVE CHANGE IN ACID NEUTRALIZING CAPACITY AT SENSITIVE AREA LAKES
(percent change)

Wilderness Area	Lake	Background ANC (µeq/L)	Area (hectares)	Change (percent)	Thresholds (percent)
Bridger	Black Joe	69	890	2.2 to 2.1	10
	Deep	61	205	2.5 to 3.0	10
	Hobbs	68	293	1.3 to 1.5	10
	Upper Frozen	5.8[a]	65	1.6 to 1.9[b]	1[b]
Fitzpatrick	Ross	61.4	4,455	1.8 to 2.1	10
Absaroka-Beartooth	Stepping Stone	27	26	2.3 to 2.5	10
	Twin Island	36	45	1.6 to 1.8	10
Cloud Peak	Emerald	55.3	293	5.0 to 6.0	10
	Florence	32.7	417	8.9 to 10.7	10
Popo Agie	Lower Saddlebag	55.5	155	3.2 to 3.8	10

[a]The background concentration is based on only six samples taken on four days between 1997 and 2001.
[b]Since the background ANC value is less than 25 µeq/L, the potential ANC change is expressed in µeq/L, and the applicable threshold is one µeq/L.

Source: Argonne 2002

A 1.0 dv change is considered a small but noticeable change in haziness as described in the preamble to the EPA regional haze regulations (*Federal Register*, Vol. 64 No. 126, dated July 1, 1999). A 1.0 dv change is defined as about a 10% change in the extinction coefficient (corresponding to a 2% to 5% change in contrast, for a black target against a uniform sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes within mandatory federal Class I areas.

It should be noted that a 1.0 dv change is not a "just noticeable change" in all cases for all scenes. Visibility changes less than 1.0 dv are likely to be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution, such as due to preferential forward light scattering. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the maximum visual range, a change greater than 1.0 dv might be required to be a "just noticeable change."

This NEPA analysis is not designed to predict specific visibility impacts for specific views in specific mandatory federal Class I areas based on specific project designs. It

is to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region based on reasonable emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a preconstruction air quality PSD permit application, the applicable air quality regulatory agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of dv change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0 dv threshold (as well as the modeling analyses assumptions) should all be considered when assessing the significance of predicted impacts.

The FS, NPS, and FWS have published their final FLAG Phase I report (*Federal Register*, Vol. 66 No. 2, dated January 3, 2001), providing "a consistent and predictable process for assessing the impacts of new and existing sources on AQRVs" including visibility. For example, the FLAG report states "A cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed," and further, "If the visibility impairment from the proposed action, in combination with cumulative new source growth, is less than a change in extinction of 10 percent [1.0 dv] for all time periods, the FLMs will not likely object to the proposed action." Although the FLAG procedures were primarily designed to provide analysis guidance to PSD permit applicants, the following analysis uses the Final FLAG Phase I report procedures for this NEPA analysis.

Based on multiple iterations of the nonsteady state CALPUFF dispersion modeling system, including the CALMET meteorological model, for four different development alternatives, potential cumulative visibility impacts estimated by the seasonal FLAG screening method exceeded the impact thresholds (including the use of FLAG and WDEQ/AQD provided background extinction values) at all 29 sensitive areas analyzed. Therefore, potential maximum visibility impacts were estimated using the daily FLAG refined method (based on hourly optical extinction and relative humidity values measured at two IMPROVE monitoring locations) for each Class I and Class II sensitive area. Although the potential modeled impacts for each sensitive area were based on 1996 MM5 regional meteorology, these values were compared to hourly optical extinction and relative humidity data collected at two locations in the analysis area between 1989 and 1999.

For example, since the 1.0 dv threshold was predicted to be reached within the mandatory federal PSD Class I Washakie Wilderness Area based on the seasonal FLAG screening methodology, the maximum modeled cumulative impacts at that area were also compared to representative hourly optical and relative humidity values measured at Bridger Wilderness Area between 1989 and 1999 using the daily FLAG refined method (table 4-12). The range of impacts was then summarized as the annual average number of days over the 11-year periods predicted to equal or exceed a 1.0 dv "just noticeable change" (table 4-13).

TABLE 4-12
PREDICTED VISIBILITY IMPACTS IN THE MANDATORY FEDERAL PSD CLASS I WASHAKIE WILDERNESS AREA FROM DIRECT WYOMING PRB OIL AND GAS PROJECT EIS ALTERNATIVE SOURCES – DAILY FLAG-REFINED METHOD
(average number of days per year predicted to equal or exceed a 1.0 dv "just noticeable change")

Alternative	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	4	2	7	6	4	7	4	6	7	2	6
2A	2	2	6	5	4	6	4	5	5	1	4
2B	1	2	6	5	3	6	4	4	5	1	3
3	1	0	4	3	1	1	2	2	2	0	0

Note:
Potential cumulative visibility impacts were predicted using daily background optical and relative humidity conditions for each of the years listed above.

Source: Argonne 2002

The prediction of potential visibility impacts based on the daily FLAG refined methodology using measured optical extinction conditions is intended to disclose potential air quality impacts on the affected environment to the public and decision maker before an action is taken. It is not intended to be an air quality regulatory analysis. Such analysis would be conducted by the applicable air quality regulatory agencies.

It is important to note that before actual development could occur, the applicable air quality regulatory agencies (including the state, tribe, or EPA) would review specific air pollutant emissions preconstruction permit applications that examine source-specific air quality impacts. As part of these permits (depending on source size), the air quality regulatory agencies could require additional air quality impacts analyses or mitigation measures. Thus, before development occurs, additional site-specific air quality analyses would be performed to ensure protection of air quality. For further mitigation information see the "Regulatory Compliance, Mitigation, and Monitoring" section of this chapter and appendix E.

Coal mines develop predictive models to assess the potential air quality impacts of their mining operations. Based on these predictive models conducted for PRB mines, mining operations do not have significant off-site particulate pollution impacts, even when production and pollution from neighboring mines are considered. However, this prediction has been based on the assumptions that mining activities are sufficiently removed from the permit boundaries and that neighboring mines are not actively mining in the immediate vicinity (within 0.6-2.5 miles). Previous modeling (BLM 1992a) has shown that incremental particulate pollution impacts decrease to insignificant levels (<1 $\mu g/m^3$ PM_{10} annual average) within 6 miles of active mining.

TABLE 4-13
PREDICTED VISIBILITY IMPACTS IN CLASS I AREAS – DAILY FLAG-REFINED METHOD

(average number of days per year predicted to equal or exceed a 1.0 dv "just noticeable change")

Class I Area	Alt 1	Alt 2A	Alt 2B	Alt 3	Nonproject Sources	Cumulative Sources
Badlands Wilderness Area[1]	3	3	1	0	13 to 17	18 to 28
Bridger Wilderness Area	4	4	3	1	7 to 9	8 to 12
Fitzpatrick Wilderness Area	4	3	3	1	6 to 9	8 to 12
Gates of the Mtns Wilderness Area	0	0	0	0	3 to 4	3 to 4
Grand Teton National Park	1	1	0	0	3 to 5	4 to 8
North Absaroka Wilderness Area	4	3	2	0	9 to 13	11 to 15
Red Rock Lakes Wilderness Area	0	0	0	0	0 to 1	0 to 3
Scapegoat Wilderness Area	0	0	0	0	2 to 2	2 to 3
Teton Wilderness Area	3	3	2	0	6 to 9	7 to 11
Theodore Roosevelt NMP[2] (North Unit)	0	0	0	0	1 to 1	1 to 3
Theodore Roosevelt NMP[2] (South Unit)	1	0	0	0	1 to 3	2 to 7
U.L. Bend Wilderness Area	1	1	1	0	4 to 5	5 to 8
Washakie Wilderness Area	5	4	4	1	10 to 14	12 to 18
Wind Cave National Park	4	3	2	0	17 to 21	22 to 28
Yellowstone National Park	3	2	1	0	8 to 11	9 to 13
Northern Cheyenne Reservation[3]	17	16	14	7	27 to 82	33 to 92

Note: Results shown are the predicted impacts under Wyoming PRB Oil and Gas Project Alternatives 1, 2A, 2B, and 3; impacts related to coal mining under all West Hay Creek lease application EIS (alternatives are included Under "Non-Project Sources")

[1]Congress designated the wilderness area portion of Badlands National Park as a mandatory federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.
[2]NMP - National memorial park.
[3]Although the Northern Cheyenne Reservation is a tribal designated PSD Class I area, it is not a mandatory federal PSD Class I area subject to EPA's regional haze regulations.

Nonproject Sources – The impact of all air pollutant emission sources not included in Wyoming PRB Oil and Gas Project EIS Alt 1, Alt 2A, Alt 2B or Alt 3, including existing surface coal mines in Wyoming and Montana and the Montana Statewide EIS sources. The range of potential annual average days above a 1.0 dv "just noticeable change" in visibility corresponds to including Montana Alternative A (low) to Montana Alternative B/C/E (high).

Cumulative Sources – The impact of all cumulative air pollutant emission sources combined, including Wyoming PRB Oil and Gas Project EIS Alt 1, Alt 2A, Alt 2B, Alt 3, and nonproject sources (which include the West Hay Creek Lease Application EIS Proposed Action and alternatives and Montana Statewide EIS sources). The range of potential annual average days above a 1.0 dv "just noticeable change" in visibility corresponds to: including nonproject, Wyoming Alternative 3 and Montana Alternative A sources (low); up to including nonproject, Wyoming Alternative 1 and Montana Alternative B/C/E sources (high).

Source: Argonne 2002

In cases where mines are within 2 miles, WDEQ follows a modeling protocol which accounts for all mine-generated particulate air pollutants from all nearby mines to determine impacts to ambient air quality. Known as the Mine A/Mine B modeling procedure, this model evaluates the total impacts of a given mining operation, including those impacts from and on neighboring mines. The Rawhide Mine is located within two miles of the Buckskin Mine.

Gaseous orange clouds, some containing concentrations of NO_x, have been produced by overburden blasting at surface coal mines in the PRB. In 1995, 1998, and 1999, OSM received citizen complaints concerning NO_x gases generated from blasting operations drifting off mine permit areas (OSM 2000). No citizen complaints were received by OSM or WDEQ during the 2001 evaluation year, which ended on September 30, 2001 (OSM 2002) or the 2002 evaluation year, which ended on September 30, 2002 (OSM 2002). These gaseous orange clouds generally do not overlap due to the distances between mines and the variation in blasting schedules.

The nature of these blasting clouds and human health consequences resulting from short-term exposures to NO_x are discussed earlier in this chapter. Included are the results of a study of possible public exposure to NO_2 concentrations from blasting. The evaluation is based on short-term measurements (15 minutes) and the results are compared to NO_2 monitoring results from annual and daily monitoring in the PRB as well as to existing workplace standards for NO_2 exposures. There is no short-term ambient air standard for NO_2 in Wyoming.

In response to the public concern about these clouds and the potential consequences to human health, WDEQ and the mines have developed required and voluntary measures to protect the public from exposure to the clouds as described in chapter 3. The mines in the eastern PRB have also been cooperating in a research and development effort aimed at reducing blasting clouds (*Casper Star Tribune* 2/3/02). This research has led to changes in blasting agents and the size of blasting shots that have reduced NO_x emissions during blasting. As indicated above, no citizen complaints were received by OSM or WDEQ/LQD during the 2001 or 2002 evaluation years.

Another air quality concern is the venting of methane that occurs when coal is mined. Methane is generated from coal beds. When coal is mined, either by surface or underground methods, the methane that is present in the coal is vented to the atmosphere. Methane is a greenhouse gas that contributes to global warming. According to the "Methane Emissions" section of Energy Information Administration/Department of Energy (EIA/DOE) report 0573(99), *Emissions of Greenhouse Gases in the United States 1999*, U.S. anthropogenic methane emissions totaled 28.8 million metric tons in 1999. In 1999, methane emissions from coal mining were estimated at 2.88 million metric tons (10% of the US total anthropogenic methane emissions in 1999). According to table 15 of this report, surface coal mining was estimated to be responsible for about 0.54 million metric tons of methane emissions in 1999. This represents about 1.88% of the estimated US anthropogenic methane

emissions in 1999, and about 18.75% of the estimated methane emissions attributed to coal mining of all types.

Table 7.2 of the EIA/DOE Coal Industry Annual Energy Review for 1999 estimated that 688.3 million short tons of coal were produced by surface mines in the US in 1999. Surface mines in the Wyoming PRB produced approximately 320 million short tons in 1999, or about 46.5% of the total production. Using these numbers, it is estimated that the Wyoming PRB coal mines were responsible for approximately 0.9% of the estimated US 1999 anthropogenic methane emission.

In many areas, including the PRB, CBM is being recovered from coal and sold. On a large scale, recovery of CBM from the coal before mining by both surface and underground methods could potentially gradually reduce US emissions of CBM to the atmosphere. In the PRB, CBM is being produced from the coal areas adjacent to and generally downdip of the mines. CBM is currently being produced from the same coal seams that would be mined in West Hay Creek LBA Tract included in this EIS. As discussed earlier in this chapter, BLM estimates that a large portion of the CBM reserves could be recovered prior to initiation of mining activity on the LBA tracts under the Proposed Action. CBM reserves that are not recovered prior to mining would be vented to the atmosphere.

Water Resources

Groundwater

As a result of statutory requirements and concerns, several studies and a number of modeling analyses have been conducted to help predict the impacts of surface coal mining on groundwater resources in the Wyoming portion of the PRB. Some of these studies and modeling analyses are discussed below.

In 1987, the USGS, in cooperation with the WDEQ and OSM, conducted a study of the hydrology of the eastern PRB. The resulting description of the cumulative hydrologic effects of all current and anticipated surface coal mining (as of 1987) was published in 1988 in the USGS Water-Resources Investigation Report entitled A*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming*@, also known as the ACHIA@ (Martin, et al. 1988). This report evaluates the potential cumulative groundwater impacts of surface coal mining in the area and is incorporated by reference into this EIS. The CHIA analysis included the proposed mining of all the 1987 leases at all of the existing mines in the southern mine group. It did not evaluate potential groundwater impacts related to additional coal leasing in this area and it did not consider the potential for overlapping groundwater impacts from coal mining and CBM development.

Each mine must assess the probable hydrologic consequences of mining as part of the mine permitting process. The WDEQ/LQD must evaluate the cumulative hydrologic

impacts associated with each proposed mining operation before approving the mining and reclamation plan for each mine, and they must find that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside of the permit area for each mine. As a result of these requirements, each existing approved mining permit includes an analysis of the hydrologic impacts of the surface coal mining proposed at that mine. If revisions to mining and reclamation permits are proposed, then the potential cumulative impacts of the revisions must also be evaluated. If the West Hay Creek LBA tract is leased to the applicant, the existing mining and reclamation permit for the Buckskin Mine must be revised and approved before the tract can be mined.

Additional groundwater impact analyses have also been conducted to evaluate the potential cumulative impacts of coal mining and CBM development. One example of these analyses is the report entitled *A Study of Techniques to Assess Surface and Groundwater Impacts Associated with Coal Bed Methane and Surface Coal Mining, Little Thunder Creek Drainage, Wyoming* (Wyoming Water Resources Center 1997). This study was prepared as part of a cooperative agreement involving WDEQ/LQD, the Wyoming State Engineer's Office, the WSGS, BLM, OSM, and the University of Wyoming. The Wyodak CBM draft EIS (BLM 1999a) presented the results of a modeling analysis of the potential cumulative impacts of coal mining and CBM development on groundwater in the coal and overlying aquifers as a result of coal mining and CBM development. As a result of comments received on this modeling analysis, it was revised and the revised results were included in the Wyodak final EIS (BLM 1999c), which was distributed to the public on October 1, 1999. The technical report for both these modeling analyses is available for public review at the BLM office in Buffalo, Wyoming (Applied Hydrology & Associates, Inc. 1999). The results of these previously prepared analyses are incorporated by reference into this EIS.

The Wyoming PRB Oil and Gas Project EIS includes an updated modeling analysis of the groundwater impacts if 50,000 CBM wells are drilled in the PRB in the next ten years. The project area for this EIS covers all of Campbell, Sheridan, and Johnson counties, as well as the northern portion of Converse County.

Another source of data on the impacts of surface coal mining on groundwater is the monitoring that is required by WDEQ/LQD and administered by the mining operators. Each mine is required to monitor groundwater levels and quality in the coal and in the shallower aquifers in the area surrounding their operations. Monitoring wells are also required to record water levels and water quality in reclaimed areas.

The coal mine groundwater monitoring data is published each year by the GAGMO, a voluntary group formed in 1980. Members of GAGMO include most of the companies with operating or proposed mines in the Wyoming PRB, WDEQ, the Wyoming SEO, BLM, USGS, and OSM. GAGMO contracts with an independent firm each year to publish the annual monitoring results. In 1991, GAGMO published a report summarizing the water monitoring data collected from 1980 to 1990 in the Wyoming PRB (Hydro-Engineering 1991b). In 1996, they published a report summarizing the

data collected from 1980 to 1995 (Hydro-Engineering 1996a). In 2001, GAGMO published a report summarizing the water monitoring data collected from 1980 to 2000 (Hydro-Engineering 2001).

The northern group of mines uses several hundred acre-feet of water per year for drinking, sanitation, washing equipment, and dust control. Sources of this water include seepage into the mine pits, sediment- and flood-control impoundments, as well as production from the aquifers below the coal.

The major groundwater issues related to surface coal mining that have been identified by scoping are:

- the effect of the removal of the coal aquifer and any overburden aquifers within the mine area and replacement of these aquifers with spoil material;
- the extent of the temporary lowering of static water levels in the aquifers around the mine due to dewatering associated with removal of these aquifers within the mine boundaries;
- the effects of the use of water from the subcoal Fort Union Formation by the mines;
- changes in water quality as a result of mining; and
- potential overlapping drawdown in the coal due to proximity of coal mining and CBM development.

The impacts of large scale surface coal mining on a cumulative basis for each of these issues are discussed in the following paragraphs.

The effects of replacing the coal aquifer and overburden with a spoils aquifer is the first major groundwater concern. The following discussion of recharge, movement, and discharge of water in the spoil aquifer is excerpted from the CHIA (Martin et al. 1988):

> *"Postmining recharge, movement, and discharge of groundwater in the Wasatch aquifer and Wyodak coal aquifer will probably not be substantially different from premining conditions. Recharge rates and mechanisms will not change substantially. Hydraulic conductivity of the spoil aquifer will be approximately the same as in the Wyodak coal aquifer allowing groundwater to move from recharge areas where clinker is present east of mine areas through the spoil aquifer to the undisturbed Wasatch aquifer and Wyodak coal aquifer to the west."*

GAGMO data from 1990 to 2000 verify that recharge has occurred and is continuing in the backfill (Hydro-Engineering 1991a, 1992, 1993, 1994, 1995, 1996b, 1997, 1998, 1999, 2000, 2001). The water monitoring summary reports prepared each year by GAGMO list current water levels in the monitoring wells completed in the backfill and

compare them with the 1980 water levels, as estimated from the 1980 coal water-level contour maps. In the 1991 GAGMO 10-year report, some recharge had occurred in 88% of the 51 backfill wells reported for that year. In the GAGMO 20-year report, 79 of the 82 backfill wells measured contained water.

Coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by mining.

The cumulative size of the backfill area in the PRB and the duration of mining activity would be increased by mining of the recently issued leases and the currently proposed LBA tracts including the West Hay Creek LBA tract. However, since reclamation is occurring in mined-out areas and the monitoring data demonstrate that recharge of the backfill is occurring, it is not anticipated that additional significant impacts would occur as a result of any of the pending leasing actions. As previously discussed, through December, 2001, about 41% of the area disturbed at the Buckskin Mine had been reclaimed, and backfill monitoring wells indicate that recharge is occurring in the backfill at the Buckskin Mine.

Clinker, also called scoria, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, occurs all along the coal outcrop area (figure 4-3) and is believed to be the major recharge source for the spoil aquifer, just as it is for the coal. However, not all clinker is saturated. Some clinker is mined for road-surfacing material, but saturated clinker is not generally mined due to difficulties in mining. Therefore, the major recharge source for the spoil aquifer is not being disturbed by current mining. Clinker does not occur in significant amounts within the Buckskin Mine or within the LBA tract. Some surficial clinker is exposed along the northern portion of the LBA tract analysis area, primarily in the SE¼NE¼ of section 17.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mines. In this EIS, assessment of cumulative groundwater impacts is based on impact predictions made by Triton for mine-related drawdown at the Buckskin Mine and extrapolating those drawdowns to consider mining of the West Hay Creek LBA tract, along with previous drawdown predictions made within the northern mine group that includes the Buckskin Mine. Figure 4-3 depicts the predicted extent of the five-foot drawdown contour within the coal aquifer from the various mining scenarios. The extent of the five-foot drawdown contour is used by WDEQ/LQD to assess the cumulative extent of impact to the groundwater system caused by mining operations. In figure 4-3, these predictions are compared to the predictions in the CHIA and monitoring information gathered since publication of the CHIA. Figure 4-3 shows only the predicted drawdowns in the coal aquifer due to mining because of the discontinuous nature of the saturated sand aquifers in the Wasatch Formation overburden in the northern group of mines.

Figure 4-3: Modeled and Extrapolated Worst-Case Coal Aquifer Drawdown Scenarios.

Most of the monitoring wells included in the GAGMO 15-year report (542 wells out of 600 total) are completed in the coal beds, in the overlying sediments, or in sand channels or interburden between the coal beds. The changes in water levels in the coal seams after 15 years of monitoring are shown on figure 4-3. This map shows the area where the actual drawdown in the coal seam has been greater than 5 feet in 15 years, in comparison with the predicted worst-case 5-foot drawdown derived from groundwater modeling done by the mines. WDEQ/LQD policy is to have the mining companies determine the extent of the 5-foot drawdown contour as a method of determining off-site impacts from the various mining operations. Significantly, the more recent GAGMO 20-year report shows much more consequential drawdowns surrounding the mines and to the west. These more recent impacts are primarily the result of nearby CBM activities.

Figure 4-3 indicates that the actual drawdowns observed in 15 years of mining are still generally within the total cumulative drawdown predicted in the 1988 CHIA. The addition of the pending LBA tracts, including the West Hay Creek tract, would extend the predicted cumulative extent of the 5-foot drawdown caused by coal mining beyond the cumulative drawdown prediction in the 1988 CHIA. As stated above, data from the GAGMO 15 year report (Hydro-Engineering 1996a) is presented on this figure even though more recent data is available in the GAGMO 20 year report (Hydro-Engineering 2001). This is because the earlier data more accurately represents drawdown as a result of coal mining alone, similart to the original assumptions made in the 1988 CHIA. The much more conseqential drawdowns as identified in the GAGMO 20 year report are primarily the result of nearby CBM activities and would not present a valid comparison to the CHIA predictions.

The CHIA predicted the approximate area of 5 feet or more water level decline in the Wyodak coal aquifer which would result from "all anticipated coal mining". "All anticipated coal mining" at that time included 16 surface coal mines operating at the time the report was prepared and six additional mines proposed at that time. All of the currently producing mines, including the Buckskin Mine, were considered in the CHIA analysis (Martin et al. 1988). The study predicted that water supply wells completed in the coal may be affected as far away as eight miles from mine pits, although the effects at that distance were predicted to be minimal.

As drawdowns propagate to the west, available drawdown in the coal aquifer increases. Available drawdown is defined as the elevation difference between the potentiometric surface (elevation to which water will rise in a well bore) and the bottom of the aquifer. Since the depth to coal increases to the west, most stock and domestic wells are completed in units above the coal. Consequently, with the exception of methane wells, few wells are completed in the coal in the areas west of the mines.

Wells in the Wasatch Formation were predicted to be impacted by drawdown only if they were within 2,000 ft of a mine pit (Martin et al. 1988). Drawdowns occur farther from the mine pits in the coal than in the shallower aquifers because the coal is a confined aquifer that is areally extensive. The area in which the shallower aquifers (Wasatch Formation, alluvium, and clinker) experience a 5-foot drawdown would be much smaller than the area of drawdown in the coal because the shallower aquifers are generally discontinuous, of limited areal extent, and may be confined or unconfined.

Of the 1,200 water supply wells within the maximum impact area defined in the CHIA study, about 580 are completed in Wasatch aquifers, about 100 in the Wyodak coal aquifer, and about 280 in strata below the coal. There are no completion data available for the remainder of these wells (about 240).

The predicted cumulative effects of mining the LBA tract are depicted on figure 4-3. Based on the 1995 data, drawdowns have coalesced in the vicinity of the Buckskin, Rawhide, Eagle Butte, and Dry Fork mines into a nearly contiguous cone of depression. Mining within the proposed West Hay Creek tract and the proposed Eagle Butte West Extension tract would increase this contiguous area if the tracts are leased.

If a maintenance lease is issued for the West Hay Creek LBA Tract, prior to amending the tract into an existing WDEQ mine permit, the lessee would be required to conduct more detailed groundwater modeling to predict the extent of drawdown in the coal and overburden aquifers caused by mining the LBA tract. WDEQ/LQD would then use the drawdown predictions to update the CHIA for this portion of the PRB. The applicant has installed monitoring wells that would be used to confirm or refute drawdowns predicted by modeling. This modeling would be required as part of the WDEQ mine permitting procedure discussed in chapter 2.

Potential water-level decline in the subcoal Fort Union Formation is the third major groundwater issue. According to the Wyoming State Engineer's records as of July 1999, 14 mines hold permits for 42 wells between 400 feet and 10,000 feet deep. The zone of completion of these wells was not specified, and not all of the wells were producing (for example, three of the permits were held by an inactive mine, and one of the wells permitted by the Black Thunder Mine has not been used since 1984).

Water level declines in the Tullock Aquifer have been documented in the Gillette area. According to Crist (1991), these declines are most likely attributable to pumpage for municipal use by Gillette and for use at subdivisions and trailer parks in and near the city of Gillette. Most of the water-level declines in the subcoal Fort Union wells occur within 1 mile of the pumped wells (Crist 1991; Martin et al. 1988). The mine facilities in the PRB are separated by a distance of 1 mile or more, so little interference between mine supply wells would be expected.

In response to concerns voiced by regulatory personnel, several mines have conducted impact studies of the subcoal Fort Union Formation. The OSM commissioned a

cumulative impact study of the subcoal Fort Union Formation to study the effects of mine facility wells on this aquifer unit (OSM 1984). Conclusions from all these studies are similar and may be summarized as follows:

Because of the discontinuous nature of the sands in this formation and because most large-yield wells are completed in several different sands, it is difficult to correlate completion intervals between wells.

In the Gillette area, water levels in this aquifer are probably declining because the city of Gillette and several subdivisions are using water from the formation (Crist 1991). (Note: Gillette is mixing this water with water from wells completed in the Madison Formation at this time.)

Because large saturated thicknesses are available in this aquifer unit, generally 500 feet or more, a drawdown of 100 to 200 feet in the vicinity of a pumped well would not dewater the aquifer.

The Buckskin Mine adjacent to the West Hay Creek LBA tract has a permit from the state engineer for two deeper Fort. Union Formation water supply wells. If the LBA tract is leased and mined as proposed, additional water would be withdrawn from the Tullock Aquifer in the area of the Buckskin Mine. The additional water withdrawal would not be expected to extend the area of water level drawdown over a significantly larger area due to the discontinuous nature of the sands in the Tullock Aquifer and the fact that drawdown and yield reach equilibrium in a well due to recharge effects.

The nearest nonindustrial Fort Union well to the Buckskin Mine facilities is over 4 miles away. Due to the distance involved, these wells have not experienced interference and are not likely to in the future. The two Buckskin Mine facility wells would be in use for roughly 5 to 6 more years if the West Hay Creek LBA tract is leased depending on which alternative is selected. Their annual water production would probably not increase.

According to the Wyoming SEO records, most of the permitted wells drilled below 1,000 feet in a 100 mi^2 area surrounding the LBA tract are either for mining, CBM, or oil and gas development. There are approximately nine wells serving subdivisions and local ranches, and there is one county well within this area. As discussed above, water-level declines in the subcoal Fort Union wells typically do not extend beyond 1 mile of pumped wells. The Buckskin Mine does not anticipate drilling additional sub-coal water-supply wells if they acquire the LBA tract. No impacts to the sub-coal water supply wells would be expected if the West Hay Creek LBA tract is leased and mined as proposed because no new wells would be required to maintain existing production.

The fourth issue of concern with groundwater is the effect of mining on water quality. Specifically, what effect does mining have on the water quality in the surrounding area, and what are the potential water quality problems in the spoil aquifer following mining?

In a regional study of the cumulative impacts of coal mining, the median concentrations of dissolved solids and sulfates were found to be larger in water from spoil aquifers than in water from either the Wasatch overburden or the coal aquifer (Martin et al. 1988). This is expected because blasting and movement of the overburden materials exposes more surface area to water, increasing dissolution of soluble materials, particularly when the overburden materials were situated above the saturated zone in the premining environment. Using data compiled from ten surface coal mines in the eastern PRB, Martin et al. (1988) also concluded that backfill groundwater quality improves markedly after the backfill is leached with one pore volume of water. The same conclusions were reached by Van Voast and Reiten (1988) after analyzing data from the Decker and Colstrip Mine areas in the Montana portion of the PRB. In general, the mine backfill groundwater TDS can be expected to range from 3,000 to 6,000 mg/L, similar to the premining Wasatch Formation aquifer, and meet Wyoming Class III standards for use as stock water.

One pore volume of water is the volume of water which would be required to saturate the spoils following reclamation. The time required for one pore volume of water to pass through the spoils aquifer is greater than the time required for the postmining groundwater system to reestablish equilibrium. According to the CHIA, estimates of the time required to reestablish equilibrium range from tens to hundreds of years (Martin et al. 1988).

Chemical analyses of 336 samples collected between 1981 and 1986 from 45 wells completed in spoil aquifers at ten mines indicated that the quality of water in the spoils will, in general, meet state standards for livestock use when recharge occurs (Martin et al. 1988). The major current use of water from the aquifers being replaced by the spoils (the Wasatch and Wyodak Coal aquifers) is for livestock because these aquifers are typically high in dissolved solids in their premining state (Martin et al. 1988).

According to monitoring data published by GAGMO (Hydro-Engineering 1991a, 1991b, 1992, 1993, 1994, 1995, 1996b, 1997, 1998, 1999 and 2000), TDS values in backfill wells have ranged from 400 to 25,000 mg/L. Of the 48 backfill wells sampled in 1999 and reported in the 2000 annual GAGMO report (Hydro Engineering 2000), TDS in 75% were less than 5,000 mg/L, TDS in 23% were between 5,000 and 10,000 mg/L, and TDS in one well was above 10,000 mg/L. These data support the conclusion that water from the spoils will generally be acceptable for its current use, which is livestock watering, before and after equilibrium is established. The incremental effect on groundwater quality due to leasing and mining of the LBA tract would be to increase the total volume of spoil and, thus, the time for equilibrium to reestablish.

The fifth area of concern is the potential for cumulative impacts to groundwater resources in the coal due to the proximity of coal mining and CBM development. The Wyodak coal is being developed for both coal and CBM in the same general area. Dewatering activities associated with reasonably foreseeable CBM development would be expected to overlap with and expand the area of groundwater drawdown in the coal aquifer in the PRB over what would occur due to coal mining alone.

Numerical groundwater flow modeling was used to predict the drawdown impacts of both the Wyodak CBM Project Final EIS (BLM 1999c) and the Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project (BLM 2002) and Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project (BLM 2003a). The modeling considered coal mining and CBM development in order to assess cumulative impacts. Modeling was done to simulate mining with and without CBM development in order to differentiate the impacts of the two types of activities. Information from earlier studies was incorporated into the more recent modeling analyses.

As expected, modeling showed that the additional groundwater impacts that would result from CBM development would be additive in nature and would extend the area experiencing a loss in hydraulic head to the west of the mining area. The area between the CBM fields and the mines would be subjected to cumulative impacts of the two activities. The 20-year GAGMO report stated that drawdowns in all areas have greatly increased in the last few years due to the water production from the Wyodak coal aquifer by coal bed methane producers (Hydro-Engineering 2001).

Figure 4-4 shows the Buckskin Mine life-of-mine drawdown map (same as figure 4-2) with the maximum modeled drawdowns for year 2009 from the Draft PRB Oil and Gas Project EIS superimposed. These modeled drawdowns are for CBM only in the upper Fort Union coal and are for the proposed action of 39,400 additional CBM wells (BLM 1999a, 2002). The groundwater modeling study done for the Draft and Final PRB Oil and Gas Project EIS (BLM 2002, 2003a) considered the impacts of coal mining and CBM development on groundwater in the coal and overlying aquifers within the project area, which included almost 8,000,000 acres within all or parts Campbell, Converse, Johnson, and Sheridan counties. This analysis used the existing coal mines and predicted CBM well locations. Figure 4-4 shows that the projected drawdown in the coal caused by mining at the Buckskin Ranch Mine would be expected to overlap with and be dwarfed by projected drawdown due to CBM production. To the south and west of the Buckskin, the projected drawdown in the coal aquifer due to CBM production would greatly exceed drawdown due to mining. Even close to the mine, projected drawdown due to mining would be less than projected drawdown due to CBM production. Drawdowns from CBM development would be projected to exceed drawdowns from coal mining at a distance of less than 1 mile from the mine. As noted in the more recent GAGMO 20-year report, significant drawdowns in excess of 240 feet have already occurred to the west due to a combination of mining and coal bed methane dewatering.

Figure 4-4: Life of Mine Drawdown Map with Maximum Modeled CBM Drawdown.

Drawdowns in the coal caused by CBM development would be expected to reduce the need for dewatering in advance of mining, which would be beneficial for mining. Wells completed in the coal may also experience increased methane emissions in areas of significant aquifer depressurization. There would be a potential for conflicts to occur over who (coal mining or CBM operators) is responsible for replacing or repairing private wells that are adversely affected by the drawdowns; however, the number of potentially affected wells completed in the coal is not large.

As discussed previously, coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by coal mining. In response to concerns about the potential impacts of CBM development on water rights, a group of CBM operators and local landowners developed a standard water well monitoring and mitigation agreement that can be used on a case-by-case basis as development proceeds. The BLM decision record for the Gillette South CBM Project EIS (BLM 1997) requires that CBM operators offer landowners this agreement as part of the federal well approval process.

BLM and industry have cooperated to develop a system of monitoring wells designed to monitor groundwater levels in the coal and in shallower aquifers in areas of CBM production. In the future, the CBM operators will be responsible for drilling and maintaining additional monitoring wells as the area of CBM development expands.

The increased dewatering or depressuring of the coal seam caused by CBM development and mining together will also increase the time required for water-level recovery to occur after the CBM and mining projects are completed.

Surface Water

Streamflows may be reduced during surface coal mining because SMCRA and Wyoming state regulations require capture and treatment of all runoff from disturbed areas in sedimentation ponds before it is allowed to flow off the mine permit areas. Also, the surface coal mine pits in the PRB are large, and these pits, together with ponds and diversions built to keep water out of the pits, can intercept the runoff from significant drainage areas.

Changes in drainage patterns and surface disturbance are decreasing and will continue to decrease flows in most of the ephemeral and intermittent drainages exiting at the mine sites. Development of CBM resources in the area west of the mines could potentially increase surface flow in some drainages. Currently, there is methane production occurring in the general analysis area. (CBM development was not considered in the CHIA (Martin et al. 1988)). The amount of CBM produced water that ultimately reaches the major channels is reduced by evaporation, infiltration into the ground, and surface landowners, who sometimes divert the produced water into reservoirs for livestock use because it is of relatively good quality. For the purposes of analysis, the Final PRB Oil and Gas Project EIS (BLM 2003) assumed that discharge to surface drainages would result in a 20% total conveyance loss, of which 82% would be

caused by infiltration and 18% would result from evapotranspiration.

The USGS has predicted that, after reclamation, major streams in the PRB will exhibit increased runoff ranging from 0.4% in the Cheyenne River to 4.3% in Coal Creek due to cumulative disturbance as a result of existing surface coal mining (Martin et al. 1988). This is based on the assumption that unit runoff rates will be increased after reclamation due to soil compaction, and the percentage changes in runoff are based on permitted mine acreages in 1981. The additional leases since that time have increased the permitted acreage by about 40% and would, under the same assumptions, increase the USGS's estimates of runoff increase by the same incremental amount. This minor increase in runoff is small compared to seasonal and annual variability of runoff in the PRB.

With the exception of the Wyodak Mine, all drainage from the northern mines contributes to the northward flowing Little Powder River. The drainage area of the Little Powder River below Corral Creek is approximately 204 $mi^{2.}$ The drainage area of Hay Creek at its confluence with the Little Powder River is approximately 15 mi^2; thus the drainage area of the Little Powder River below Hay Creek is 219 mi^2. The entire area of disturbance from the four operating mines as currently permitted would impact approximately 7% of the drainage basin of the Little Powder River at this point, and this disturbance would occur over about 50 years. Proposed LBAs would raise this disturbance acreage to roughly 8% of the Little Powder River drainage basin below Hay Creek.

Sediment concentrations should not increase significantly in area streams even with the addition of mining the pending LBA tracts because state and federal regulations require that all surface runoff from mined lands pass through sedimentation ponds.

The Final PRB Oil and Gas Project EIS estimates that the peak year of CBM water production in the Little Powder River sub-watershed would occur in 2005 (BLM 2003). In that year, under the Final PRB Oil and Gas Project EIS preferred alternative (Alternative 2-A), an estimated 2,543 CBM wells would be producing at an average rate of 6.2 gpm per well. Based on the modeling done for that EIS, the amount of produced water estimated to reach to main stem of the Little Powder River sub-watershed during the peak year of CBM water production would be about 13 cfs (9,143 acre-feet /year). The confluence of Hay Creek, which flows through the West Hay Creek LBA Tract, with the Little Powder River is located about three miles east of the LBA Tract, and some of this CBM produced water would be expected to move through Hay Creek. These CBM water discharges would be expected to be more constant than the naturally occurring flows, which fluctuate widely on a seasonal and annual basis.

The CBM discharges could result in erosion and degradation of small drainages, which could affect water quality and channel hydraulic characteristics. From a surface water standpoint, the increased flows due to CBM discharges and the reduced flows due to surface coal mining will tend to offset each other. However, conflicts could also result. The CBM development takes place upstream from the mines. Provisions the mines

have taken to prevent water from entering the pits (storage ponds or diversions) could be adversely affected by having to deal with flows that were not included in designs or that change conditions for future designs.

Alluvial Valley Floors

No cumulative impacts to alluvial valley floors are expected to occur as a result of leasing and subsequent mining of the West Hay Creek LBA tract. Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. AVFs that are not significant to agriculture can be disturbed during mining but they must be restored as part of the reclamation process. Impacts during mining, before the AVF is restored, would be expected to be incremental, not additive.

Wetlands

Wetlands are discrete features that are delineated on the basis of specific soil, vegetation, and hydrologic characteristics. Wetlands within areas of coal mining disturbance are impacted; wetlands outside the area of disturbance are generally not affected unless their drainage areas (hence, water supplies) are changed by mining. Therefore, the impacts to wetlands as a result of surface coal mining are mostly incremental, not additive as are impacts to groundwater and air quality. Increasing the area to be mined would increase the number of wetlands that would be impacted.

Buckskin Mine has been authorized to impact 8.58 acres of jurisdictional wetlands. An additional 17.52 acres are jurisdictional wetlands is included in the West Hay Creek LBA tract (see the “Wetlands” section in chapter 3). COE requires replacement of all impacted jurisdictional wetlands in accordance with section 404 of the Clean Water Act. As part of the mining and reclamation plans for each mine, COE approves the plan to restore the wetlands and the number of acres of wetlands to be restored. Replacement of functional wetlands may occur in accordance with agreements with the surface managing agency (on public land) or by the private landowners. No federal surface lands are included in the West Hay Creek LBA tract. During mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not function in the same way as the premine wetlands did.

Vegetation

Most of the land that is being or would be disturbed is sandy prairie grassland, big sagebrush shrubland or agricultural pasturelands and croplands. These vegetation types account for 86% of the LBA analysis area lands, the primarily land use is grazing and wildlife habitat. Rangeland is, by far, the predominant land use in the PRB, comprising 92% of the land use in Converse and Campbell counties. A small amount of previously cultivated land would be disrupted by mining. At the completion of mining, it is anticipated that all disturbed land would be reclaimed to a condition equal to or greater the highest previous use. Reclamation would be conducted to restore the previous grazing, wildlife, cropland pastureland and other miscellaneous uses.

Reclaimed vegetation types would be mostly in the form of upland grasslands, big sagebrush shrublands, and silver sagebrush shrublands. Where appropriate, cropland, pastureland, and riparian types would be established in approximate relationship to their premining components. Some of the minor vegetation community types, such as those occurring on rough breaks, would not be restored to premining conditions but may be replaced to a higher level due to use of better quality soils.

Based on annual reports prepared by mining companies and submitted to WDEQ, in any given year approximately 8,000 acres of land disturbed by mining activities at the five active northern surface coal mines would not be reclaimed to the point of planting with permanent seed mixtures. Over the life of the five active northern mines, a total of about 25,000 acres would be disturbed. This disturbed area includes all existing federal, state, and private coal leases. Most all of this acreage is native rangeland and would be returned to that state by planting approved revegetation seed mixtures as required. However, 26% is either agricultural cropland or pastureland and could be reclaimed as such.

Several impacts to vegetation would occur as a result of operations at these five mines. Most of the surface disturbance would occur in two vegetation types: upland grassland (various types) and Wyoming big sagebrush. The big sagebrush vegetation type comprises 21% of the West Hay Creek LBA tract area. Upland grassland types comprise 46% of the disturbance area of the tract. All five mines plan to restore these two types as required by law. It is estimated that it would take from 20 to 100 years for big sagebrush density to reach premining levels. The big sagebrush component provides important wildlife habitat (particularly for mule deer, pronghorn, and sage grouse). The reduction in acreage of big sagebrush vegetation type would reduce the carrying capacity of the reclaimed lands for pronghorn and sage grouse populations. Mule deer should not be affected since they are not as abundant in this area.

Although some of the less extensive native vegetation types (riparian bottomland) would be restored during reclamation, the treated grazing lands would not. Following reclamation and release of the reclamation bond, privately owned surface lands would be returned to agricultural management. The areas with reestablished native vegetation could again be subject to sagebrush management practices.

Community and species diversities would initially be lower on reclaimed lands. The shrub components would take the longest to be restored to premining conditions. Shrub cover and forage values would gradually increase in the years following reclamation. Over longer periods of time, species re-invasion and shrub establishment on reclaimed lands should largely restore the species and community diversity on these lands to premining levels.

Over the long term, the net effect of the cumulative mine reclamation plans may be the restoration, at least in part, of all vegetation types originally found in the area. However, the shrub component may be substantially reduced in aerial extent. Shrubs are relatively unproductive for livestock but very important for wildlife. All of the vegetation

types found in the cumulative analysis area, as on the LBA tract, are fairly typical for this region of eastern Wyoming.

Wildlife

The direct impacts of surface coal mining on wildlife occur during mining and are therefore short-term. They include road kills by mine-related traffic, restrictions on wildlife movement created by fences, spoil piles and pits, and displacement of wildlife from active mining areas. The indirect impacts last longer and include loss of carrying capacity and microhabitats on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

After mining and reclamation, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density, would cause a decrease in carrying capacity and diversity on the LBA tract. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent.

Cumulative impacts to most wildlife would increase as additional habitat is disturbed but would moderate as more land is reclaimed. Raptor and grouse breeding areas have been diminishing statewide for at least the last 30 years partly due to surface-disturbing activities. Coal mining and gas exploration and development have been identified as potential contributors to the decline in their breeding habitat. Therefore, surface occupancy and disturbance restrictions, as well as seasonal restriction stipulations, have been applied to operations occurring on or near these crucial areas on public lands. These restrictions have helped protect important raptor and grouse habitat on public lands, but the success of yearlong restrictions on activities near areas critical to grouse has been limited because most of the surface in the PRB is privately owned. Erection of nesting structures and planting of trees on reclaimed land will gradually replace raptor nesting and perching sites. There is no crucial habitat for waterfowl or fish on the mine sites. Small- and medium-sized animals would move back into the areas once reclamation is completed.

Numerous grazing management projects (fencing, reservoir development, spring development, well construction, vegetative treatments) have also impacted wildlife habitat in the area. The consequences of these developments have proven beneficial to some species and detrimental to others. Fencing has aided in segregation and distribution of livestock grazing, but sheep-tight woven wire fence has restricted pronghorn movement. Water developments are used by wildlife, but without proper livestock management, many of these areas can become overgrazed. The developed reservoirs provide waterfowl, fish, and amphibian habitat. Vegetation manipulations have included the removal or reduction of native grass-shrublands and replacement with cultivated crops (mainly alfalfa/grass hay), as well as a general reduction of shrubs (mainly sagebrush) in favor of grass. These changes have increased spring and summer habitat for grazing animals but have also reduced the important shrub component that is critical for winter range, thus reducing over winter survival for big game and sage grouse. The reduction in sagebrush has been directly blamed for the

downward trend in the sage grouse populations.

The regional EISs (BLM 1974, 1979, 1981, and 1984) predicted significant cumulative impacts to pronghorn from existing concentrated mining and related disturbance as a result of habitat disturbance and creation of barriers to seasonal and daily movements. Significant cumulative indirect impacts were also predicted because of increased human population and access resulting in more poaching, increased vehicle/pronghorn collisions, and increased disturbance in general. However, the WGFD recently reviewed monitoring data collected on mine sites for big game species and the monitoring requirements for big game species on those mine sites. Their findings concluded that the monitoring had demonstrated the lack of impacts to big game on existing mine sites. No severe mine-caused mortalities have occurred, and no long-lasting impacts on big game have been noted on existing mine sites. The WGFD recommended that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors.

Leasing the West Hay Creek LBA tract would increase the area of habitat disturbance in the northern group of mines by approximately four percent and would enlarge the area where daily movement is restricted.

The West Hay Creek LBA tract is within the Gillette Antelope Herd Unit, which is located north of Interstate 90 between Wyoming 59 and the Powder River. The mining operations within the Gillette antelope herd unit are the Buckskin Mine, Eagle Butte Mine, and the Rawhide Mine. These mines will cumulatively disturb approximately 18,000 acres based on existing leases. If the West Hay Creek LBA tract is leased, the estimated mining disturbance to yearlong pronghorn range within the Gillette antelope herd unit would increase by up to 990 acres to 19,160 acres.

A WGFD review of monitoring data collected on mine sites concluded that the monitoring demonstrated the lack of impacts to big game on existing mine sites. The WGFD also recommended termination of big game monitoring on all existing mines. No long term cumulative impacts have been noted for the existing mines. Therefore, mining the West Hay Creek LBA tract should not increase cumulative impacts to the Powder River mule deer herd.

The area of active mining in the northern group of mines contains significant numbers of raptor nests. The largest concentration of nesting activity in the area is associated with the rough breaks country and areas where trees have become established. Raptor mitigation plans are included in the approved mining and reclamation plans of each mine. The raptor mitigation plan for each mine is subject to FWS review and approval before the mining and reclamation plan is approved. Any nests that are impacted by mining operations must be relocated in accordance with these plans after special use permits are secured from FWS and WGFD. The creation of artificial raptor nest sites and raptor perches may ultimately enhance raptor populations in the mined area. On the other hand, where power poles border roads, perched raptors may continue to be

illegally shot, and continued road kills of scavenging eagles may occur. Any influx of people into previously undisturbed land may also result in increased disturbance of nesting and fledgling raptors.

Cumulative impacts to waterfowl from already approved mining, as well as the proposed LBA tract, would be negligible because most of these birds are transient and most of the ponds are ephemeral. In addition, the more permanent impoundments and reservoirs that are impacted by mining would be restored. Sedimentation ponds and wetland mitigation sites would provide areas for waterfowl during mining.

Direct habitat disturbance from already approved mining, as well as the LBA tract, should not significantly affect regional sage grouse populations because few vital sage grouse wintering areas or leks have been, or are planned to be, disturbed. However, noise related to the mining activity could indirectly impact sage grouse reproductive success. Sage grouse leks close to active mining could be abandoned if mining-related noise elevates the existing ambient noise levels. Surface coal mining activity is known to contribute to a drop in male sage grouse attendance at leks close to active mining. Over time this can alter the distribution of breeding grouse (Remington and Braun 1991). Coal mining activity does cause long-term disturbance to nesting habitat. Because sage grouse populations throughout Wyoming have been declining over the past several years, this impact could be significant to the local population when evaluated with the cumulative impacts of all energy-related development occurring in the area.

The existing and proposed mines in the northern PRB would cumulatively cause a reduction in habitat for other mammal and bird species. Many of these species are highly mobile, have access to adjacent habitats, and possess a high reproductive potential. Habitat adjacent to existing and proposed mines include sagebrush shrublands, upland grasslands, bottomland grasslands, improved pastures, haylands, croplands, wetlands, riparian areas, and ponderosa pine woodlands. As a result, these species should respond quickly and invade suitable reclaimed lands as reclamation proceeds. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was slightly less than on adjacent undisturbed areas, although their overall numbers were greater (Shelley 1992).

Cumulative impacts on fish habitat and populations would be minimal because local drainages generally have limited value due to intermittent or ephemeral flows. The Dry Fork of the Little Powder River has historically supported a small trout population in its upper reach. Some of the permanent pools along drainages support minnows and other nongame fish, and the larger impoundments and streams in the area which have fish populations would be restored following mining.

Additional discussions of cumulative impacts to wildlife from coal development and industrialization of the eastern PRB are included in BLM regional EISs for the area (BLM 1974, 1979, 1981, 1984), and these documents are incorporated by reference into

this EIS. The impacts predicted in these documents have generally not been exceeded. Recent findings by the WGFD have revealed that impacts of mining on big game have been minimal. No severe mine-caused mortalities have occurred and no long-lasting impacts on big game have been noted on existing mine sites. The WGFD recommended that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which apply to the LBA tract.

The cumulative impacts of mining the LBA tract would be assessed within the WGFD's and the WDEQ/LQD's review of the mine permit application and the WDEQ/LQD's permit approval process.

Threatened, Endangered, and Proposed Wildlife Species

These are discussed in appendix G.

Land Use and Recreation

Surface coal mining reduces livestock grazing and wildlife habitat, limits access to public lands that are included in the mining areas, and disrupts oil and gas development. In addition, when oil and gas development facilities are present on coal leases, all associated facilities and equipment must be removed prior to mining. If the coal is mined before all of the CBM resources are recovered, the CBM resource would be released into the atmosphere. The potential impacts of conflicts between CBM and coal development are discussed in the "Geology and Minerals" section in this chapter.

Cumulative impacts resulting from energy extraction in the PRB include a reduction of livestock grazing and subsequent revenues, a reduction in habitat for some species of wildlife (particularly pronghorn, sage grouse and mule deer), and loss of recreational access to public lands (particularly for hunters).

There are no wilderness areas in the immediate vicinity of the existing northern group of mines, and the majority of the land is seldom used by the public except for dispersed recreation (hunting), off-road vehicles, and sightseeing. Hunting and other public access is generally limited inside of the mine permit areas for safety reasons. However, most of this land surface is private and access is controlled by the landowner. Leasing the West Hay Creek LBA tract would not affect access to public lands because no public lands are included on the tract.

The increased human presence associated with the cumulative energy development in the PRB has likely increased levels of legal and illegal hunting. Conversely, the mines in the area have become refuges for big game animals during hunting seasons since they are often closed to hunting. Reclaimed areas are attractive forage areas for big game. Energy development-related indirect impacts to wildlife have and will continue to result from human population growth. Energy development has been the primary cause of human influx into the eastern PRB. Mining the LBA tract under the Proposed Action

and Alternatives 2 and 3 would allow a continuation of employment and production at the Buckskin Mine for an additional five to six years.

The demand for outdoor recreational activities, including hunting and fishing, has increased proportionately as population has increased. However, at the same time these demands are increasing, wildlife habitat and populations are being reduced. This conflict between decreased habitat availability and increased recreational demand has had (or may have) several impacts: demand for hunting licenses may increase to the point that a lower success in drawing particular licenses will occur. Hunting and fishing may become less enjoyable due to more limited success and overcrowding; poaching may increase; the increase in people and traffic has and may continue to result in shooting of nongame species and road kills. Increased off-road activities have and will continue to result in disturbance of wildlife during sensitive wintering or reproductive periods. However, as discussed in chapter 3, the major historical management problem with the Gillette antelope herd unit is the ability to achieve an adequate harvest, according to WGFD. This herd unit area includes the West Hay Creek LBA tract, and the Buckskin, Eagle Butte, and Rawhide mines.

Campbell County's public recreation facilities are some of the most extensively developed in the Rocky Mountain region, and use by young, recreation-oriented residents is high. The relatively strong financial position of the county recreation program appears to assure future recreation opportunities for residents regardless of the development of the LBA tract or any other specific mine.

Cultural Resources

In most cases, treatment of eligible sites is confined to those that would be directly impacted, while those that may be indirectly impacted receive little or no consideration unless a direct mine-associated effect can be established. The higher population levels associated with coal development coupled with increased access to remote areas can result in increased vandalism both on and off mine property. Development of lands in which coal is strip-mineable (shallow overburden) may contribute to the permanent unintentional destruction of segments of the archeological record.

A majority of the known cultural resource sites in the PRB are known because of studies at existing and proposed coal mines. An average density estimate of 8.5 sites per mi^2 (640 acres) can be made based on inventories at existing mines in the area, and approximately 25% of these sites are typically eligible for the NRHP. Based on the cultural inventory, the density of sites and occurrence of eligible sites appears to be lower on the West Hay Creek LBA tract (chapter 3; table 3-11). Approximately 580 cultural resource sites will be impacted by already-approved mines, with an estimated 86 of these sites being eligible for nomination to the NRHP. Clearly, a number of sites eligible for nomination to the NRHP have been or will be impacted by coal mining operations within the PRB. Ground disturbance, the major impact, can affect the integrity of or destroy a site. Changes in setting or context greatly impact historical properties. Mitigation measures such as stabilization, restoration, or moving of

buildings may cause adverse impacts to context, in-place values, and overall integrity. Additionally, loss of sites through mitigation can constitute an adverse impact by eliminating the site from the regional database and/or affecting its future research potential.

Beneficial results or impacts can also occur from coal development. Valuable data are collected during cultural resource surveys. Data that would otherwise not be collected until some time in the future, or lost in the interim, are made available for study. Mitigation also results in the collection and preservation of data that would otherwise be lost. The data that has been and will be collected provides opportunities for regional and local archeological research projects.

Native American Concerns

No cumulative impacts to Native American traditional values or religious sites have been identified as a result of leasing and subsequent mining of the West Hay Creek LBA tract.

Paleontological Resources

Impacts to paleontological resources as a result of the already-approved cumulative energy development occurring in the PRB consist of losses of plant, invertebrate, and vertebrate fossil material for scientific research, public education (interpretive programs), and other values. Losses have and will result from the destruction, disturbance, or removal of fossil materials as a result of surface-disturbing activities, as well as unauthorized collection and vandalism. A beneficial impact of surface mining can be the exposure of fossil materials for scientific examination and collection, which might never occur except as a result of overburden removal, exposure of rock strata, and mineral excavation.

Visual Resources

A principal visual impact in this area is the visibility of mine pits and facility areas. People most likely to see these facilities would either be passing through the area or visiting it on mine-related business. Except for the loading facilities, the pits and facilities are not visible from more than a few miles away. No new facilities would be required to mine the LBA tract as an extension of the existing Buckskin Mine. Leasing the LBA tract would not change this impact.

After mining, the reclaimed slopes might appear somewhat smoother than premining slopes; there would be fewer gullies than at present. Even so, the landscape of the reclaimed mine would look very much like undisturbed landscape in the area.

Noise

Existing land uses within the PRB (mining, livestock grazing, oil and gas production, transportation, and recreation) contribute to noise levels, but wind is generally the primary noise source. Mining on the LBA tract would not increase the number of noise-producing facilities within the PRB, but it would lengthen the time this particular noise source would exist, expand the area this noise source would affect, and may augment the level of impacts to other resources (increased exposure of wildlife to noise impact, increased noise impacts to recreational users). Mining-related noise is generally masked by the wind at short distances, so cumulative overlap of noise impacts between mines is not likely.

Recreational users and grazing lessees using lands surrounding active mining areas do hear mining-related noise; but this has not been reported to cause a significant impact. As stated above, wildlife in the immediate vicinity of mining may be adversely affected by noise; however, observations at other surface coal mines in the area indicate that wildlife generally adapt to noise conditions associated with active coal mining.

Cumulative increases in noise from trains serving the PRB mines have caused substantial increases (more than five dBA) in noise levels along segments of the rail lines over which the coal is transported to markets. However, no significant adverse impacts have been reported as a result

Transportation Facilities

New or enhanced transportation facilities (road, railroads, and pipelines) are expected to occur as a result of energy development in the Powder River Basin. However, no new cumulative impacts to transportation facilities are expected to occur as a direct result of leasing and subsequent mining of the West Hay Creek LBA tract. The transportation facilities for the Buckskin Mine are already in place. Construction of new rail facilities for transporting coal out of the PRB, such as the proposed DM&E railroad, would add another route of coal transportation out of the basin but would not be expected to increase the number of coal trains without an increase in market demand for the coal. Traffic levels from the mine would be maintained for a longer period under the action alternatives. Oil and gas pipelines on the tract would have to be relocated or removed prior to mining.

Socioeconomics

Because of all the energy-related development that has been occurring in and around Campbell County during the past 30 years, socioeconomic impacts are a major concern. Wyoming's economy has been structured around the basic industries of extractive minerals, agriculture, tourism, timber, and manufacturing. Each of these basic industries is important, and the extractive mineral industry has long been a vital part of Wyoming's economy. Many Wyoming communities depend on the mineral industry for much of their economic well-being. The minerals industry is by far the

largest single contributor to the economy of Wyoming. In 2001, valuation on minerals produced in 2000 was $6,407,060,245 (Wyoming Department of Revenue 2002). Wyoming ranks among the top ten mineral producing states in the nation. Because most minerals are taxed as a percentage of their assessed valuation, the mineral industry is a significant revenue base for both local and state government in Wyoming.

Since1990, coal production in the Powder River Basin has increased by an average of 7.6 % per year. WGS is currently projecting that coal production in Campbell County will increase by about 3% in 2003, with an estimated 1% per year increase for the years 2004 through 2007 (WGS 2002b). In 2000, Wyoming coal supplied approximately 31% of the United States= coal consumption (DOE 2002). PRB coal is used to generate electricity for public consumption in 22 states as well as Canada and Spain (Wyoming Mining Association 2002). Electricity consumers in those states benefit from low prices for PRB coal, from cleaner air due to the low sulfur content of the coal, and from the royalties and bonus payments that the federal government receives from the coal.

Locally, continued sale of PRB coal helps stabilize municipal, county, and state economies. By 2005, annual coal production is projected to generate about $2.6 billion of total economic activity, including $351 million of personal income, and support the equivalent of nearly 15,885 full-time positions (BLM 1996a).

In addition to the West Hay Creek LBA tract a number of mineral and related developments have occurred, are in progress, or are anticipated in Campbell County and the surrounding area.

The 500-Mw Wygen II coal-fired power plant is proposed near the Wyodak Mine east of Gillette. (Black Hills Corporation 2001). NAPG has proposed the construction of three coal-fired power plants in Campbell County: the 300-Mw Two Elk and the 500-Mw Two Elk Two plants near the Black Thunder Mine, and the 500-Mw Middle Bear plant near the Cordero-Rojo Mining Complex *(Billings Gazette* 2001). In addition, NAPG has proposed the construction of a power line that would link its proposed 500-Mw power plants with interstate transmission lines in the front range of Colorado *(Gillette News Record, 2001*). According to Pedersen Planning Consultants (2001) power plant development between 2001 and 2010 could bring over 6,000 temporary and 450 permanent jobs to Campbell County alone.

The DM&E Railroad Corporation has proposed the construction of a rail line connecting its existing facilities in South Dakota and Minnesota with PRB coal mines. The lead regulatory agency for the expansion project, the Surface Transportation Board, granted final approval in January 2002. DM&E must still obtain permits or approvals from other agencies including the BLM, USFS, and COE. Several lawsuits were filed against the proposal following the approval of the project by the Surface Transportation Board (WGS 2002b). For Wyoming, the estimated direct-construction workforce is 700 persons for the estimated $1.5 billion project.

Recently, Gillette experienced a population increase as a result of CBM development in the area. In the past several years, Gillette's population has increased, unemployment has decreased, housing has become increasingly tight, and traffic and criminal activity have increased. Under the Proposed Action for the Wyoming Oil and Gas Project DEIS (BLM 2003), it is estimated that the peak yearly workforce that would be needed to operate and maintain the facilities associated with the predicted oil and gas development would be 1,918 workers.

If all of the new projects are undertaken, it is likely that the population in northeastern Wyoming would continue to grow, and there would be increasing demands on housing, schools, roads, and law enforcement in the communities in this area. The population increase would be expected to be somewhat dispersed among all of the communities in the area, including Douglas, Wright, and Newcastle as well as Gillette. The extent of the impacts to the local communities would depend on the amount of overlap between the construction periods on the proposed projects. In a 2001 study of future housing needs in Campbell County (Pederson Planning Consultants 2001), it was estimated that increases in CBM development and surface coal mine employment, coupled with the construction of currently proposed power plants, could increase Campbell County housing demand by over 5,000 housing units, with the peak occurring in about 2005. Delays in power plant and railroad permitting and construction could alter the timing and magnitude of the peak in population and housing demand. At this time, based on the status of their planning and permitting efforts, the Black Hills Corporation, Inc. Wygen II coal-fired power plant, the NAPG Two Elk coal-fired power plant, and the proposed DM&E rail line are considered reasonably foreseeable developments based on the status of their planning and permitting efforts. None of the currently proposed power plants is currently under construction. Construction of other proposed plants would be dependent on completion of permitting requirements and availability of financing. Construction of the proposed DM&E railroad also depends on completion of permitting requirements and availability of financing as well as resolution of legal issues. Increases in mining employment would potentially occur gradually as new coal leases are permitted for mining. No new employment is currently anticipated if the West Hay Creek LBA tract is leased.

The construction of coal-fired power plants and the DM&E railroad expansion and continued CBM development would result in direct fiscal benefits to city, county, and state governments. Equipment and facilities would be subject to excise (sales and use) and ad valorem (property) taxes. Counties that have a major construction project of $50 million or larger also receive extra revenues in the form of impact assistance. According to an article in the *Gillette News-Record,* if the three NAPG power plants are constructed, Campbell, Converse, Weston, and Crook counties could receive as much as $11 million in impact assistance *(Gillette News-Record* 2001).

SHORT-TERM USE OF THE ENVIRONMENT VS. LONG-TERM PRODUCTIVITY

From 2004 on, the Buckskin Mine plans to produce coal at an average production level of 25 million tons per year for 12.4 years under the No Action Alternative, for 17.6 years under the Proposed Action, up to 18.4 years under Alternative 2, or for 17.6 years under Alternative 3 (table 2-1). As the coal is mined, almost all components of the present ecological system, which have developed over a long period of time, would be modified. In partial consequence, the reclaimed land would be topographically lower, and although it would resemble original contours, it would lack some of the original diversity of geometric form.

The forage and associated grazing and wildlife habitat that the LBA tract provides would be temporarily lost during mining and reclamation. During mining there would be a combined loss of vegetation on 830 acres (Proposed Action) 990 acres (Alternative 2), or 830 acres (Alternative 3) with an accompanying disturbance of wildlife habitat, grazing land, cropland and pastureland. This disturbance would occur incrementally over a period of years. The mine site would be returned to equivalent or better forage production capacity for domestic livestock before the performance bond is released. Long-term productivity would depend largely on postmining range-management practices, which to a large extent, would be controlled by private landowners.

Mining would disturb pronghorn habitat, but the LBA tract would be suitable for pronghorn following successful reclamation. Despite loss and displacement of wildlife during mining, it is anticipated that reclaimed habitat would support a diversity of wildlife species similar to premining conditions. The diversity of species found in undisturbed rangeland would not be completely restored on the leased lands for an estimated 50 years after the initiation of disturbance. Re-establishment of mature sagebrush habitat--which is crucial for pronghorn and sage grouse--could take even longer.

CBM development is taking place on the tract, and CBM is being produced on adjacent lands. BLM's analysis suggests that a large portion of the CBM resources on the tract can be recovered prior to mining. CBM that is not recovered prior to mining would be vented to the atmosphere during the mining process. Methane is a greenhouse gas which contributes to global warming. According to the *Methane Emissions* section of Energy Information Administration/ Department of Energy (EIA/DOE) report 0573(99), *Emissions of Greenhouse Gases in the United States 1999*, US anthropogenic methane emissions totaled 28.8 million metric tons in 1999. U.S. 1999 methane emissions from coal mining were estimated at 2.88 million metric tons (10% of the US total anthropogenic methane emissions in 1999). According to table 15 of this report, surface coal mining was estimated to be responsible for about 0.54 million metric tons of methane emissions in 1999. This represents about 1.88% of the estimated US anthropogenic methane emissions in 1999, and about 18.75% of the estimated methane emissions attributed to coal mining of all types. Based on the 1999 coal production figure, the Wyoming PRB coal mines were responsible for approximately 0.9% of the estimated US 1999 anthropogenic methane emission.

Total US methane emissions attributable to coal mining would not be likely to be reduced if the West Hay Creek LBA tract is not leased at this time because total US coal production would not decrease if a lease for this tract is not issued. However, the methane on this LBA tract could potentially be more completely recovered if leasing is delayed.

There would be a deterioration of the groundwater quality in the lease area because of mining, but the water quality would still be adequate for livestock and wildlife. This deterioration would probably occur over a long period of time. During mining, depth to groundwater would increase only within 1 mile away from the pits in the coal aquifer. The water levels in the coal aquifer should return to premining levels at some time (probably less than 100 years) after mining has ceased.

Mining operations and associated activities would degrade the air quality and visual resources of the area on a short-term basis. Following coal removal, removal of surface facilities, and completion of reclamation, there would be no long-term impact on air quality. The long-term impact on visual resources would be negligible.

Short-term impacts to recreation values may occur from reduction in big game populations due to habitat disturbance. These changes would primarily impact hunting in the lease area. However, because reclamation would result in a wildlife habitat similar to that which presently exists, there should be no long-term adverse impacts on recreation.

The Proposed Action, Alternative 2, and Alternative 3 would extend the life of Buckskin Mine by about 5.2, up to 6.0, and 5.2 years, respectively, thereby enhancing the long-term economy of the region.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The major commitment of resources would be the mining and consumption of 130 million tons (Proposed Action), 150 million tons (Alternative 2), or 130 millions tons (Alternative 3) of coal to be used for electrical power generation. CBM that is not recovered before mining would also be irreversibly and irretrievably lost (see additional discussion of the impacts of venting CBM to the atmosphere in the previous section). It is estimated that one to two percent of the energy produced would be required to mine the coal, and this energy would also be irretrievably lost.

The quality of topsoil on approximately 830 acres (Proposed Action), 990 acres (Alternative 2), or 830 acres (Alternative 3) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining-related activities. Newly formed soil material would be unlike that in the natural landscape.

Loss of life may conceivably occur due to the mining operation and vehicular and train traffic. On the basis of surface coal mine accident rates in Wyoming as determined by

the Mine Safety and Health Administration (1997) for the 10-year period 1987-1996, fatal accidents (excluding contractors) occur at the rate of 0.003 per 200,000 man-hours worked. Disabling (lost-time) injuries occur at the rate of 1.46 per 200,000 man-hours worked. Any injury or loss of life would be an irretrievable commitment of human resources.

Disturbance of all known historic and prehistoric sites on the mine area would be mitigated to the maximum extent possible. However, accidental destruction of presently unknown archeological or paleontological values would be irreversible and irretrievable.