

#### 4.0 ENVIRONMENTAL CONSEQUENCES

This chapter discloses the potential environmental consequences that may result from implementing the Proposed Action, Alternative 1 (the No-Action Alternative), and Alternative 2. The effect or impact a consequence will 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 Horse Creek LBA<sup>1</sup> Tract is leased to the applicant as a maintenance tract under one of the action alternatives, the permit area for the adjacent mine would have to be amended to include the new lease area before it could be disturbed. Table 4-1 shows the area to be mined and disturbance area for the existing Antelope Mine (which represents the No-Action Alternative), and how the mine area would change under the Proposed Action and Alternative 2. If the tract is leased, the area that would have to be added to the existing permit area would be the LBA tract plus an adjacent strip of land that would be used for highwall

reduction after mining and such mine-related activities as construction of diversions, flood- and sediment-control structures, roads, and stockpiles. Portions of the LBA tract that are adjacent 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 either the Proposed Action or Alternative 2 are very similar because the size of the area that would be disturbed under each alternative is similar.

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.

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Refer to page vii for a list of abbreviations and acronyms used in this document.

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Table 4-1. Comparison of Existing and Proposed Antelope Mine Disturbance Area and Mining Operations

	<b>No Action Alternative (Existing Permit Area)</b>	<b>Proposed Action</b>	<b>Alternative 2</b>
Additional Lease Area (Acres)	---	2,837.9	3,215.0
Total Lease Area (Acres)	6,008.9	8,846.8	9,223.9
Increase in Lease Area	---	47.2%	53.5%
Estimated Total Disturbance Area (Acres) <sup>1</sup>	5,172	8,362	8,753
Increase in Estimated Disturbance Area	---	62%	69%
Estimated Recoverable Coal Remaining as of 1/00 <sup>2</sup> (Million Tons)	161.0	429.7	462.4
Increase in Estimated Recoverable Coal as of 1/00 (Percent)	---	167%	187%

- Notes: <sup>1</sup> Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, railroad facilities, stockpiles, etc.
- <sup>2</sup> Estimated Recoverable Coal Resources = tons of mineable coal x recovery factor. For the Horse Creek LBA Tract, mineable coal = 264 millions tons (Proposed Action) or 300 million tons (Alternative 2) and ACC's estimated recovery factor = 93 percent, based on historic operations.

Section 4.1 analyzes the direct and indirect impacts associated with leasing and mining the LBA tract under the Proposed Action and Alternative 2. Section 4.2 presents the probable environmental consequences of the No-Action Alternative (Alternative 1, not issuing a lease for the tract). Section 4.3 discusses regulatory compliance, mitigation, and monitoring in terms of what is required by federal and/or state law (and is therefore part of the Proposed Action and alternatives) and any additional mitigation and monitoring that may be required. Section 4.4 summarizes the residual

effects of the Proposed Action and Alternative 2. Section 4.5 discusses the cumulative impacts that would occur if these lands were mined when added to other past, present, and reasonably foreseeable future actions. The cumulative impact analysis includes a discussion of five projects that were recently completed, are in progress, or are proposed in the area of the LBA tract and that would occur independently of leasing the LBA tracts. These projects are: 1) construction of the North Rochelle Mine facilities and rail loop which has been completed; 2) construction and operation of the ENCOAL Plant,

which has been proposed within the rail loop at North Rochelle; 3) construction and operation of the Two Elk power plant, which has been proposed east of the Black Thunder Mine; 4) the construction of the proposed DM&E Railroad line, and 5) the ongoing development of CBM resources west of the area of active coal mining. Section 4.6 analyzes the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. Section 4.7 presents the irreversible and irretrievable commitments of resources that would occur with implementation of the Proposed Action or Alternative 2.

#### **4.1 Direct And Indirect Impacts Of Action Alternatives**

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 judgement 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.

##### 4.1.1 Topography and Physiography

Surface coal mining would permanently alter the topography of the LBA tract. Topsoil would be removed from the land and stockpiled or placed directly on recontoured areas. Overburden would be blasted and stockpiled or directly placed 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. Horse Creek would be diverted into temporary channels or blocked to prevent flooding of the pits. A direct, permanent impact would be topographic moderation. The restored land surface would contain gentler more uniform slopes, but the basic drainage network would be restored. Following reclamation, the average surface elevation would be approximately 36 ft lower due to removal of the coal. (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 during the permit revision process.

Direct adverse impacts resulting from topographic moderation would include a reduction in microhabitats (e.g., cutbank slopes) for some wildlife species and a reduction in habitat diversity, particularly a reduction 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 (see Section 4.1.3). 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 Antelope Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action or Alternative 2, the area that would be permanently topographically changed would increase as shown in Table 4-1.

### 4.1.2 Geology and Minerals

Within the Horse Creek LBA Tract, mining would remove an average of 150 ft of overburden, 45 ft of interburden, and 75 ft of coal on about 2,041 acres under the Proposed Action or 2,358 acres under Alternative 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternative 2. Table 4-2

compares the estimated coal, overburden, and interburden thicknesses for the existing Antelope Mine coal leases with estimated coal overburden and interburden thickness for the Horse Creek LBA Tract.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompact mixture averaging about 234 ft in thickness. Approximately 246 million additional tons of coal would be mined under the Proposed Action, compared to 279 million tons under Alternative 2.

The geology from the base of the coal to the land surface would be subject to permanent change on the LBA tract under either action alternative. 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.

Development of other minerals potentially present on the LBA tract could not occur during mining; however, development of these resources could occur following mining. CBM associated with the coal would be irretrievably lost as the coal is removed. There are currently no producing oil or gas wells on the LBA tract. There is one plugged and abandoned deep oil and gas test well present on the LBA tract under the

Table 4-2. Comparison of Existing and Proposed Antelope Mine Coal, Overburden, and Interburden Thicknesses

	1995 Permit Area <sup>1</sup>	Antelope LBA Tract	No Action Alternative (Existing Permit Area)	Proposed Action Tract	Alternative 2 Tract
Average Overburden Thickness <sup>1</sup> (feet)	83	110	86	150	150
Average Total Mineable Coal Thickness <sup>1</sup> (feet)	33	73.5	38	75	75
Average Interburden Thickness <sup>1</sup> (feet)	0	31	4	45	45

<sup>1</sup> There are two mineable coal seams at the Antelope Mine. One seam is mineable over most of the 1995 permit area. Two seams are mineable over most of the Antelope LBA Tract (leased in 1997) and the Horse Creek LBA Tract.

Proposed Action, another plugged and abandoned oil and gas test well is located on the LBA tract under Alternative 2, and there is one CBM well location posted on a private oil and gas lease on the LBA tract under the Proposed Action and Alternative 2. Well location information, federal oil and gas ownership, and federal oil and gas lessee information are presented on Figure 3-10 and Table 3-9. Conflict could arise between oil and gas and coal lease holders. BLM is required to manage federal lands on a multiple use basis; 43 CFR 3400.1(b) provides that "the presence of deposits of other minerals...or production of deposits of other minerals shall not preclude the granting of an exploration license, a license to mine or a lease for the exploration, development or production of coal deposits on the same lands with suitable stipulations for simultaneous operations." The special stipulations that Wyoming BLM attaches to new coal leases include a stipulation relating to coal leases issued within producing oil and gas fields (Appendix D). BLM has

recently developed a policy statement on conflicts between CBM and coal development (BLM Instruction Memorandum No. 2000) which is included in the response to comments received from the Wyoming Office of Federal Land Policy in Appendix F of this EIS. This conflict policy encourages optimization of the recovery of both coal and CBM resources to ensure that the public receives a reasonable return for the publicly-owned resources.

#### 4.1.3 Soils

Under the currently approved mining and reclamation plan, approximately 5,172 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Antelope Mine (Table 4-1). Disturbance related to coal mining would directly affect an additional 3,190 acres of soil resources on and adjacent to the LBA tract under the Proposed Action or 3,581 acres under Alternative 2. The reclaimed soils would have different physical, biological, and chemical properties than the premining soils.

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They would be more uniform in type, thickness, and texture. Average topsoil thickness would be a fairly uniform 26 inches. 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 rates. The decrease 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.

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, and 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 therefore considered part of the Proposed Action and alternatives.

##### 4.1.4 Air Quality

WDEQ/AQD issued an air quality permit (MD-288) for the Antelope Mine on July 8, 1996. ACC was authorized to increase coal production from a maximum of 12 million tons per year to a maximum rate of 30 million tons per year. The actual production rate depends on market conditions and contracts. In 1998, ACC's production was 19.4 million tons. As shown on Table 2-1 of Chapter 2, anticipated annual production on the Antelope Mine including the Horse Creek LBA Tract is 30 million tons per year. Subject to market constraints, ACC plans to achieve its maximum permitted coal production rate by year 2004. Permits to increase coal production to 30 mmtpy are in place, but unless the Horse Creek Tract is acquired by ACC it is not likely that the investment in personnel and equipment will be made. As discussed in Chapter 2, coal production without the Horse Creek LBA Tract is projected to level off at 22 mmtpy.

Figure 4-1 was prepared using the air quality modeling analysis prepared by the Antelope Mine in 1996 and submitted to WDEQ/AQD as part of a mine permit renewal package (ACC 1996). The figure illustrates modeled PM<sub>10</sub> conditions in the year 2002, which is the predicted worst-case scenario for the Antelope Mine.

Figure 4-1 indicates that at a coal removal rate of 30 mmtpy, PM<sub>10</sub> concentrations are below 50 µg/m<sup>3</sup> (including 15 µg/m<sup>3</sup> background concentration) at the Antelope Mine permit boundary. If ACC acquires the Horse Creek LBA Tract, the PM<sub>10</sub> concentrations shown on the edges of the existing Antelope Mine permit area would be shifted to the edges of the amended permit area which would include the Horse Creek LBA Tract, and mining at the Antelope Mine would be extended by 8 to 9 years. Concentrations above 50 µg/m<sup>3</sup> are predicted in the areas of active pit, but the state standard requires only that particulate concentrations above 50 µg/m<sup>3</sup> not be exceeded at the mine's permit boundary.

ACC's current air quality permit (MD-330 issued August 5, 1997) allows for a production rate of 30 mmtpy. The prior permit (MD-288 issued July 8, 1996) also allowed for a 30 mmtpy production rate. The differences between these two permits dealt with conveyor belt widths and control facilities such as baghouses. ACC's allowed production rate has been 30 mmtpy since permit MD-231 was issued on June 27, 1995; this permit allowed certain changes in the mine plan, an increase in maximum

production rate from 12 to 30 mmtpy, and the construction of two additional coal storage silos.

Since changes in what was allowed between permits MD-288 and MD-330 were minor in terms of particulate emissions rates (only 9.26 additional tpy PM<sub>10</sub>), modeling was not required for permit MD-330. Modeling for PM<sub>10</sub> for permit MD-288 showed an annual average of 48.56 µg/m<sup>3</sup> for 1999, which was below the standard of 50µg/m<sup>3</sup> and therefore the permit could be approved. The computed average included a background concentration of 15µg/m<sup>3</sup>.

Since February 2, 1996, AQD has required mines to model for NO<sub>x</sub>. The NO<sub>x</sub> inventory in the model must include mine-related vehicular tailpipe emissions, emissions from blasting and emissions from locomotive engines while these engines are on the mine property. ACC modeled NO<sub>x</sub> for permit MD-288 but not for MD-330 since no changes in NO<sub>x</sub> emissions were proposed. The NO<sub>x</sub> modeling showed a 1999 average concentration of 31.6 µg/m<sup>3</sup> (background ≡ zero) vs. a standard of 100µg/m<sup>3</sup>.

The modeling and permit approval are done with the understanding that BACT will be applied. For Antelope Mine, BACT includes watering and/or chemical stabilization on topsoil removal areas, haul roads, and access roads; minimizing of blasting areas; minimizing the dragline drop distance; contemporaneous reclamation of disturbed areas; a negative pressure system and stilling

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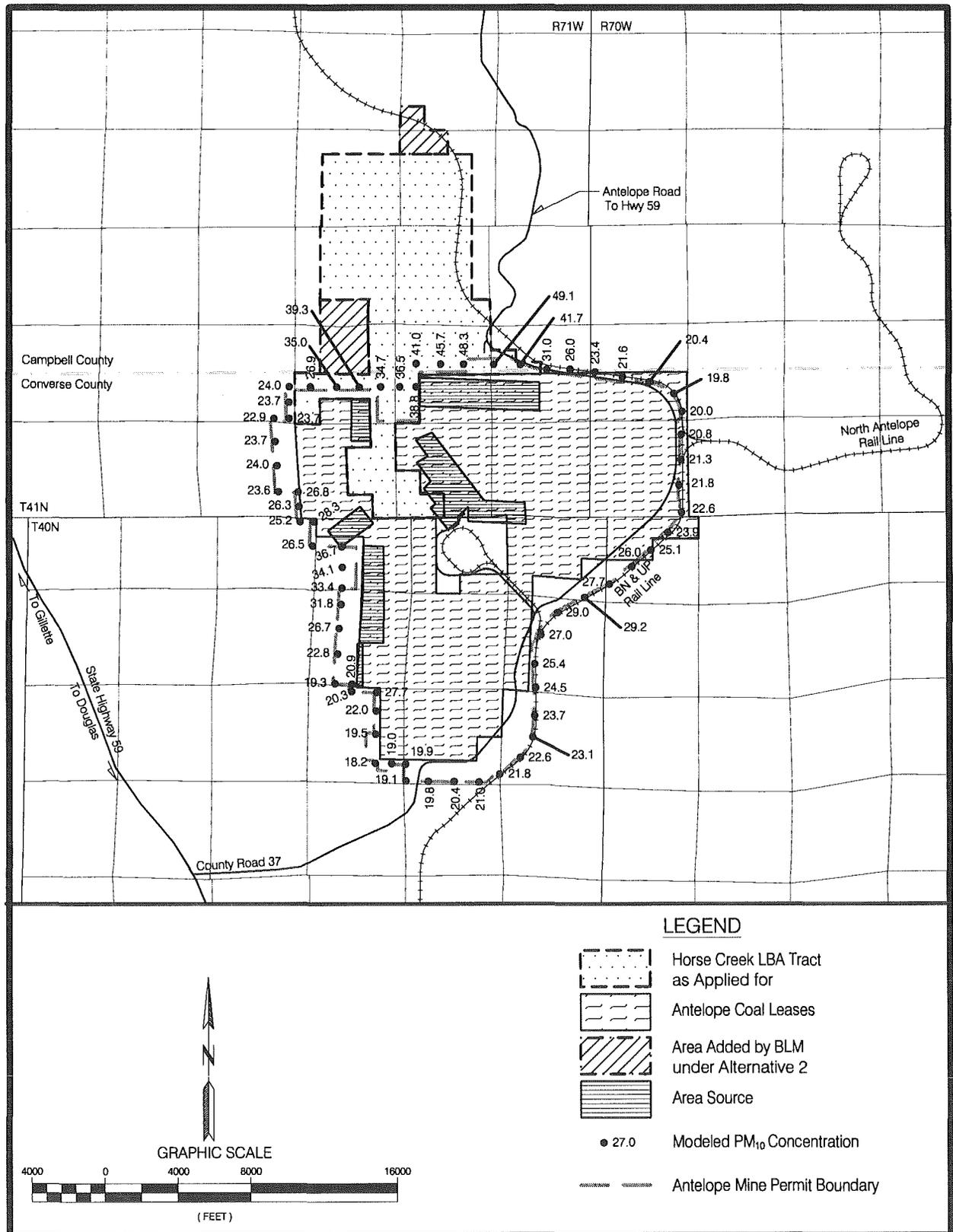


Figure 4-1. Modeled PM<sub>10</sub> Concentrations at Antelope Mine Permit Boundary, Year 2002 Worst-Case Scenario Resulting from 30 Million Tons Per Year of Coal Removal from Existing Leases.

shed for coal truck dumps; baghouses, covered conveyors, water sprays and storage silos for coal handling and storage; and enclosed chutes and dust return systems for the coal train loadout. In addition, baghouses must meet certain specifications regarding loading rates and opacity.

ACC would be required to modify their WDEQ/AQD air quality permit to include mining the Horse Creek LBA Tract before it could be mined, if ACC requires the tract. Provided the maximum production rate remains at 30 mmtpy and emissions of PM<sub>10</sub> from point sources and truck dumps do not increase above 100 tpy (current levels are at 86.05 tpy for MD-330), modeling may or may not be required for this revision. Since the near-pit crusher and the conveyor would move to the Horse Creek Tract and the average stripping ratio would increase only about 5 percent, fugitive dust and gaseous pollutant emissions would be expected to remain within levels allowed by the current permit.

A surface coal mine is not a named facility under Wyoming's PSD regulations and therefore is not considered a "major emitting facility" unless it has the potential to emit 250 tons or more of any regulated pollutant. Fugitive dust emissions are not considered in determining potential to emit. Since ACC is a surface coal mine and its allowable point source PM<sub>10</sub> and truck dumping TSP emission rates are estimated to be 86.05 tpy at its maximum production rate of 30 mmtpy, the mine is not considered a major emitting facility and an increment

analysis under PSD regulations is not required.

Blasting is not a major source of particulate emissions at PRB mines (PM<sub>10</sub> emissions inventories show that overburden and coal blasting comprise less than one percent of the total emissions). Overburden removal, wind erosion, and coal haul roads generate the majority of dust. Antelope Mine has invested in conveyors to reduce the need for coal haul trucks, which also reduces dust emissions.

As discussed in Section 3.5, there is growing public concern over the releases of NO<sub>x</sub> from blasting, which can form a low-lying orange cloud that can be transported by wind. At the WMA sponsored Gillette symposium held to discuss this issue on January 12 and 13, 2000 experts from industry and government agencies discussed the issue and possible causes and solutions. Some of the possible solutions being explored are improved blasting techniques or explosives and reduced powder factors. A more detailed analysis of the gases that form the clouds is also planned, which may increase understanding of the causes of the problem and suggest possible solutions.

Air quality impacts resulting from, or associated with, mining operations would be limited primarily to the operational life of the mine. During the time the LBA tract is mined, the elevated TSP levels in the vicinity of the mining operations would continue, as would the elevated concentrations of gaseous emissions

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due to fuel combustion. Compliance with all state and federal air quality standards would be maintained. As with current operations, mining would occur near County Road 37 and Antelope Road making dust visible to the public. The required mitigation measures, which are discussed in Section 4.3, would minimize this impact.

Air quality impacts from the No Action Alternative and the Proposed Action and Alternative 2 would not be expected to be substantially different. Under the No Action alternative, production is projected to be 22 mmtpy, and under the Proposed Action and Alternative 2, production is projected to be 30 mmtpy, which is a 36% production increase. TSP data collected at air quality monitoring stations located upwind and downwind of the Antelope Mine are shown in Figure 3-5 and discussed in Section 3.5. These data indicate that TSP levels at the upwind monitoring station have remained relatively constant as production has increased. When the difference between TSP measured at the upwind monitoring site and at the downwind monitoring site is calculated, there is an increasing trend, but the rate of increase of the TSP difference between the two stations is lower than the rate of increase in coal and overburden production (Figure 3-5 and section 3-5). Therefore, based on the monitoring information at the mine, the TSP levels along the upwind side of the mine would be expected to continue to remain fairly constant and within the current TSP and PM<sub>10</sub> standards with the increased overburden and coal production

projected to occur under the Proposed Action and Alternative 2.

Haul distances from the pit to the crushing facilities would increase from current levels, so dust emissions may increase in proportion to the increased haul distance. As coal production is shifted from existing leases to the Horse Creek lease, ACC would move conveyors to the north, helping limit increased fugitive dust from coal hauling. A slightly larger area would be mined under Alternative 2.

The nearest Class I area is located approximately 80 miles east at Wind Cave National Park in southwestern South Dakota. Mines are not considered to be major emitting facilities in accordance with Section 24 of WDEQ/AQD Rules and Regulations. Therefore, mines are not required by the State of Wyoming 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 (Section 4.5).

##### 4.1.5 Water Resources

###### Surface Water

Streamflows in Horse Creek would be diverted around the active mining areas in temporary diversion ditches or captured in flood-control reservoirs above the pit. If flood-control impoundments are used, it will be necessary to evacuate them following major events to provide space for the next flood.

Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tract as a result of the diversions and 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. Therefore, the sediment would be deposited in ponds or other sediment-control devices inside the permit area. Sediment produced by large storms (i.e., 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 Antelope Mine under the action alternatives, the amount of area disturbed and not reclaimed at any given time will not significantly increase due to leasing. 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, discussed in Section 4.1.1, 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 Alternative 2, and they are similar to the expected impacts for currently permitted mining.

#### Groundwater

Mining the LBA tract would impact the groundwater resource quantity in two ways: 1) Mining would remove the coal aquifers and any overburden aquifers on the mined land and replace them with unconsolidated spoils; and 2) water levels in the coal and overburden aquifers adjacent to the mine 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.

Mining the LBA tract would remove shallow aquifers on an additional 3,190 acres (Proposed Action) or 3,581 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 storativity, drawdowns will extend further from the pit face than in materials with lower transmissivity and higher storage. 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). Of the four overburden wells monitored by ACC during 1997-1998, no significant water level changes were observed. Four interburden wells were monitored for water level in 1997-98. One shows total drawdown of about 25 ft, another shows about 7 ft of drawdown and the other two have not been affected by mining. The three underburden wells monitored for water level show declines of up to 32 feet.

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. Coal drawdowns from 1980 to 1995 are generally in excess of five ft within four miles of the active pits at the Antelope Mine (Hydro-Engineering 1996a).

In 1998 ACC monitored water levels in 15 monitor wells in the Anderson coal seam and 13 monitor wells in the Canyon coal seam. Water levels and maps showing drawdowns in the immediate vicinity of the pit are included in each year's annual report

to WDEQ/LQD. As expected, drawdowns in the coal seam are a function of distance from the pit as well as geologic and hydrologic barriers and boundaries such as crop lines, fracture zones, and recharge sources. The maximum drawdown measured in an Anderson monitor well is about 22 feet, while in the Canyon seam drawdowns of over 75 feet have been measured. To date, mining has occurred in relatively dry portions of the Anderson coal seam, while the northeast part of the mine has encountered a fully saturated Canyon seam. Drawdowns have resulted from mining and also from a series of dewatering wells installed to lower water levels in advance of the pit.

ACC used the MODFLOW model to predict the extent of water drawdown in the Canyon coal seam as a result of mining at the Antelope Mine. The results of the groundwater modeling are reported in Mine Plan Section MP 5.2 and Addendum MP-J of the Antelope Mine 525-T6 permit document (ACC 1998). Predicted drawdowns over the life of mine are shown on Figure 4-2. These predictions are approximate and were based on extrapolation of ACC's earlier predictions by extending the drawdowns westward and northward by the dimensions of the Horse Creek Tract. More precise predictions of the extent of drawdowns will be required in order to amend the Horse Creek LBA Tract into the WDEQ/LQD permit area.

Wyoming State Engineer's Office records indicate a total of 306 permitted water wells located within

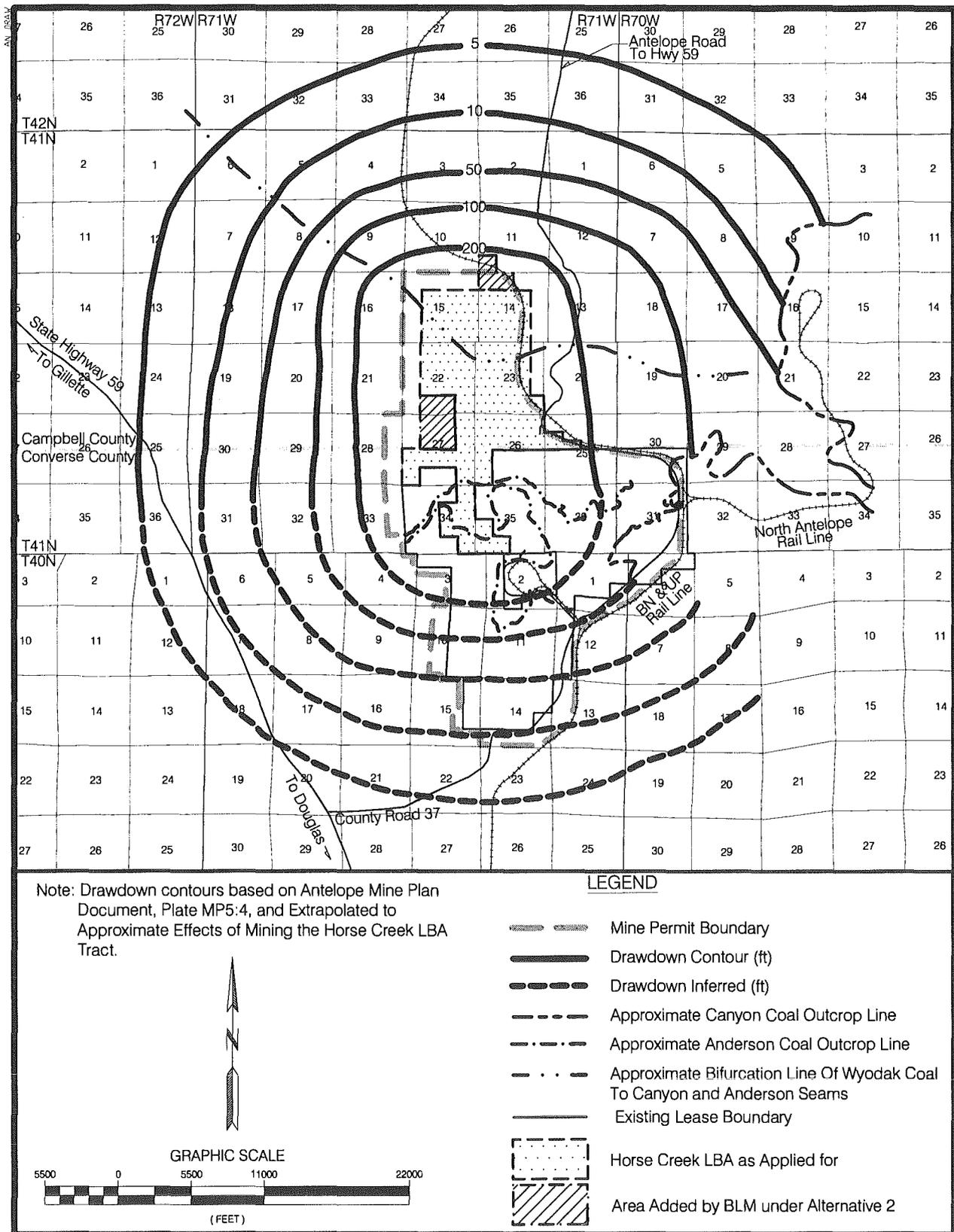


Figure 4-2. Life Of Mine Drawdown Map

three miles of the LBA tract. The majority (258) are owned by coal mining companies and are used for groundwater monitoring and water supply. Of the 48 non mine-related wells, 43 are permitted for stock watering or domestic use, one for industrial use and two for miscellaneous use. The two remaining wells are used for monitoring purposes.

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 Antelope 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 thus part of the action alternatives. The most probable source of replacement water would be one of the aquifers underlying the coal.

Drawdowns of groundwater levels due to mining at the Antelope Mine, including the Horse Creek LBA Tract, would reach their greatest extent in the Canyon coal seam. The drawdown in the Anderson coal seam will not extend beyond the eastern and southwestern boundaries of the mine because the Anderson seam is missing from these areas (see Figure 4-2). The Anderson seam is eroded away in some areas beneath Antelope Creek. Therefore, mining the Horse Creek LBA Tract will not extend the impacts to the Anderson seam south

of Antelope Creek beyond what will occur due to the existing mine operation.

North of the Antelope Mine, but within the Horse Creek LBA Tract, the Canyon and Anderson coal seams merge to form the Wyodak coal seam (Denson et al. 1978). For the current mine area (without the Horse Creek LBA Tract), ACC determined that the effects of the predicted drawdown on possible neighboring groundwater users would be negligible. This determination was based on the finding that there were no known water users withdrawing water solely from the Anderson or Canyon coal seams to the west and northwest within the area of the 5-foot drawdown contour (ACC Permit 525-T6 Mine Permit Renewal Document, Mine Plan, p. MP5-66, Rev. 10/01/96).

In July 1999 the files of the SEO were searched to determine whether the preceding statement would still be true for the 5-foot drawdown as extrapolated on Figure 4-2 to consider mining of the Horse Creek LBA Tract. It was found that there were 10 permitted water supply wells within the expanded 5-foot drawdown contour with completion depths that indicated they produce water from the Anderson or Canyon coal seam (this excludes wells constructed only for the purpose of monitoring or mine dewatering). These wells are shown on Table 4-3. During the permitting process, 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 5-foot

Table 4-3. Additional Water-Supply Wells Possibly Subject to Drawdown if Horse Creek LBA Tract is Mined.

SEO Permit No.	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P95332W	F. Putnam	Domestic, Stock	20	480	50
P95333W	F. Putnam	Domestic, Stock	6	360	45
P58121W	Big Horn Fractionation	Miscellaneous	25	396	250
P109953W	P.L. Isenberger Litton	Misc., Stock	6	350	60
P23601P	P.L. Isenberger Litton	Stock	7	250	-1
P9571W	US Forest Service	Stock	4	495	0
P23599P	P.L. Isenberger Litton	Stock, Domestic	10	225	-1
P23600P	P.L. Isenberger Litton	Stock	7	300	100
P25606P	P.&E. Wilkinson	Stock, Domestic	2.5	220	100
P101690W	Land and Farm Office	Stock	10	334	250

Note: Wells in this table are believed from their completion depths to be completed in the Canyon or Wyodak coal seam, and are within the additional area of 5 feet or more drawdown caused by mining the Horse Creek LBA Tract. Wells impacted by the No-Action Alternative are already addressed in the state mine permit document.

drawdown contour. 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. Decreases in water levels in underburden monitoring wells are thought by ACC to be caused by depressurization associated with dewatering of the overlying coal. ACC has a water supply well completed in

aquifers below the coal. If the LBA tract is leased by the applicant, water would be produced from this well for a longer period of time, but ACC would not require additional sub-coal 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

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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 Horse Creek LBA Tract would be expected to be similar to the groundwater quality measured in wells completed in the backfill at nearby mines. To date, four wells have been installed to monitor water level and water quality in replaced backfill at the Antelope Mine. All four wells were dry through the most recent annual report period, which ended in September 1999 (ACC 1999a). TDS concentrations observed in the backfill aquifers at mines surrounding the Horse Creek LBA Tract are generally higher than those found in the undisturbed Wasatch or Anderson and Canyon coal aquifers. At the nearby North Antelope/Rochelle Complex, 1998 TDS concentrations in the backfill were variable and ranged from 716 mg/L to 13,492 mg/L (Hydro Engineering 1999) with a geometric mean of 3,554 mg/L. Four of the eight backfill wells present at the North Antelope/Rochelle Complex show decreasing TDS concentration with time, decreasing an average of 27 percent from 1986 to 1999. 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 areas in the northern PRB. Postmining groundwaters are therefore expected to be of better quality after one pore volume of water moves through the backfill than what is observed in the backfill today. In general, the mine backfill groundwater TDS can be expected to range from 3,000 - 6,000 mg/L, 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 permit documents of the nearby North Antelope/Rochelle Complex are variable but in general comparable to the Wasatch Formation overburden and Wyodak coal. At the North Antelope/Rochelle Complex, the backfill aquifer has been tested at four wells, and the average hydraulic conductivity is 36 ft/day, which exceeds the average hydraulic conductivity (9.5 ft/day) reported for the Wyodak coal in the vicinity of the North Antelope/Rochelle Complex. The data available indicate that the hydraulic conductivity of the backfill would be greater than or equal to premining coal values, suggesting that wells completed in the backfill would provide yields greater than or equal to premining coal wells.

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. These impacts are discussed in section 4.5.5.

#### 4.1.6 Alluvial Valley Floors

The Horse Creek LBA tract has been evaluated for the presence of AVF's. Certain reaches of Antelope Creek and Horse Creek that are within the current Antelope Mine permit boundary have been declared AVF's by WDEQ/LQD, and portions of these declared AVF's are within the LBA tract.

Impacts to designated AVF's are generally not permitted if the AVF is determined to be significant to agriculture. AVF's that are not significant to agriculture can be disturbed during mining, but they must be restored as part of the reclamation process. In order to restore the AVF, the physical and hydrologic characteristics of the AVF must be determined.

The WDEQ/LQD has determined that the potential AVF's on Antelope Creek and Horse Creek within the current Antelope Mine permit boundary are not significant to agriculture (WDEQ/LQD 1988). The Horse Creek LBA Tract and the surrounding area that would be amended into the Antelope Mine if ACC acquires the tract has been studied for AVF's, and the report has been submitted to WDEQ/LQD. Preliminary findings by that agency are that there is an AVF that is not significant to agriculture.

The essential functions of the AVF, including subirrigation and the pool-run morphology of the Horse Creek channel, will have to be replaced if the tract is mined (WDEQ/LQD November 2, 1999).

ACC's approved mining and reclamation plan avoids disturbing the Antelope Creek Valley. Therefore, portions of the Antelope Creek Valley within the Horse Creek LBA Tract would not be mined under any alternative. Consequently, disruptions to streamflows which might supply AVFs on Antelope Creek downstream of the Antelope Mine would not be expected to be significant. Groundwater intercepted by the mine pits would be routed through settling ponds to meet state and federal quality criteria, and the pond discharges would likely increase the frequency and amount of flows in these streams, which would increase surface water supplies to downstream AVF's.

If the LBA tract is mined as an extension of existing operations, the mining would extend upstream on streams already in the active mine areas. Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVF's through mining of the LBA tract.

#### 4.1.7 Wetlands

As discussed in Chapter 3, ACC has completed a wetlands inventory and submitted it to COE. This inventory identified the acres of jurisdictional wetlands on the Horse Creek LBA Tract (see Section 3.8). Existing wetlands along Antelope Creek would

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not be disturbed by mining. Existing wetlands elsewhere in the LBA tract would be destroyed 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 Horse 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 function 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.

##### 4.1.8 Vegetation

Under the Proposed Action, mining of the LBA tract would progressively remove the native vegetation on 3,190 acres on and near the LBA tract. Acreage disturbed under Alternative 2 would be 3,581 acres. 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 contemporaneously with mining on adjacent lands, i.e., reclamation would begin once an area is mined. Estimates of the time elapsed from topsoil stripping through reseeded of any given area range from two to four years. This would be longer for areas occupied by stockpiles, haulroads, 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 action alternatives, in which the LBA tract would be mined as an extension of the existing Antelope Mine. Grazing restrictions prior to mining and during reclamation would remove up to 100 percent of the LBA area from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region, and 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 will not be restricted throughout the operations.

Re-established vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ). The majority of the approved species are native to the LBA tract. Initially, the reclaimed land would be dominated by grassland vegetation which would be less diverse than the premining vegetation. At least 20 percent of the 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 and rangeland) should be achieved even with the changes in vegetation composition and diversity. Private landowners (see Figure 3-9) would have the right to manipulate the vegetation on their lands as they desire once the reclamation bond is released.

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 percent of these disturbed lands would have been reseeded. The remaining 25 percent 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 Horse 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 U.S. suggests that droughts could occur periodically during the life of the mine. Such droughts would severely hamper revegetation efforts during the drought years, 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, however, 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 re-establishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum slope would be 20 percent 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 mixed prairie grasslands with graminoid/forb-dominated areas, and the overall species diversity would be reduced, especially for the shrub component. Jurisdictional wetlands would fall under the jurisdiction of the COE.

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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 Horse Creek LBA Tract.

The decrease in plant diversity would not seriously affect productivity of the reclaimed areas, regardless of the alternative selected, and 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**

Surveys to date have not revealed the presence of any T&E or candidate plant species on the Horse Creek LBA Tract. USFWS requirements mandate surveys for Ute Ladies Tresses in potential habitat before surface disturbing activities commence. If found, a mitigation plan would be required.

#### 4.1.9 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 include loss of 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 or Alternative 2, the area of mining disturbance would be extended onto the LBA tract and mining would be extended by up to nine years at the Antelope Mine.

Under the Proposed Action or Alternative 2, big game would be displaced from portions of the LBA tract to adjacent ranges during mining. Pronghorn would be most affected; however there is no crucial pronghorn habitat on the LBA tract. Mule deer and white-tailed deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. The displacement would be incremental, occurring over several years and allowing for gradual changes in big

game 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, however, 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. There would be more restrictions on big game movement on or through the tract, however, 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.

Road kills related to mine traffic would be extended in the area by up to nine 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 re-established on the reclaimed land, but the topographic changes would be permanent.

Medium-sized mammals (such as lagomorphs, coyotes, and foxes) would be temporarily displaced to other habitats by mining, potentially

resulting in increased competition and mortality. However, these animals would quickly 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.

Mining the LBA tract would eliminate a small amount of potential sage grouse habitat. However, no sage grouse have been observed on or near the LBA tract during annual monitoring surveys for the adjacent Antelope Mine, and the nearest lek is five miles away. Thus, mining is not expected to impact sage grouse populations.

Regional raptor populations will not be deleteriously impacted by mining the LBA tract. However, individual birds or pairs may be impacted. As noted in Section 3.10.4, three ferruginous hawk nests and two golden eagle nests were on the LBA tract after the 1998 breeding season. One more intact ferruginous hawk nest was present on the area added under Alternative 2. Thirty-six additional raptor nests were found intact in the vicinity of the LBA after the 1998 breeding season. Mining activity could cause raptors to abandon nests proximate to disturbance. There is an approved

raptor mitigation plan for the existing Antelope Mine. If the LBA tract is leased, a raptor mitigation plan covering the Horse Creek LBA Tract would be developed during the mine permitting process. That plan, required by USFWS and WDEQ/LQD, would address the impacts of mining on nesting raptors. Foraging habitat for raptors would be reduced until revegetation can attract and support lagomorphs and small mammals, which serve as their prey. Raptors could be impacted by the construction or relocation of power lines, which can pose an electrocution hazard. The raptor mitigation plan includes provisions for protection from electrocution.

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. Several required measures would minimize these impacts. A diverse seed mixture planted in a mosaic with a shrubland phase would provide food, cover, and edge effect. Cottonwood plantings along reclaimed drainages would eventually restore perching and nesting sites for species that are restricted to wooded riparian areas.

Waterfowl and shorebird habitat on the LBA tract is minimal, and

production of these species is very limited. Mining the LBA tract would thus 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.

A minimal amount of low-quality fish habitat will be impacted on the proposed lease. No perennial streams or reservoirs occur on the area. The only fish present are common, widespread species. Portions of creeks that are disturbed during mining will be restored during reclamation.

The impacts discussed above would apply to both action alternatives.

#### 4.1.10 Threatened, Endangered, and Candidate Wildlife Species

T&E wildlife surveys specific to the proposed lease tract were conducted in the summer of 1999. No T&E species or potential habitat for T&E species were found during those surveys (ACC 1999b). If the Horse Creek LBA tract is leased, BLM would attach a stipulation to the lease providing for further surveys of the tract for T&E species and their critical habitats. A biological assessment would be prepared on the mining and reclamation plan prior to approval by the Assistant Secretary of the Interior. In the event that T&E species are identified at this point or after approval of the mining and reclamation permit, OSM has also

been attaching a condition to recently approved mining and reclamation permits providing for modification or cancellation of the mining and reclamation plan approval on the basis of consultation with the USFWS pursuant to Section 7 of the Endangered Species Act. Therefore, issuing a maintenance lease for the Horse Creek LBA tract to the Antelope Mine would not be expected to affect any T&E species.

There are no prairie dog colonies on the LBA tract, and surveys of nearby towns have produced no evidence of black-footed ferrets. Bald eagles could potentially nest or roost on the LBA tract; however, there are no concentrated food sources for eagles on the LBA tract and the loss of any potential prey habitat would be short-term. Peregrine falcon nesting habitat does not exist on the LBA tract, and there are no concentrated food sources for peregrines on the LBA tract.

Small portions of two known mountain plover use areas overlap the proposed lease. The current mining and reclamation plan for the Antelope Mine includes a habitat recovery replacement plan for the identified mountain plover use areas on the existing leases, and a similar plan would be required as part of the mine permit revision for all plover habitat identified on the Horse Creek LBA Tract. That plan, which would have to be approved by the USFWS, would be expected to reduce potential impacts to an acceptable level. No recent sightings of swift fox have been reported on or near the tract.

Few MBHFI depend on or regularly use the proposed lease. For the most part, mining will have negligible impacts on these species of concern. A plan to monitor MBHFI and a plan to mitigate potential impacts to MBHFI is included in the existing approved Antelope Mine mining and reclamation plan. A similar plan would be required by USFWS and WDEQ/LQD if the LBA tract is leased and when a mining and reclamation plan including the tract is submitted for approval.

#### 4.1.11 Land Use and Recreation

The major adverse environmental consequences of the Proposed Action or Alternative 2 on land use would be reduction of livestock grazing, loss of wildlife habitat, and curtailment of oil and gas development on about 3,190 acres (Proposed Action) or about 3,580 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.

There are currently no producing oil or gas wells on the LBA tract. One plugged and abandoned deep oil and gas test well is present on the LBA tract under the Proposed Action and another plugged and abandoned oil and gas test well is located on the LBA tract under Alternative 2. These two wells were not completed for production, therefore no production equipment would have to be removed prior to mining. One CBM well location is posted on a private oil and gas lease on the LBA tract under the Proposed Action and Alternative 2. If

this well is completed for production and if other CBM wells are drilled to produce the methane in advance of mining, the production equipment needed for these wells would have to be removed in advance of mining. Well location information, federal oil and gas ownership, and federal oil and gas lessee information are presented on Figure 3-10 and Table 3-9.

As discussed in Section 1.2 of this document, some of the lands included in the tract were managed by the USFS until recently when they were included as part of an exchange between the USFS and local landowners. As a result of this land exchange, there are currently no federal surface lands included in the LBA tract under any of the alternatives. Therefore, no federal land would be removed from public access if the Horse Creek LBA Tract is leased.

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

Following reclamation, the land would be suitable for grazing and wildlife uses, which are the historic land uses. There are no BLM or USFS 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 the State of Wyoming. Following reclamation bond release, management of the privately-owned surface would revert to the private surface owner.

### 4.1.12 Cultural Resources

All portions of the Proposed Action area, and all but forty acres of the Alternative 2 area, have been subjected to Class III inventory and SHPO consultation on site evaluations.

At this time, all eligible sites and all sites originally classified as of undetermined eligibility in Converse County have been subjected to additional data recovery action, and as a result, no additional work is needed on cultural sites in the Converse County portion of the LBA tract. After completion of the consultation with SHPO on the evaluation of all sites within the Campbell County portion of the tract, two sites in Campbell County are considered eligible for the NRHP.

Impacts to eligible or unevaluated cultural resources cannot be permitted. If unevaluated sites cannot be avoided, they must be evaluated prior to disturbance. 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 sites on the Horse Creek LBA Tract which can not be avoided or which have 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 Wyoming SHPO would consult with the lead federal and state agencies 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 but adjacent to mine permit areas.

#### 4.1.13 Native American Concerns

No sites of Native American religious or cultural importance are known to occur 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.

#### 4.1.14 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 (see Appendix D).

#### 4.1.15 Visual Resources

Mining activities at the existing Antelope Mine are currently visible from County Road 37 and the Antelope Road, and mining activities on the Horse Creek LBA Tract would also be visible from these local access roads.

Mining would affect landscapes classified by BLM as VRM Class IV, and landscape character would not be significantly changed following reclamation. No unique visual resources have been identified on or near the Horse 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; however, 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.

#### 4.1.16 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 on the LBA tract. The Noise Control Act of 1972 indicates that a 24-hour equivalent level of less than 70 dBA

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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 ft. 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 ft, the intensity of this blast would be reduced to 40 dBA. Since the nearest occupied dwelling is over one mile away from the LBA tract, there should be no significant noise impacts.

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.

### 4.1.17 Transportation Facilities

No new or reconstructed transportation facilities would be required under the Proposed Action or Alternative 2. Essentially all of the coal mined on the LBA tract would be transported by rail. Leasing the LBA tract would extend the length of time that coal is shipped from the

permitted Antelope Mine. Traffic to and from the mine would continue at existing or slightly higher levels for an additional 8 or 9 years, depending on which alternative is selected.

An active pipeline currently crosses the LBA tract, and any relocation of the pipeline would be handled according to specific agreements between the coal lessee and the pipeline owner if the need arises. 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 and Union Pacific have upgraded and will continue to upgrade their rail capacities to handle the increasing coal volume projected from the southern PRB with or without the leasing of the proposed LBA tract.

### 4.1.18 Socioeconomics

Leasing and subsequent mining of the LBA tract would extend the life of the already permitted Antelope Mine by eight to nine years.

Coal prices are currently projected to remain relatively constant throughout the life of the mine (WSGS 1999). Assuming a price of \$4.00 per ton, the revenue from the sale of the recoverable coal from the LBA tract would total \$984 million for the Proposed Action (246 million tons of coal) or \$1.1 billion for Alternative 2 (278.7 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, as discussed below.

The federal government would collect a royalty at the time the coal is sold. This royalty is 12.5 percent of the sale price of the coal. This would amount to approximately \$123 million under the Proposed Action, or \$139.5 million under Alternative 2. 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 (discussed above). 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 \$270.6 million under the Proposed Action, or \$306.6 million under Alternative 2. This figure includes half of the federal royalty discussed above.

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 cents per ton to 38.3 cents per ton. This range of bonus payments would represent a potential bonus payment range of \$27 million to \$106 million

for the estimated federal coal tonnage in the Horse 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 under an action alternative and coal production increases as projected, ACC anticipates that total employment at the Antelope Mine would increase by up to 70 employees, which would result in a total employment of 250 at the Antelope Mine over the 8 to 9 years the tract is being mined. Seventy persons represents less than one half of one percent of the 26,341 persons in the December 1999 labor force in Campbell and Converse Counties (Wyoming Employment Resources Division, February 2000). Considering that the December 1999 unemployment in these counties was 1,156, it appears that the labor force could absorb the projected potential increase in employment. As a result, no additional demands on the existing infrastructure or services in these communities would be expected because no influx of new residents would be needed to fill new jobs. The economic stability of the communities of Douglas, Wright, and Gillette would benefit by having the Antelope Mine employees living in their communities employed for an additional 8 to 9 years.

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 Alternative 2 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 and/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, and 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.

### 4.1.19 Hazardous and Solid Waste

If ACC acquires the Horse 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 Antelope 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 Antelope Mine, as described in Chapter 2.

### **4.2 No-Action Alternative**

Under the No-Action Alternative, the coal lease application would be rejected and the area contained in the application would not be offered for lease at this time. 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 Antelope Mine would not be changed if this alternative is chosen. The impacts described on the preceding pages and in Table 2.3 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 Antelope coal leases under the No-Action Alternative, but these impacts would not be extended onto the LBA tract.

The general nature and magnitude of cumulative impacts as summarized in Table 2.3, which would occur from implementation of the Proposed Action or Alternative 2, would not be substantially different under the No-Action Alternative. However, coal removal and the associated disturbance and impact would not occur on the 3,190 to 3,581 additional acres disturbed in the Proposed Action or Alternative 2, respectively. A portion of the Horse

Creek LBA Tract adjacent to the existing Antelope 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 nine years of mining would be lost. Without the LBA tract, operations at Antelope Mine would end in about 2006, when the existing leases are mined out. Not leasing this tract at this time could result in a bypass of this federal coal if the lease is not sold while the existing mine is still in operation and pits are in a position to be expanded into the LBA area.

#### **4.3 Regulatory Compliance, Mitigation, and Monitoring**

In the case of surface coal mining, SMCRA and state law require a considerable amount of mitigation and monitoring. Measures that are required by regulation are considered to be part of the Proposed Action and Alternative 2. 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 Antelope Mine. If the Horse Creek LBA Tract is leased, these requirements, mitigation plans, and monitoring plans would be part of a mining and reclamation covering the Horse Creek LBA Tract. 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 4-4. Some

of these mitigation and monitoring measures are also described in the resource discussions in Section 4-1 of this document.

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. One issue of current concern is the release of NO<sub>x</sub> from blasting, and the resulting formation of low-lying orange clouds that can be carried outside the mine permit areas by wind. As a result of this concern, industry and agency representatives have met and discussed possible causes and solutions, including improving blasting techniques or explosives, reducing powder factors, and analyzing the composition of the orange clouds, and these procedures are being evaluated. BLM is not involved in the regulation of blasting activities at the coal mines in the Powder River Basin, however, BLM supports the continuing efforts of the involved regulatory agencies to develop appropriate procedures and techniques to resolve this problem.

Table 4-4. Regulatory Compliance, Mitigation and Monitoring Measures required under the Proposed Action, Alternative 1 (No Action), or Alternative 2

<b>RESOURCE</b>	<b>Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law<sup>1</sup></b>	<b>MONITORING<sup>1</sup></b>
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 & 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 <sub>10</sub> or TSP; Off-site ambient monitoring for PM <sub>10</sub> 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 streamflows 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, & backfill

<sup>1</sup> These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in their current approved mining and reclamation plan (the No-Action Alternative). If the Horse Creek LBA Tract is leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the Horse Creek LBA Tract that must be approved before mining can occur on the tract under Alternative 1 or 2.

Table 4-4. Regulatory Compliance, Mitigation and Monitoring Measures required under the Proposed Action, Alternative 1 (No Action), or Alternative 2. (Continued)

RESOURCE	Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law <sup>1</sup>	MONITORING <sup>1</sup>
Groundwater Quality	Evaluating cumulative impacts to water quality associated with proposed mining; Replacing existing water rights that are interrupted, discontinued, or diminished by mining with water of equivalent quality	Monitoring wells track water quality in overburden, coal, interburden, underburden, & backfill
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 of reclaimed wetlands using same procedures used to identify premining jurisdictional wetlands.
Vegetation	Permanently revegetating 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; 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 of revegetation growth & diversity until release of final reclamation bond (minimum 10 years). Monitoring of erosion to determine need for corrective action during establishment of vegetation. Use of controlled grazing during revegetation evaluation to determine suitability for postmining land uses.
<sup>1</sup> These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in their current approved mining and reclamation plan (the No-Action Alternative). If the Horse Creek LBA Tract is leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the Horse Creek LBA Tract that must be approved before mining can occur on the tract under Alternative 1 or 2.		

Table 4-4. Regulatory Compliance, Mitigation and Monitoring Measures required under the Proposed Action, Alternative 1 (No Action), or Alternative 2. (Continued)

RESOURCE	Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law <sup>1</sup>	MONITORING <sup>1</sup>
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 & annual wildlife monitoring surveys; Monitoring for Migratory Birds of High Federal Interest
Threatened, Endangered, & Candidate 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
Land Use	Suitably restoring reclaimed area for historic uses (grazing and wildlife);	Monitoring of controlled grazing prior to bond release evaluation.
Cultural Resources	Conducting Class I & 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 of mining activities during topsoil stripping; cessation of activities and notification of authorities if unidentified sites are encountered during topsoil removal.

<sup>1</sup> These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in their current approved mining and reclamation plan (the No-Action Alternative). If the Horse Creek LBA Tract is leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the Horse Creek LBA Tract that must be approved before mining can occur on the tract under Alternative 1 or 2.

Table 4-4. Regulatory Compliance, Mitigation and Monitoring Measures required under the Proposed Action, Alternative 1 (No Action), or Alternative 2. (Continued)

<b>RESOURCE</b>	<b>Regulatory Compliance or Mitigation Required by Stipulations or Required by State or Federal Law<sup>1</sup></b>	<b>MONITORING<sup>1</sup></b>
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 pipeline, 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 waste 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 materials 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.

<sup>1</sup> These requirements, mitigation plans, and monitoring plans are in place for the existing Antelope Mine in their current approved mining and reclamation plan (the No-Action Alternative). If the Horse Creek LBA Tract is leased, these requirements, mitigation plans, and monitoring plans would be part of a mining plan revision covering the Horse Creek LBA Tract that must be approved before mining can occur on the tract under Alternative 1 or 2.

#### **4.4 Residual Impacts**

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

##### 4.4.1 Topography and Physiography

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

##### 4.4.2 Geology and Minerals

Geology from the base of the coal to the surface would be subject to significant, permanent change.

##### 4.4.3 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.

##### 4.4.4 Air Quality

No residual impacts to air quality would occur following mining.

##### 4.4.5 Water Resources

The area where groundwater drawdowns and replacement of coal and overburden with spoils occur would be increased under the action 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 would be different from premining conditions.

##### 4.4.6 Alluvial Valley Floors

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

##### 4.4.7 Wetlands

Replaced wetlands (jurisdictional or functional) may not duplicate the exact function and landscape features of the premining wetland.

##### 4.4.8 Vegetation

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

##### 4.4.9 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.

##### 4.4.10 Threatened, Endangered, and Candidate Species

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

4.4.11 Land Use and Recreation

No residual impacts to land use and recreation are expected.

4.4.12 Cultural Resources

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

4.4.13 Native American Concerns

No residual impacts to Native American concerns have been identified.

4.4.14 Paleontological Resources

No residual impacts to significant paleontological resources are expected.

4.4.15 Visual Resources

No residual impacts to visual resources are expected.

4.4.16 Noise

No residual impacts to noise are expected.

4.4.17 Transportation Facilities

No residual impacts to transportation facilities are expected.

4.4.18 Socioeconomics

No residual impacts to socioeconomics are expected.

**4.5 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 Horse Creek LBA Tract is leased and mined and if other proposed development in the area occurs.

Important points to keep in mind include: 1) the total areas of all mines would not be disturbed at once; 2) the number of acres, type of vegetation, etc., disturbed would vary from year to year; 3) the impacts to groundwater would vary as mining progresses through each permit area (depending on saturation, how close the next mine pit is, etc.); and 4) the intensity and extent of CBM development is speculative.

Since decertification of the Powder River Federal Coal Region in 1990, the Wyoming State Office of the BLM has held twelve competitive coal lease sales and issued nine new federal coal leases containing approximately 2.365 billion tons of coal using the LBA process (Table 1-1). This leasing process has undergone the scrutiny of two appeals to the Interior Board of

#### 4.0 Environmental Consequences

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Land Appeals and one audit by the General Accounting Office.

The Wyoming BLM has pending applications for six additional federal coal tracts containing about 2.2 billion tons of coal (Table 1-2). Five of the applications are for maintenance tracts for existing mines, one is potentially for a new mine start. Three of the pending applications have been reviewed by the PRRCT and have been recommended for processing (Horse Creek, Belle Ayr, and North Jacobs Ranch). The remaining three (State Section, NARO, and Little Thunder) have not yet been reviewed by the PRRCT. The NARO and Little Thunder LBA tracts are both maintenance tracts for existing mines. The State Section LBA could potentially represent a new mine start, or it could be mined as a maintenance tract by an existing mine. The State Section LBA overlaps the North Jacobs Ranch LBA and adds additional acreage north of the North Jacobs Ranch LBA. The applicant for the State Section LBA previously applied for the New Keeline LBA, which was rejected. The State Section LBA includes all of the area included in the New Keeline LBA.

BLM also recently completed one exchange in the Powder River Basin, authorized by Public Law 95-554. Under this exchange, 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 Highway 90.

The Wyoming and Montana BLM state offices completed a study entitled "*Powder River Basin Status Check*" in 1996. The purpose of this study was to document actual mineral development impacts in the PRB from 1980 to 1995 and compare them with mineral development impacts that were predicted to occur by 1990 in the five previously prepared PRB regional EIS's. Portions of the status check were updated prior to the 1997 and 1999 PRRCT public meetings in Casper, Wyoming and Billings, Montana. Four of the previously prepared regional EIS's evaluated coal development in the PRB in Wyoming. They are:

*Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming*, BLM, October 1974;

*Final Environmental Statement, Eastern Powder River Coal*, BLM, March 1979;

*Final Environmental Impact Statement, Powder River Coal Region*, BLM, December, 1981; and

*Draft Environmental Impact Statement, Round II Coal Lease Sale, Powder River Region*, BLM, January 1984.

For Wyoming, the status check compared actual development in Campbell and Converse counties with predictions in the 1979 and 1981 Final EIS's, and USGS Water Resources Investigations Report 88-4046, entitled "*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin*" (Martin, et al.,

1988), which is frequently referred to as "the CHIA."

In 1999, Campbell and Converse Counties produced approximately 319.9 million tons of coal, according to the records of the Wyoming State Inspector of Mines. This is more than three times the total 1980 coal production of 94 million tons for the entire state. The increasing state production is primarily due to increasing sales of low-sulfur, low-cost PRB 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 percent of Wyoming's coal sales.

The currently operational mines in Campbell and northern Converse Counties are shown in Figure 1-1. Their current status and ownership are shown in Table 4-5. 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 produce 85 to 95 percent of the coal produced in Wyoming each year. Table 4-6 summarizes predicted coal mining activity (from the 1979 and 1981 regional EIS's) with actual activity that has occurred since the EIS's were prepared.

Campbell and Converse counties' oil production decreased to 20.7 million barrels of oil in 1998 from 32.8 million barrels in 1992, a 36.9%

decrease. Currently, oil prices are increasing and it is unclear if this trend of decreasing oil production will continue in the foreseeable future.

Natural gas production has been increasing, particularly in Campbell County, due to the development of shallow CBM resources west of the coal mines. As of November 1999, in the PRB in Wyoming, approximately 1,500 CBM wells were reporting production. About 3,000 additional CBM wells are capable of producing, which means they have been drilled and completed for production but are currently not producing for reasons that could range from non-economic levels of production to waiting on a pipeline. Approximately 4,300 additional permits to drill have been approved (WOGCC). Ninety-four percent of these wells are in Campbell County. Since 1990, seven EA's and two EIS's have been prepared to analyze the impacts of CBM development in Campbell County, and BLM is currently starting work on another EA and another EIS to analyze the impacts of drilling additional CBM wells in the Powder River Basin. The EA will analyze the impact of developing CBM resources on undrilled federal leases in the Wyodak project area that are adjacent to state and private leases with producing CBM wells. If the federal leases are not developed, the federal CBM resources may be drained by the wells on the adjacent leases. The proposed EIS will analyze the potential impacts of proposed additional CBM development in the Wyoming portion of the basin and update the BLM planning documents

Table 4-5. Status of Wyoming Powder River Basin Coal Mines

1999 Mine	1994 Mine Operator	Coal Production <sup>1</sup>		1999 Mine Operator	Coal Production <sup>1</sup>		Status/Comments
		1993 Actual <sup>3</sup>	1994 Permitted <sup>4</sup>		1998 Actual <sup>3</sup>	1999 Permitted <sup>4</sup>	
Buckskin	SMC (Zeigler)	11.18	24.0	Vulcan Coal	17.29	22.0	Active
Clovis Point	Kerr-McGee	0	4.0	Wyodak Resources	0	4.0	Mine shut down/leases relinquished or sold; facilities sold; Wyodak has AQD permit
Dry Fork	Phillips/WFA	3.28	15.0	WFA	1.03	15.0	Active
Eagle Butte	Cyprus-Amax	16.70	29.6	RAG American	18.07	35.0	Active
Fort Union	Fort Union Ltd	0.06	9.3	Kennecott/Kfx	0.05	9.4	Active
Rawhide	Carter (Exxon)	9.86	24.0	Peabody	5.39	24.0	Shut down
Wyodak	Wyodak Resources	3.03	10.0	Wyodak Resources	3.28	10.0	Active
<b>NORTHERN MINE GROUP TOTALS</b>		<b>44.11</b>	<b>115.9</b>		<b>45.11</b>	<b>119.4</b>	
Belle Ayr	Cyprus-Amax	15.59	25	RAG American	22.48	45	Active
Caballo/N. Caballo	Carter (Exxon)/Western Energy	15.42	40	Peabody	25.98	51	Active/Caballo Mine + former Rocky Butte & West Rocky Butte leases
Cordero Rojo	Kennecott/Drummond	21.01	44	Kennecott	36.98	60	Active/Cordero + Caballo Rojo Mines
Coal Creek	ARCO	0.11	18	Arch	7.07	18	Active
<b>CENTRAL MINE GROUP TOTALS</b>		<b>52.13</b>	<b>127</b>		<b>95.21</b>	<b>174</b>	
Antelope	Kennecott	7.29	12	Kennecott	19.42	30	Active
Black Thunder	ARCO	34.32	36	Arch	42.68	100	Active
Jacobs Ranch	Kerr-McGee	18.39	25	Kennecott	29.08	55	Active
N. Antelope/Rochelle	Peabody	32.94	50	Peabody	64.64	75	Active/North Antelope Mine + Rochelle Mine
N. Rochelle	SMC (Zeigler)	0.02	8	Vulcan Coal	0.04	20	Active/facilities constructed in 1998-99
<b>SOUTHERN MINE GROUP TOTALS</b>		<b>92.96</b>	<b>131</b>		<b>155.86</b>	<b>280</b>	
<b>TOTALS FOR 3 MINE GROUPS</b>		<b>189.2</b>	<b>373.9</b>		<b>293.5</b>	<b>573.4</b>	

<sup>1</sup> Actual production (million tons) on left, permitted production (million tons) on right.

<sup>2</sup> Source: Wyoming State Geological Survey *GEO-NOTES*, August 1994.

<sup>3</sup> Source: *COAL OUTLOOK SUPPLEMENT*, August 9, 1999 and Wyoming State Inspector of Mines *ANNUAL REPORT* for 1999.

<sup>4</sup> Source: Bernard J. Dailey, WDEQ/AQD, personal communication March 3, 2000. Figures are permitted capacity as of October 1, 1999.

Table 4-6. Coal Production and Development Levels, Campbell and Converse Counties, Wyoming

	Coal Production (Million Tons)	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 <sup>1</sup>	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					
Proposed New Power Plants	NAPG Two Elk, Zeigler ENCOAL, and Calpine & Black Hills Wyodak #2					
Existing Coal Enhancement:	ENCOAL-Buckskin (inactive), KFx-Fort Union (active), and Wyodak Eartheo (active)					
Proposed New Coal Enhancement	ENCOAL-North Rochelle					

<sup>1</sup> Includes the Dave Johnson Mine, which is not included in Table 4-5.

Sources: 1979 and 1981 BLM Powder River Basin Regional EISs, Wyoming State Geological Survey Geo-notes-1996-99, and Wyoming State Inspector of Mines Annual Reports, 1990-99

in the area of CBM development interest. The regional coal EIS's (BLM 1974, 1979, 1981, 1984) and the Buffalo RMP (BLM 1985) analyzed oil and gas development, but did not anticipate that the oil and gas development would include production of CBM resources.

Under the current process for approving CBM drilling, CBM wells can be drilled on private and state oil and gas leases after approval by the Wyoming Oil and Gas Conservation Commission and the Wyoming State Engineer's Office. On federal oil and gas leases, BLM must analyze the individual and cumulative environmental impacts of all drilling, as required by NEPA, before CBM drilling on the federal leases can be authorized. Approximately 88% of the coal rights in the Wyodak CBM project area shown in Figure 1-1 are federal, but only about half of the oil and gas rights in this area are federal. 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 rights.

Other mineral development levels in the Wyoming PRB are currently lower than predicted in the EIS's. In the 1970's, 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 1980's. There are currently three *in situ* uranium operations in Converse and Johnson counties, but no mines and no mills. Uranium production has been increasing since 1990.

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 Powder River Basin, but not in Campbell or Converse Counties.

The proposed Horse Creek LBA Tract is situated within a nearly continuous corridor of five coal mines (counting the North Antelope/Rochelle Complex as one mine) in northern Converse and southern Campbell counties, Wyoming (see Figure 4-1). This southern mine corridor is approximately 24 miles long and eight miles wide. Production of coal in this southern mine group began in 1977 at the Black Thunder Mine. The current maximum permitted production rate for these five mines is 280 million tons per year (Table 4-5). Seven maintenance leases, including approximately 19,650 acres of federal coal, have been issued to mines in this southern group since decertification (Jacobs Ranch, West Black Thunder, North Antelope/Rochelle, Antelope, North Rochelle, Powder River, and Thundercloud--see Table 1-1). There are also four pending maintenance leases including approximately 14,870 acres of federal coal in this group of mines (Horse Creek, North Jacobs Ranch, NARO and Little Thunder--see Table 1-2). The State Section LBA tract, located north of and adjacent to the Jacobs Ranch Mine (Figure 4-1), is also located in this mine corridor. The North Jacobs Ranch LBA Tract partially overlaps the State Section LBA tract.

CBM wells have been drilled around the Jacobs Ranch, Black Thunder, and North Antelope/Rochelle mines. Production from these wells was delayed for a while pending completion of additional pipelines in this area. CBM drilling and production is expected to continue in the areas around the coal mines, and on the LBA's. 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 west of the southern mine group. These potential impacts are discussed in the following cumulative impact discussion for these resources.

In addition to the ongoing coal mining and leasing and the CBM development, four other projects were recently completed or are in progress or planned during preparation of this EIS in the vicinity of the southern mine group: 1) construction of the North Rochelle Mine facilities and rail loop; 2) construction and operation of the ENCOAL facilities within the rail loop at the North Rochelle Mine; 3) construction and operation of the Two Elk Power Plant east of the Black Thunder Mine; and 4) construction and use of the proposed DM&E rail line. These projects are considered in this cumulative impact discussion because, due to their locations, the impacts from these projects could overlap with the impacts of mining the Horse Creek LBA Tract.

Construction of the North Rochelle Mine facilities and rail loop began in June 1997 and was completed in mid-1999. The mine was not in

production during most of the construction period, but production resumed on December 21, 1998.

The ENCOAL Plant could consist of three 5,500 ton/day parallel modules with an associated 240 Mw co-generation power plant. The power plant boiler would burn coal fines from the plant as well as some minor purge gas streams, and would produce enough electricity to run the ENCOAL Plant and the North Rochelle Mine. Excess electricity would be available for external sale. ENCOAL has submitted a request for amendment to the North Rochelle mining permit to WDEQ/LQD, since the ENCOAL Plant would be located within the rail loop at the North Rochelle Mine. ENCOAL is also pursuing a surface land exchange with the USFS because the proposed location for the ENCOAL facilities is on USFS surface. In addition, ENCOAL has filed a Permit Amendment Application with the Industrial Siting Division of WDEQ for the proposed LFC plant, and an air quality permit application with WDEQ/AQD. Other permits that will be obtained include a wastewater permit from WDEQ, a permit for a quantity of water from the Wyoming SEO, and various construction and waste disposal permits from the state and county.

The ENCOAL operations at the North Rochelle Mine would use up to 700 gpm of water. According to plans submitted to the Wyoming State Engineer (ENCOAL 1997), ENCOAL Corporation proposes to provide required industrial water for the ENCOAL plant by means of a two-

phase approach. The Phase 1 industrial water supply would be based on use of groundwater from two existing wells in a local scoria aquifer during approximately the first eight years of plant operation. The Phase 2 industrial water supply would be based on use of groundwater from deeper aquifers during the remaining operational life of the plant if experience shows the scoria aquifer cannot continue to provide 700 gpm. The full life of the project is projected to be 30 years. This project is currently on hold and there is no proposed construction schedule at this time.

Two Elk would be a coal-fired power plant located east of Black Thunder Mine and would generate 250 Mw. The plant would burn low-Btu "waste coal" and coal fines from nearby mines as well as sub-bituminous coal in a pulverized coal boiler. This ability to burn low Btu waste coal and fines would allow the Two Elk plant to recover fuel values that might otherwise be lost and thereby generate electric power more efficiently than existing coal-fired plants. Coal and waste coal would be transported from the mine to the power plant by direct truck haul on unpaved roads, and ash would be returned to the mine by enclosed, 4-wheel off-highway trucks. An application for an air quality Permit to Construct was submitted to WDEQ and was deemed administratively complete on August 5, 1997. The Two Elk project received a Permit to Construct from WDEQ/AQD on February 27, 1998. The permittee has two years from the date of issuance to begin construction. No

final decisions have been made as to how much water would be used, or where it would be obtained. Various scenarios for "wet" and "dry" operations are being evaluated at this time. Other permits that will be obtained include a wastewater permit from WDEQ and various construction and waste disposal permits from the state and county. According to a recent article in the Gillette News-Record, construction could begin on this plant in 2000 (Gillette News-Record 2000).

The Surface Transportation Board preliminarily approved the DM&E Railroad expansion plan (to build 262 miles of new track in the Powder River Basin and to rehabilitate 650 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 DM&E had proposed to start construction in 1999 and complete the new railroad line in 2001; however, final approval and construction cannot take place until after the environmental analysis is completed. The proposed route in Wyoming will generally follow along the Cheyenne River valley. A draft EIS is tentatively expected in summer 2000.

With the exception of some projected impacts to the labor and housing markets, none of the impacts to the physical environment projected by these projects would extend into the Horse Creek analysis area.

The status check identified one part of the coal mining process where the

actual levels of development did not agree with the predictions, and this was the number of acres reclaimed. In general, coal mine reclamation efforts have been successful in both the Wyoming and Montana portions of the basin; however, as indicated in Table 4-7, the regional EIS's assumed that reclamation would proceed at a faster pace than has actually occurred.

Table 4-7 compares the 1979 and 1981 predictions of surface coal mining disturbance and reclamation areas with actual disturbance and reclamation areas. The EIS predictions are for the total area of disturbance that is available for reclamation and the area that has been reclaimed. The actual numbers,

which are taken from the Annual Reports filed with WDEQ/LQD by each mine, show all acres of disturbance and acres seeded with final seed mixture. Since the EIS predictions for disturbed areas include only areas available for reclamation and the actual disturbed areas shown in Table 4-7 include areas that are not currently available for reclamation (mine facilities, rail facilities, roads, etc.), the numbers are not exactly comparable. To make them more comparable, the number of actual disturbed acres would be decreased to reflect the acres at each mine occupied by mine and rail facilities, roads, etc.; however those numbers have not been available for all mines in the annual reports. Also, since reclamation is a process

Table 4-7. Predicted and Actual Coal Mine Disturbance and Reclamation, Campbell and Converse Counties, Wyoming

Year	Surface Coal Mining Disturbance (Acres)*	Surface Coal Mining Reclamation (Acres)**	Percent Reclaimed
1979 EIS Prediction for 1990	22,794	12,666	55.57%
1981 EIS Prediction for 1990	48,400	34,100	70.45%
Actual 1990	31,797	6,994	22.00%
Actual 1996	47,018	12,165	25.87%
Actual 1997/98***	52,502	14,504	27.63%

\* Includes all disturbance, including mine facilities, rail facilities, roads, sedimentation ponds, etc.

\*\* Includes only acres seeded with permanent seed mixture, not all acres currently being reclaimed.

\*\*\* Based on most recent Annual Report submitted to WDEQ/LQD that is available for each mine.

#### 4.0 Environmental Consequences

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involving many steps, and seeding with the final seed mixture happens near the end of the process, Table 4-7 shows the area that is currently almost completely reclaimed but it does not show the total number of acres that are being reclaimed at this time.

For the southern group of mines, approximately 33% of the area of disturbance has been seeded with a final seed mixture.

At Antelope Mine, 259.6 acres were disturbed in 1999 and 409.9 acres were seeded to the permanent vegetation species. Cumulatively through September 30, 1999, a total of 3,285.4 acres had been disturbed at Antelope Mine and 967.5 acres had been reclaimed. Approximately 250 acres were graded to approximate final contour, ready for topsoiling and final seeding in 1999. Currently, WDEQ/LQD (1997) 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 the drainage may not occur until late in the life of mine. This issue is further complicated when two operators are mining in the same drainage on different reclamation schedules, in that bond release for the first operator to mine the basin could be held until the second operator's portion of the basin is reclaimed. Due to the uncertainties involved the process of applying for and receiving final bond release, most companies

are electing to postpone the initiation of bond release until late in the life of mine.

The development of reclamation schedules for PRB mines must take into account various unique factors:

- Very thick coal seams;
- Diverse premining topography;
- Surface-mining methods using trucks and shovels combined with draglines; and
- Large-volume material movements.

These factors affect the amount of reclamation that can be accomplished at any given time.

Achievement of final postmine topography immediately following mining is not always possible. The mining plan dictates the backfill placement and timing sequence and must take into account changing strip ratios which create material surpluses or deficits. Stockpiling, which may be required to fill final pit voids or store new pit boxcut material, affects the backfill material balance. Operating changes can also affect the backfill placement timing and sequence. Some examples include changing the pit direction to conform to lease configuration, changing plans to accommodate production growth and changes in technology or mining method. The achievement of contemporaneous reclamation is evaluated on a site-by-site basis by the WDEQ taking the mining complexities unique to each mine into account.

#### 4.5.1 Topography and Physiography

Following surface coal mining and reclamation, topography will be modified in an elongated corridor east of and paralleling Highway 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. Premining features that were more topographically unique (e.g., steeper hills and gullies, rock outcrops, etc.) will generally be smoothed. The reduction in topographic diversity may lower the carrying capacity for big game in the reclaimed areas; however, big game ranges are generally very large and mining activities are, in general, not located in habitats defined as crucial. The overall flattening and lowering 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 (see Section 4.5.5). There would be no significant cumulative impacts to topography and physiography due to the proximity of coal mining, CBM development, and the proposed construction of the railroad line and ENCOAL and Two Elk power plants in this area because the construction and operation of those projects would cause minimal topographic and/or physiographic changes.

#### 4.5.2 Geology and Minerals

The PRB coal region encompasses an area of about 20,000 mi<sup>2</sup> and contains nearly 240 billion tons of sub-bituminous coal resources (BLM 1979). Converse County has a total area of 4,050 mi<sup>2</sup> of which slightly less than one percent is within current permit boundaries. Campbell County has a total area of about 4,760 mi<sup>2</sup>, of which approximately four percent is within current mine permit boundaries. Coal mining in this area disturbs about 2,000 acres annually with about 1,850 acres reclaimed annually (BLM 1996g). Mining and reclamation rates are expected to continue to increase through the year 2015, but the balance between reclamation and mining should remain about the same. 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 southern mines, approximately 43,610 acres of federal coal are currently leased. This is about a 61% increase over the 27,160 acres of federal coal that were leased in the southern group of mines in 1990, prior to decertification. Under the Proposed Action, approximately 2,840 additional acres of federal coal would be leased, which would represent a 6.5% increase in the area of leased federal coal in the southern group of five 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 analysis (e.g., section 4.5.3).

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Coal and CBM are non-renewable resources that form as organic matter decays and undergoes chemical changes over geologic time. The CBM and coal resources, that are removed would be used to generate power and would not be available for use in the future. Based on the information that is currently available, removal of the CBM and water from the coal prior to mining it does not damage the coal. 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.

### 4.5.3 Soils

The five existing southern mines as permitted would disturb approximately 38,000 acres throughout their combined lives (they would disturb about 1,200 acres annually during active mining at the currently planned mining rates). The recently leased North Rochelle, Powder River and Thundercloud LBA tracts would add an estimated total of about 11,000 additional acres of disturbance, which would bring the total disturbance in the southern mine group to approximately 49,000 acres. This is an increase of 29% in the estimated disturbance area over what is currently permitted for the southern mine group. If the Horse Creek LBA Tract is leased and mined, the disturbance area in the southern group of mines would increase by as much as 3,580 acres, to approximately 52,600 acres. This would represent an additional 7.3% increase in disturbance. Assuming ten years from initial disturbance to

utilization of a parcel of reclaimed land by domestic livestock, approximately 12,000 acres (13 percent disturbed by Antelope) would be unavailable for such use at any given time during active mining. However, the replaced topsoil would support a stable and productive native vegetation community adequate in quantity and quality to support planned postmining land uses (i.e., wildlife habitat and rangeland).

Additional, although less extensive, soil disturbance would be associated with the proposed CBM development west of the mines, and with construction of the proposed power plants and railroad line.

### 4.5.4 Air Quality

According to current regulatory standards by which air quality is defined, surface mining and CBM development in the PRB have not resulted in impacts to air quality that have exceeded federal or state standards.

Based on 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

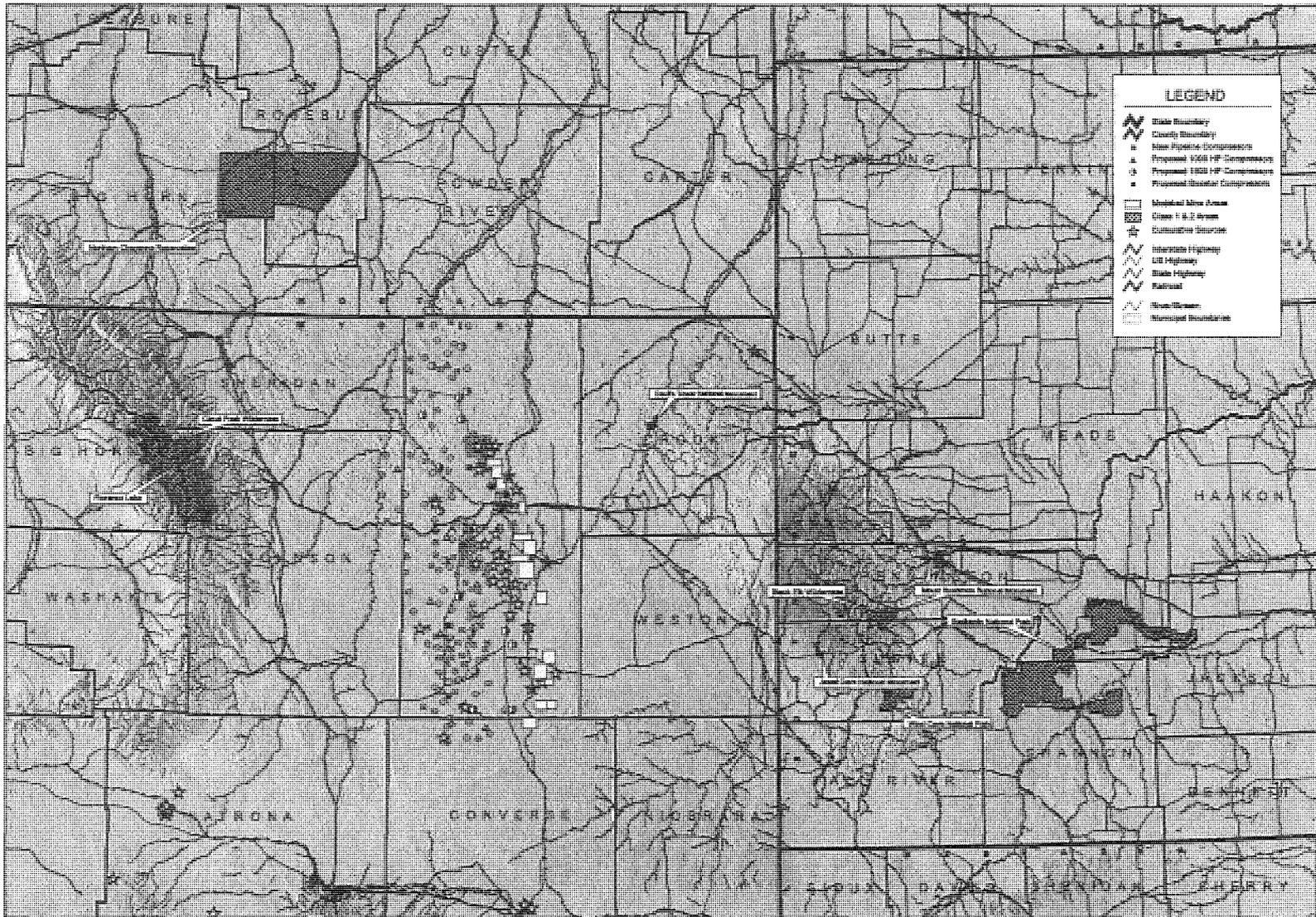
pollution impacts decrease to insignificant levels ( $< 1 \mu\text{g}/\text{m}^3 \text{PM}_{10}$  annual average) within six miles of active mining.

In cases where mines are in close proximity (within two mi), 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. In past modeling conducted in support of Antelope Mine's air quality permit, the Antelope Mine has not been subject to Mine A/Mine B protocol, but has been modeled alone due to its distance from its neighbors. If the LBA tract is leased under the Proposed Action or Alternative 2 and past procedures are followed, WDEQ would require that ambient air quality modeling be conducted only at the Antelope Mine for consideration of incorporation of the Horse Creek LBA Tract on air quality. The modeling protocol is restricted as a matter of state regulatory policy to evaluation of the average annual impacts with respect to the ambient standard of  $< 50 \mu\text{g}/\text{m}^3 \text{PM}_{10}$ . The Wyoming air quality standard is  $50 \mu\text{g}/\text{m}^3$  which includes  $15 \mu\text{g}/\text{m}^3$  background concentrations.

A regional cumulative impact analysis was performed for this EIS to estimate impacts on air quality in the year 2015 from the Proposed Action and all other reasonably foreseeable actions. This analysis consisted of an

update and modification to the May 1999 Wyodak CBM Project DEIS far-range cumulative air quality analysis (BLM 1999, Greystone 1999). At the recommendation of the interagency group that developed the protocol for the air quality analysis for the Wyodak CBM project DEIS, separate analyses were not run to compare the predicted cumulative regional air quality impacts in 2015 with and without mining of the Horse Creek LBA Tract. The changes in air emissions due to mining the Horse Creek lease as an extension of Antelope Mine would be a change in the location of Antelope Mine emissions, a change in production from 22 million tons per year without the Horse Creek LBA tract to the permitted capacity of 30 million tons per year with the Horse Creek LBA Tract, and a longer duration of mining activity at the Antelope Mine. Therefore, no significant change in long-term cumulative air impacts are anticipated if the Horse Creek LBA Tract is leased and mined as a maintenance lease for the Antelope Mine.

The regional (far-range) cumulative air quality analysis was carried out using the CALMET/CALPUFF Version 5 model. Modeling was performed to estimate impacts of  $\text{NO}_x$ ,  $\text{SO}_2$  and particulate matter emissions on air quality, regional haze, and air quality related values (AQRVs) at Class I and sensitive Class II areas within approximately 150 miles (240 km) of Gillette, Wyoming. The area included in the model analysis is shown in Figure 4-3. The model analysis results presented in this section represent an indication of potential



**LEGEND**

- State Boundary
- County Boundary
- Proposed 4000 HP Compressor
- Proposed 1000 HP Compressor
- Proposed Hydraulic Compressor
- Interstate Access Road
- State F & D Access
- Cultural Resource
- Interstate Highway
- US Highway
- State Highway
- Railroad
- River/Stream
- Municipal Boundaries

Transverse Mercator Projection  
 1927 North American Datum  
 Zone 13

Note: Map is from Wyodak CBM Project  
 Air Quality Technical Reference  
 Document (Greystone 1999).

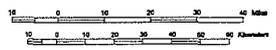


Figure 4-3  
 Cumulative Air Quality Modeling Domain

impacts based on currently available modeling technology and anticipated levels of activity in the year 2015 (see discussion below).

### **Cumulative Emissions Inventory**

An inventory of incremental air pollutant emissions was prepared using 1995 as the base year and 2015 as the analysis year. The inventory utilized data assembled for the Wyodak CBM Project cumulative analysis, but included a number of updates and revisions to incorporate newly available information. The inventory included a breakdown of particulate matter emissions into three sub-groups: elemental carbon particles (EC), organic carbon particles (OC), and other undifferentiated particles, including fugitive dust (PM<sub>10</sub>). The carbon particles, which are emitted primarily from diesel engines (mine equipment and trains), were treated separately because of their potential impact on regional haze. SO<sub>2</sub> emissions from blasting, trains and other diesel engines were also included, again because of potential regional haze impacts.

The four groups of air emission sources that were inventoried and the sources of emissions data relied upon are described below.

- All stationary point sources that began operation after 1995 and/or are permitted and reasonably expected to be operating after 1995. All permitted point source information was based upon state agency files, as obtained

for the Wyodak CBM Project DEIS (BLM 1999).

- Potential incremental increase in surface coal mining emissions. Coal production in the year 2015 is projected to total 387 million tons per year for the PRB mines listed in Table 4-5 (Resource Data International 1998). This is about 15 percent more than the 1999 production and about 71 percent of the 1999 permitted production for active mines shown in Table 4-5. The permitted production is the regulatory limit based on present air quality permits. Thus, the reasonably foreseeable 2015 coal production assumed for the analysis represents about 71 percent of 1999 maximum permitted production.

Incremental coal production from 1995 to 2015 was calculated for each of the 14 PRB mines active after 1999 (Table 4-5) by assuming each mine would produce 71 percent of 1999 permitted production. Emission increases for each pollutant were estimated based on the ratio of emissions to coal production as shown by the most recent air quality evaluation for each mine, or for a similar mine if recent data were unavailable. Planned major changes in mine plans (e.g. use of conveyors to replace haul trucks) were taken into account where applicable.

NO<sub>x</sub> is produced at mines by blasting, diesel equipment, and on-site locomotives. The expected decrease in NO<sub>x</sub> emissions from diesel equipment engines due to new federal emission standards was taken into account in estimating 2015 incremental emissions.

SO<sub>2</sub> emissions originate from blasting, diesel equipment, and locomotives at each mine. Incremental emissions were calculated from projected increases in fuel use, based on data in recent mine analyses for fuel use per unit of coal production.

Particulate matter is generated at mines as fugitive dust (PM<sub>10</sub>), and as engine emissions (a combination of PM<sub>10</sub>, EC, and OC). Fugitive PM<sub>10</sub> emissions per unit of coal production were calculated from recent data for each mine and used to estimate incremental emissions for 2015 production. Incremental emissions of PM<sub>10</sub>, EC, and OC from engines were calculated from projected fuel use, using the proportions of each particulate component in diesel exhaust as given by EPA's source composition library.

- Coal transportation locomotive emissions. Emissions of NO<sub>x</sub>, SO<sub>2</sub>, and particulate matter (EC, OC, and PM<sub>10</sub>) from coal train operations were calculated using EPA emission

factors, locomotive fuel use, and the reasonably expected coal production for 2015. The proposed DM&E Railroad line was included in the analysis, using a potential route and number of trains suggested by DM&E. Fuel use and the fraction of total traffic on each of the existing BN and UP rail routes were provided by the railroads. Emissions assumptions and calculations were provided to BN, UP, and DM&E representatives for review prior to use for modeling. EPA's Tier I and Tier II emission standards for new and rebuilt locomotives were taken into account in calculating year 2015 emissions by use of EPA's projected fleet average emission factors for that year.

- Wyodak CBM sources. Emissions for the CBM development will originate from compressor engines (NO<sub>x</sub>), vehicle tailpipe emissions (NO<sub>x</sub>), road dust from vehicle traffic (PM<sub>10</sub>), and fugitive dust from disturbed areas (PM<sub>10</sub>). Total emissions from all of these sources were taken from the Wyodak CBM DEIS analysis (BLM 1999).

Total emissions from all sources and operations are shown in Table 4-8. These emissions were modeled as point and area sources, as appropriate, using the CALMET/CALPUFF modeling system, to estimate air quality impacts at the

Table 4-8. Cumulative Pollutant Emissions for Far-Range Air Quality/AQRV Analysis

Source	Emissions after 1995 (tons/year)					Percent of Total				
	NO <sub>x</sub>	SO <sub>2</sub>	EC	OC	PM <sub>10</sub>	NO <sub>x</sub>	SO <sub>2</sub>	EC	OC	PM <sub>10</sub>
<b>Wyodak CBM Sources</b>										
Proposed Compressors	2,806					13.9	0.0	0.0	0.0	0.0
Road Dust from Vehicle Traffic					11,224	0.0	0.0	0.0	0.0	64.2
Fugitive Dust from Disturbed Areas					956	0.0	0.0	0.0	0.0	5.5
Project Vehicle Exhaust	18					0.1	0.0	0.0	0.0	0.0
<b>Other Sources</b>										
Other Point Sources	7,662	5,032			917	37.9	76.0	0.0	0.0	5.2
Coal Mines Incremental increase (NO <sub>x</sub> from blasting, trains, vehicles)	2,475					12.2	0.0	0.0	0.0	0.0
Coal Mines Incremental increase of fugitive dust					4,234	0.0	0.0	0.0	0.0	24.2
Coal Mines Incremental increase from mining vehicles		698	193	73	86	0.0	10.6	55.0	54.5	0.5
Coal Trains Incremental increase	7,262	888	158	61	70	35.9	13.4	45.0	45.5	0.4
<b>Total</b>	<b>20,223</b>	<b>6,618</b>	<b>351</b>	<b>134</b>	<b>17,487</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

Class I and sensitive Class II areas shown on Figure 4-3.

### Cumulative Air Quality Impacts

Based on the emission increase inventories for all regional sources, maximum 3-hour, 24-hour, and annual SO<sub>2</sub> impacts, 24-hour and annual PM<sub>10</sub> impacts, and annual NO<sub>2</sub> impacts were modeled and compared to the PSD Class I increments at the Class I areas and to the National Ambient Air Quality Standards (NAAQS) at each sensitive Class II area. It is important to note that this is not a formal PSD

increment analysis, and the references to PSD increments and NAAQS are intended only as a basis for comparison. The comparison does not constitute an air quality regulatory determination. Air quality standards are most stringent at Class I areas (National Parks and large designated wildernesses) to afford the most protection for these pristine areas. The results of the air quality analysis for each area are provided in Table 4-9, which demonstrates that maximum projected cumulative impacts are much smaller than regulatory standards and increments.

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Table 4-9. Results of Air Quality Impact Analysis ( $\mu\text{g}/\text{m}^3$ )

Area	Annual NO <sub>2</sub>	24-hr PM <sub>10</sub>	Annual PM <sub>10</sub>	3-hr SO <sub>2</sub>	24-hr SO <sub>2</sub>	Annual SO <sub>2</sub>
<b>CUMULATIVE IMPACTS</b>						
Northern Cheyenne Reservation, MT	0.03	0.58	0.02	1.60	0.56	0.02
Badlands National Park, SD	1.26	0.65	0.10	3.61	1.20	0.21
Wind Cave National Park, SD	0.16	0.62	0.06	2.17	0.84	0.08
<b>Class I PSD Increment</b>	<b>2.5</b>	<b>4</b>	<b>8</b>	<b>25</b>	<b>5</b>	<b>2</b>
Black Elk Wilderness, SD	0.09	1.04	0.05	2.48	0.79	0.07
Jewel Cave National Monument, SD	0.13	0.76	0.08	3.92	0.87	0.10
Mt. Rushmore National Monument, SD	0.08	1.01	0.05	1.93	0.55	0.06
Cloud Peak Wilderness, WY	0.01	0.90	0.04	1.08	0.32	0.01
Devils Tower National Monument, WY	0.13	0.80	0.16	2.84	0.50	0.07
<b>National Ambient Air Quality Standard</b>	<b>100</b>	<b>150</b>	<b>50</b>	<b>1300</b>	<b>365</b>	<b>80</b>

#### Visibility Impacts

Visibility impacts were calculated based on cumulative emissions impacts (modeled concentrations of nitrate, sulfate, carbon, and other particulate matter) within the CALPUFF modeling domain. Extinction coefficients were computed and their effect on visibility assessed by comparison to background extinction coefficients corresponding to the mean of the cleanest 20% IMPROVE (Interagency Monitoring of Protected Environments) visibility data from Badlands National Park and the Bridger Wilderness. Seasonal average relative humidity values were used for the comparison.

Results of the visibility analysis are shown in Table 4-10. Potential visibility reductions greater than the threshold values of 0.5 and 1.0 deciviews are indicated for all Class I and sensitive Class II areas. The number of days with an indicated potential change of one deciview or more ranges from four days in the Cloud Peak Wilderness to 70 days in

Badlands National Park. It should be recognized that the analysis results reflect potential impacts at any one or more receptors in each area (not at all receptors), and that the indicated change is relative to the 20% of best visibility days in each area. On many of the days for which model-predicted impacts occur, natural atmospheric conditions and/or background air quality levels would result in lower background visibility.

The model predicts that Badlands National Park would experience the most significant visibility impacts in 2015. The indicated impacts in Badlands National Park are strongly influenced by the close proximity of the modeled DM&E rail route. The modeled route is only one of a number of potential routes, and may not be representative of the actual route to be selected, nor is the modeled number of daily trains necessarily realistic of 2015 DM&E traffic. The Badlands National Park results in Table 4-10 reflect data for those areas of the Park more than 20 km (12 mi) from the modeled rail

Table 4-10. Predicted Annual Days of Visibility Reductions At Class I and Class II Sensitive Areas from Cumulative Sources

Location	Type of Area	Number of Days deciview change >0.5	Number of Days deciview change >1.0
Northern Cheyenne Reservation	Class I	18	8
Badlands National Park	Class I	173	70
Wind Cave National Park	Class I	94	45
Black Elk Wilderness	Class II	66	28
Jewel Cave National Monument	Class II	72	32
Mt. Rushmore National Monument	Class II	58	22
Cloud Peak Wilderness	Class II	15	4
Devils Tower National Monument	Class II	70	28

Note: The Northern Cheyenne Reservation is a redesignated Class I area and is not addressed by existing visibility regulations which apply to the federally mandated Badlands and Wind Cave Class I areas.

route. The CALPUFF modeling system in the version applied in the present analysis is not appropriate for definition of impacts at shorter distances from linear sources such as railroads.

#### **AQRV Impact (Acid Deposition)**

In addition to evaluating potential impacts to visibility in Class I and sensitive Class II areas, an assessment of potential impacts to other AQRVs in these areas was performed. The AQRVs of concern for the Class I and sensitive Class II areas include soil, water, flora, and fauna. For impacts to AQRVs, other than visibility, acid deposition of nitrates and sulfates is of primary interest due to its effects on lake acidification, as well as possibly affecting flora and fauna.

The cumulative acid deposition analysis evaluated potential impacts to AQRVs by computing the amount of nitrogen and sulfur that would be deposited on land masses within the Class I and II areas. Additionally, the potential effects of acid deposition on Florence Lake (a sensitive lake located within Cloud Peak Wilderness, Wyoming) were also evaluated at the request of the FS. Nitrogen would originate from wet and dry deposition of nitrates and nitric acid, as well as dry deposition of NO<sub>x</sub>. Sulfur would originate from wet and dry deposition of sulfates and SO<sub>2</sub>.

To evaluate potential impacts to AQRVs, the wet and dry deposition of the nitrogen and sulfur-containing chemicals were computed using the CALPUFF model. Annual fluxes (mass per unit area) calculated for the Class I and sensitive Class II areas were compared to the limits of

#### 4.0 Environmental Consequences

acceptable change (2.7 to 4.5 lb/acre/year) for evaluating effects on soil, flora, and fauna. The acid deposition calculations used in this analysis followed the procedures outlined in the IWAQM Phase 2 Report (USEPA 1998) and FS guidance.

To evaluate the impacts to aquatic systems (Florence Lake) from acid deposition, the loss of acidification neutralization capacity (ANC), in micro-equivalents per liter ( $\mu\text{eq/L}$ ), was computed using FS methods (USFS 1987). Since the baseline ANC at Florence Lake is 37.6  $\mu\text{eq/L}$  (USDA FS 1999), the limit of acceptable change in the ANC is 10 percent.

The results of the AQRV analysis for effects from acid deposition are summarized in Table 4-11. The maximum annual deposition fluxes of nitrogen and sulfur due to cumulative emissions are shown for each Class I and II area. As the data show, the highest nitrogen deposition would be 0.24 lb/acre/year, a value that is only nine percent of the lower limit of acceptable change.

The ANC calculation for Florence Lake showed that the expected change in ANC due to cumulative acid deposition impacts would be 0.07%, a value much lower than the limit of acceptable change (10%).

#### Discussion

The cumulative air quality impact analysis presented here indicates that impacts in Class I and sensitive Class II areas, based on reasonably expected pollutant emission increases through the year 2015, will be quite small with the exception of impacts on visibility. The model results suggest that visibility impacts may exceed Limits of Acceptable Change (LACs) on some days in all areas evaluated. It should be noted that the LACs for visibility impacts, as well as those for other AQRVs, are not regulatory limits, but represent federal land manager policies for evaluating impacts.

The model-predicted numbers of days of visibility impacts should be interpreted only as an indication of possible impacts. There are many

Table 4-11. Predicted Levels of Acid Deposition from Cumulative Sources (lb/acre/year)

Area	Significance Level	Total Nitrogen Deposition	Total Sulfur Deposition
Northern Cheyenne Reservation	2.7 - 4.5	0.067	0.011
Badlands National Park	2.7 - 4.5	0.238	0.075
Wind Cave National Park	2.7 - 4.5	0.066	0.061
Black Elk Wilderness	2.7 - 4.5	0.047	0.059
Jewel Cave National Monument	2.7 - 4.5	0.051	0.076
Mt. Rushmore National Monument	2.7 - 4.5	0.030	0.050
Cloud Peak Wilderness	2.7 - 4.5	0.004	0.006
Devils Tower National Monument	2.7 - 4.5	0.044	0.055

uncertainties involved in air quality model projections, particularly for long-range transport modeling over large areas with widely varying terrain and land surface characteristics. The CALPUFF modeling system is relatively new and its calculation algorithms and methods of application are still evolving. Results are subject to wide variability with the quality and quantity of input meteorological data, the accuracy of emission estimates, the form of representation of different types of sources, chemical reaction and particle size assumptions, and other factors.

Some of the comments received on the CALPUFF cumulative analysis for the Wyodak CBM Project DEIS were considered and addressed in the present analysis, primarily through:

- updated evaluation of railroad and coal mine emissions
- addition of a potential DM&E railroad route
- distribution of future coal train traffic based on current distribution and DM&E projections
- addition of carbon particles as specific components of PM<sub>10</sub>
- addition of SO<sub>2</sub> emissions from diesel engines
- simulation of coal train emissions by area sources rather than volume sources.

The changes and refinements used in this analysis were reviewed by a group of industry and agency representatives which included members of the interagency committee that developed the protocol for the Wyodak CBM Project DEIS, as well as Kennecott and DM&E Railroad. The Wyodak CBM Project DEIS interagency committee included representatives from the BLM, EPA, NPS, USFS, and the State of Wyoming.

There are additional refinements and/or improvements in model application that would lead to a better definition of potential future impacts. These include utilization of recent model refinements, incorporation of more sources of regional meteorological data, further refinement of emission estimates, and a better characterization of source parameters and geometries. In addition, further research is needed into the accuracy and appropriate interpretation of model results for regional haze. These improvements were beyond the scope of the present analysis but will be addressed in future regional impact analyses.

It should be noted that model-predicted impacts, especially in Badlands National Park, are affected by proximity to the modeled route of the DM&E railroad. The DM&E route and traffic volumes were provided as examples of a possible future scenario but are not yet determined. The model parameters utilized for DM&E are not necessarily indicative of what will be ultimately implemented. Thus, predicted impacts in Badlands NP and other sensitive areas

proximate to the DM&E route are especially subject to future refinement. The CALPUFF model is a long-range transport model, and is not necessarily the best methodology for evaluating impacts at short distances (0 - 50 km). Since all of the Badlands receptors were within this distance from the hypothetical DM&E route, a more appropriate and detailed model approach would be in order if the eventual rail route passes this or other sensitive areas.

### 4.5.5 Water Resources

#### Surface Water

Surface coal mining reduces streamflows because of the regulations that require all runoff from disturbed areas to be captured and treated in sedimentation ponds. 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 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 little methane production occurring in the general analysis area. (CBM development was not considered in the CHIA (Martin et al. 1988)). The Gillette South CBM Project EIS (BLM 1997) estimates that an average surface

discharge of 20 gpm from each of the 423 wells considered in that analysis would result in an increase in flow of 0.5 percent to 2.4 percent of the 2-year, 24-hour flood flows (per square mile) if all of the wells discharge into the same drainage basin. 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. The Wyodak CBM DEIS and FEIS (BLM 1999, 1999b) evaluate impacts of CBM production within a much larger project area, extending from over 30 miles north of Gillette to over 60 miles south of Gillette. The project area would extend westward from the PRB coal mine areas for a distance of 18 to 36 miles. The Wyodak CBM project area includes the Gillette South project area. The Wyodak CBM project considers 3,000 to 5,000 CBM wells that would each generate 12 gpm of water. This water would be discharged at an estimated 500 to 1,000 different locations over a period of 10 to 20 years. These water discharges would double the annual yield from the Upper Cheyenne drainages, in which the southern mine cluster including Antelope is located. These CBM water discharges would be constant, as opposed to naturally occurring flows which fluctuate widely on a seasonal and annual basis. Most streams in the area are naturally dry throughout most of each year.

The USGS has predicted that, after reclamation, major streams in the

PRB will exhibit increased runoff ranging from 0.4 percent in the Cheyenne River to 4.3 percent 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 percent 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.

Drainage from all five southern mines combines where Black Thunder Creek enters the Cheyenne River. The drainage area of the Cheyenne River at this point is approximately 2,430 mi<sup>2</sup>. The entire area of disturbance from these five mines as currently permitted would impact approximately two percent of the drainage basin of the Cheyenne River, and this disturbance would occur over about 50 years. Proposed LBA's and recently issued leases would raise this disturbance acreage to roughly four percent of the Cheyenne River drainage basin at Black Thunder Creek.

Sediment concentrations should not increase significantly in area streams even with the addition of mining the pending and recently issued LBA tracts because, as discussed in Section 4.1.5, state and federal

regulations require that all surface runoff from mined lands pass through sedimentation ponds. The potential for cumulative adverse impacts to the Cheyenne River drainage is also minimal because it is typically dry for a substantial portion of the year.

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 (e.g., 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.

#### 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 "*Cumulative Potential Hydrologic Impacts of Surface Coal Mining in the Eastern Powder River Structural Basin, Northeastern Wyoming*", also known as the "CHIA" (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 Horse Creek LBA Tract is leased to the applicant, the existing mining and reclamation permit for the Antelope 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 Project Draft EIS (BLM 1999) 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 CBM Project Final EIS, which was distributed to the public on October 1, 1999. The technical report for both these modeling analyses are 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.

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 Gillette Area Groundwater Monitoring Organization (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 State Engineer's Office, 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).

The southern group of mines uses about 1,736 ac-ft of water per year for drinking, sanitation, washing equipment, and dust control. This water comes from aquifers below the coal, from seepage into the mine pits, and from sediment- and flood-control impoundments. The five southern mines pump an estimated 1,400 ac-ft

per year from the pits and dewatering wells.

Assessment of cumulative groundwater impacts in this EIS is based on impact predictions made by ACC in 1993 for dewatering at the Antelope Mine and extrapolating those drawdowns to consider mining of the Horse Creek LBA Tract, along with previous drawdown predictions made within the southern mine group that includes the Antelope Mine. Figure 4-4 depicts the predicted extent of the 5-ft drawdown contour within the coal aquifer from the various mining scenarios. The extent of the 5-ft drawdown contour is used by WDEQ/LQD to assess the cumulative extent of impact to the groundwater system caused by mining operations. In Figure 4-4, these predictions are compared to the predictions in the CHIA and monitoring information gathered since publication of the CHIA. Figure 4-4 shows only the predicted drawdowns in the coal aquifer due to mining because of the limited extent of the saturated sand aquifers in the Wasatch Formation overburden in the southern group of mines.

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

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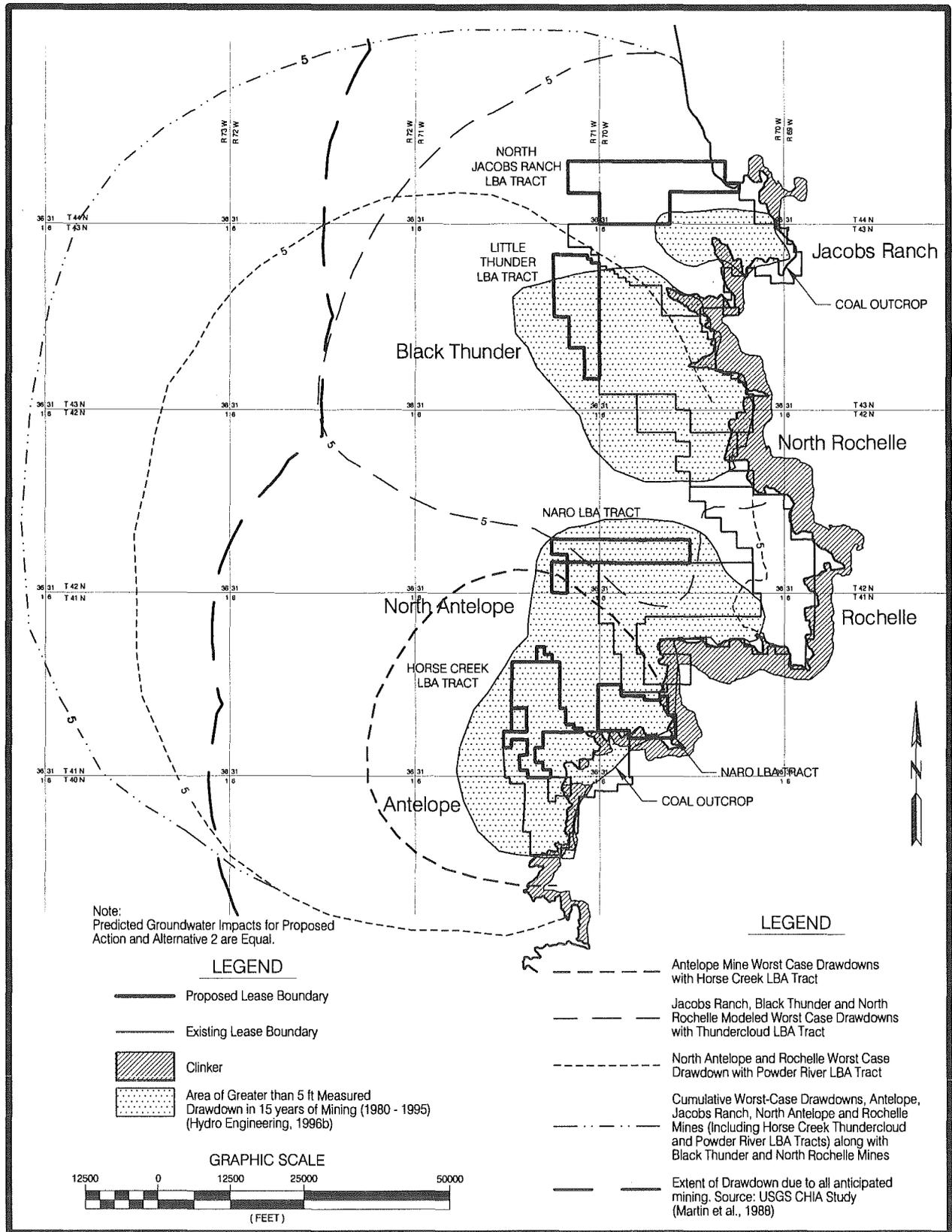


Figure 4-4. Modeled and Extrapolated Worst-Case Coal Aquifer Drawdown Scenarios Showing Extent of Actual 1995 Drawdowns and USGS Predicted Cumulative Drawdowns.

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. 1988:24):

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 1999 verify that recharge has occurred and is continuing in the backfill (Hydro-Engineering 1991a, 1992, 1993, 1994, 1995, 1996b, 1997, 1998, 1999). 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 percent of the 51 backfill wells reported for that year. In the 1999 GAGMO report, 89 percent of the 64 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 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.

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 4-4) 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 since abundant clinker exists above the water table and does not present the mining problems that would result from mining saturated clinker. Therefore, the major recharge source for the spoil aquifer is not being disturbed by current mining. Clinker does not occur in significant amounts on the LBA tract being considered in this EIS.

The second major groundwater issue is the extent of water level drawdown in the coal and shallower aquifers in the area surrounding the mines. 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 4-4, which was adapted from the 1996 GAGMO 15-year report (Hydro Engineering 1996a). This map shows the area where actual drawdown in the coal seam has been greater than 5 ft in 15 years, in comparison with the predicted worst-case 5-ft

drawdown derived from groundwater modeling done by the mines. WDEQ/LQD policy is to have the mining companies determine the extent of the 5-ft drawdown contour as a method of determining off-site impacts from the various mining operations.

Figure 4-4 indicates that the drawdowns observed in 15 years of mining are still well within the total cumulative drawdown predicted in the CHIA. Adding the predictions for the Horse Creek, Thundercloud and Powder River LBA Tracts to existing drawdown predictions prepared for the Black Thunder and North Rochelle Mines extends the predicted cumulative extent of the 5-ft drawdown about 9.5 miles past the cumulative drawdown prediction in the 1988 CHIA.

The CHIA predicted the approximate area of 5 ft 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 Antelope 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. Proceeding west, the coal depth increases faster than the potentiometric surface declines, so available drawdown in the coal increases. Since the depth to coal increases, 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. Those wells completed in the coal have considerable available drawdown, so adverse impacts to wells outside the immediate mine area are unlikely.

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-ft 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.

Since the actual 1995 drawdown lies within the cumulative drawdown predicted by the CHIA study, the cumulative impacts to water wells have not reached the maximum levels predicted in that report. 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 additional groundwater impacts that would be expected as a result of extending mining into the LBA's issued or proposed to date would be to extend the drawdown into areas surrounding the proposed new leases. The predicted cumulative effects of mining the LBA tract are depicted on Figure 4-4. Currently, the actual drawdown in the coal aquifer in the vicinity of Black Thunder and Jacobs Ranch mines is expressed in two separate cones of depression; drawdowns in the vicinity of the Antelope and North Antelope/Rochelle mines have coalesced. These cumulative drawdowns would be increased by mining the Horse Creek LBA Tract, which is located between Antelope and North Antelope.

Prior to amending the LBA tract into its existing WDEQ mine permit, the applicant (ACC) will 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 will then use the drawdown predictions to update the CHIA for this portion of the PRB. The applicant has installed monitoring wells which would be used to confirm or refute drawdowns predicted by modeling. This modeling would be required as part of the WDEQ mine

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permitting procedure discussed in Section 1.2.

Withdrawal of water for the ENCOAL facility would lower water levels in the scoria aquifer to the east of the North Rochelle Mine if the rate of withdrawal exceeds recharge (currently unknown). As discussed above, the scoria provides the primary source of recharge to the Wyodak coal aquifer. As mining at the North Rochelle Mine continues, the coal will be removed and replaced with spoil, which would be expected to have the same conductivity as the Wyodak coal aquifer according to Martin, et al. (1988 p. 24). The primary impact due to lowering water levels in the scoria would be a potential delay in the recovery of water levels in the North Rochelle Mine backfill, as the rate at which the backfill would receive recharge from the scoria would be related to the scoria water levels. Based on the size of the scoria aquifer supplying ENCOAL and the amount of water to be withdrawn from it, complete recovery of the scoria water levels could take up to 100 years, slowing recovery of North Rochelle Mine spoil water levels for an equal duration. Since predictions for recovery of water levels in the spoils range from tens to thousands of years, the additional delay in recovery caused by the ENCOAL water supply wells is within the range of predictions.

The proposed Two Elk project, if constructed, would also add to cumulative impacts. Currently, water demands for the Two Elk project have not been finalized. The likely source

of supply for the Two Elk project will be the Lance-Fox Hills Aquifer.

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 ft and 10,000 ft 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 one mile of the pumped wells (Crist 1991; Martin et al. 1988). The mine facilities in the PRB are separated by a distance of one 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 utilizing water from the formation (Crist 1991). (Note: Gillette is using this water as a back-up source at this time.)
- Because large saturated thicknesses are available in this aquifer unit, generally 500 ft or more, a drawdown of 100 to 200 ft in the vicinity of a pumped well would not dewater the aquifer.

The Antelope Mine adjacent to the Horse Creek LBA Tract has a permit from the State Engineer for a deeper Ft. Union Formation water supply well. Extending the life of the mine with the LBA would result in additional water being withdrawn from the Tullock Aquifer. 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 sub-coal Fort Union well to the Antelope Mine facilities is over

5 miles away, at the North Antelope/Rochelle Complex. Due to the distance involved, these wells have not experienced interference and are not likely to in the future. The Antelope Mine well will be in use for 8 to 9 more years if the Horse Creek LBA Tract is leased. Its annual water production would increase, though not directly in proportion to coal production, which could increase by about 36% if the Horse Creek Tract is leased.

According to the Wyoming SEO, the only permitted wells drilled below 1,000 ft in a 100 mi<sup>2</sup> area surrounding Wright are four wells permitted by the City of Wright. As discussed above, most of the water-level declines in the subcoal Fort Union wells occur within one mile of pumped wells. The Horse Creek LBA Tract, about 17 miles southeast of Wright, would not contribute significantly to any cumulative impact on the water supply for that town under the action alternatives because no new wells would be required to maintain existing production.

Water requirements and sources for the proposed Two Elk project are not currently known. The State Engineer is discouraging further development of the lower Fort Union aquifers, so the most likely source for Two Elk is the Lance-Fox Hills. This will reduce the chances that Two Elk will add to cumulative hydrologic impacts of mining.

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. On the basis of studies done in North Dakota, it was estimated that at least one pore volume of water must leach the spoil before the dissolved solids concentration in the water would be similar to the premining dissolved solids concentration (Houghton et al. 1987). 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 spoil aquifer is greater than the time required for the postmining groundwater system to re-establish equilibrium. According to the CHIA, estimates of the time required to re-establish 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 spoil 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 and 1999), TDS values in backfill wells have ranged from 400 to 25,000 mg/L. Of the 43 backfill wells measured in 1998 and reported in the 1999 annual GAGMO report (Hydro Engineering 1999), TDS in 70 percent were less than 5,000 mg/L, TDS in 28 percent 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 re-establish.

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 the Wyodak CBM Project (BLM 1999). 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.

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 15-year GAGMO report points out that there are already areas of overlapping impacts between the Marquiss and Lighthouse CBM projects and the Caballo, Belle Ayr and Cordero-Rojo mines (Hydro-Engineering 1996a).

Figure 4-5 shows the Antelope Mine life of mine drawdown map (same as Figure 4-2) with the maximum modeled drawdowns from the Wyodak CBM DEIS superimposed. These modeled drawdowns are for CBM only in the upper Wyodak Coal and are for the proposed action of 3,000 CBM wells (BLM 1999, 1999b). The

groundwater modeling study done for the Wyodak CBM Draft and Final EIS's considered the impacts of coal mining and CBM development on groundwater in the coal and overlying aquifers in the area shown in Figure 1-1 using the existing coal mines and predicted CBM well locations based on discussions with CBM. The model did not project any potential CBM drilling in the area of the Antelope Mine. The closest projected CBM well "pod" under the Proposed Action analyzed in that modeling analysis was located in T. 42 N., R. 72 W., approximately five miles northeast of the Horse Creek LBA Tract. Figure 4-5 shows that the projected drawdown in the coal caused by mining at the Antelope Mine would be expected to overlap with projected drawdown due to CBM production. To the north and west of the Antelope Mine, the projected drawdown in the coal aquifer due to CBM production would exceed drawdown due to mining. In close proximity to the mine, projected drawdown due to mining would exceed drawdown due to CBM production. Drawdowns from CBM development would be projected to exceed drawdowns from coal mining at a distance of approximately one mile from the mine.

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

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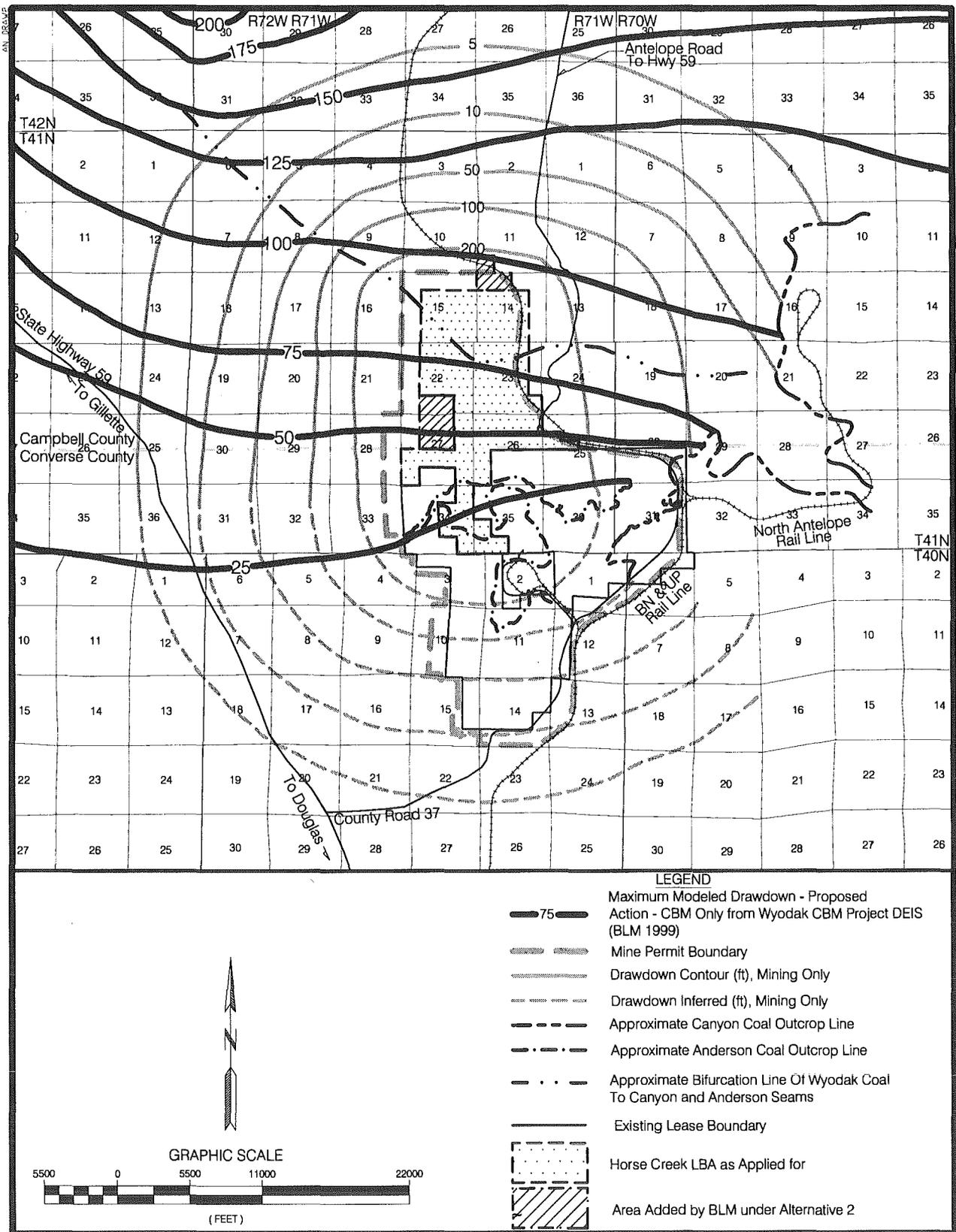


Figure 4-5. Life Of Mine Drawdown Map With Maximum Modeled CBM Drawdown Contours Superimposed.

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.

#### 4.5.6 Alluvial Valley Floors

No cumulative impacts to alluvial valley floors are expected to occur as a result of leasing and subsequent mining of the Horse Creek LBA Tract. Impacts to designated AVF's are generally not permitted if the AVF is determined to be significant to agriculture. AVF's 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.

#### 4.5.7 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.

Antelope Mine has been authorized to impact 32.7 acres of jurisdictional wetlands. This number would increase if the LBA tract is leased (see Section 3.8). Existing wetlands along Antelope Creek would not be disturbed by mining the existing

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Antelope leases or the Horse Creek LBA Tract.

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 private landowners; no federal surface lands are included in the Horse 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.

##### 4.5.8 Vegetation

Most of the land that is being or would be disturbed is grassland, sagebrush shrubland or breaks grassland and is used for grazing and wildlife habitat. Rangeland is, by far, the predominant land use in the PRB, comprising 92 percent of the land use in Converse and Campbell Counties. A small amount of previously cultivated lands would be disrupted by mining. At the completion of mining, it is anticipated that all disturbed land would be reclaimed for grazing and wildlife habitat, mostly in the form of mixed native grass prairie, sagebrush shrubland and, where appropriate, bottomland grassland. Some of the minor community types, such as those occurring on 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 10,000 acres of land disturbed by mining activities at the five existing southern surface coal mines would not be reclaimed to the point of planting with permanent seed mixtures. Over the life of the five southern mines, a total of about 49,000 acres would be disturbed. This disturbed area includes all leases existing including federal, state and private coal. The currently proposed Horse Creek, North Jacobs Ranch, State Section, NARO, and Little Thunder LBAs would add another 18,600 acres. Almost all of this acreage is native rangeland and would be returned to a native rangeland state through planting of approved revegetation seed mixtures as required.

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: mixed grass prairie (25 percent) and Wyoming big sagebrush (40 percent). The big sagebrush vegetation type comprises eight percent of the Horse Creek LBA Tract area, somewhat less than the percentage for the five-mine southern cluster. Upland grassland comprises 51 percent 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, therefore, 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 (e.g., graminoid/forb ephemeral drainages) would be restored during reclamation, the treated grazing lands would not. Following reclamation and release of the reclamation bond, however, privately owned surface lands would be returned to agricultural management and the areas with re-established 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 areal 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.

#### 4.5.9 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 are longer term 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 due, in part, to surface-disturbing activities. Coal mining and gas exploration and development have been identified as potential

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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. Because of the split mineral estate that exists in the PRB, yearlong prohibitions on surface occupancy and restrictions on activities near areas critical to grouse have not proven successful. These restrictions and stipulations have helped to protect important raptor and grouse habitat on public lands. Erection of nesting structures and planting of trees on reclaimed land will gradually replace raptor nesting and perching sites. There is little crucial habitat for waterfowl or fish on the mine sites. Small- and medium-sized animals will rapidly 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; however, 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 overwinter 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 EIS's (BLM 1974, 1979, 1981, and 1984b) 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. Leasing of the Horse Creek LBA Tract would increase the area of habitat disturbance in the southern group of mines by approximately six percent and would enlarge the area where daily movement is restricted.

The Horse Creek LBA Tract is within the Lance Creek Pronghorn Herd Unit, which includes about 2.8 million acres. The mining operations within the Lance Creek Herd Unit are the Black Thunder, North Rochelle, North Antelope/Rochelle, and Antelope Mines. These mines will

cumulatively disturb approximately 37,000 acres based on existing leases (includes estimated disturbance for the recently leased North Rochelle, Powder River and Thundercloud LBA tracts, which are not yet permitted). If the Horse Creek LBA Tract is leased, the estimated mining disturbance within the Lance Creek Herd Unit would increase by up to 3,581 acres to about 40,580 acres. This would represent approximately 1.4 percent of the Lance Creek Herd Unit area.

The Horse Creek LBA Tract is located within both the Thunder Basin and Lance Creek Mule Deer Herd Units. The two herd units contain approximately four million acres and include 11 permitted coal mines along Highway 59. The northern-most is Caballo and the southern-most is Antelope. Currently permitted disturbance within this 9-mine group includes approximately 76,760 acres. Addition of the Horse Creek LBA Tract would increase the disturbance area by up to 3,581 acres, an increase of five percent. The recently issued Thundercloud and Powder River LBA Tracts, with a combined proposed disturbed area of as much as 8,503 acres, are also within these two mule deer herd units. Adding the Horse Creek, Thundercloud and Powder River tracts to the area to be disturbed within the Thunder Basin and Lance Creek Mule Deer Herd Units would increase disturbance by 12,084 acres, bringing the total disturbance up to 88,844 acres or 2.2 percent of the total area.

There is little use of the LBA tract by other big game species (elk, and white-tailed deer).

The area of active mining in the southern 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 USFWS 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 USFWS 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 insignificant 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, and over time this can alter the distribution of breeding grouse (Remington and Braun 1991). 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 southern 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. As a result, these species should respond quickly and invade suitable reclaimed lands as reclamation proceeds.

Cumulative impacts on fish habitat and populations would be minimal

because local drainages generally have limited value due to intermittent or ephemeral flows. 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 discussed in BLM regional EIS's for the area (BLM 1974, 1979, 1981, 1984b), and these documents are incorporated by reference into this EIS. The impacts predicted in these documents have generally not been exceeded.

#### 4.5.10 Threatened, Endangered, and Candidate Species

The USFWS has evaluated potential impacts to T&E species on the existing permit areas and has, in general, determined that no adverse impacts would occur to protected species.

OSM (1982) prepared a biological assessment of the eastern PRB in 1982 which concluded that mining operations might affect bald eagles. Following requirements of the Endangered Species Act, OSM requested a biological opinion from the USFWS, which was expanded to include a commentary on black-footed ferrets and peregrine falcons. The 1982 opinion stated that cumulative impacts would not be adverse for bald eagles or peregrines but might be adverse for ferrets. As a result, OSM requires ferret surveys

within one year of surface disturbance, either as a commitment in the mine plan or as a permit stipulation. Since preparation of this biological opinion in 1982, there have been changes to the species proposed for listing and additional development, including coal bed methane. USFWS requirements now mandate surveys for Ute Ladies-tresses and mountain plovers in potential habitat prior to surface-disturbing activities. The swift fox is another candidate species that has potential habitat in the PRB. This species has not been recently recorded in the area and should not be impacted.

As stated in Section 4.1.10, T&E wildlife surveys specific to the Horse Creek LBA tract were conducted in the summer of 1999. No T&E species or potential habitat for T&E species were found during those surveys (ACC 1999b). If the Horse Creek LBA tract is leased, BLM would attach a stipulation to the lease providing for further surveys of the tract for T&E species and their critical habitats. A biological assessment on the mining and reclamation plan would be prepared prior to approval by the Assistant Secretary of the Interior. In the event that T&E species are identified after approval of the mining and reclamation permit, OSM has also been attaching a condition to recently approved mining and reclamation permits providing for modification or cancellation of the mining and reclamation plan approval on the basis of consultation with the USFWS pursuant to Section 7 of the Endangered Species Act. Therefore, no cumulative impacts to T&E species are projected as a result

of issuing a maintenance lease for the Horse Creek LBA tract to the Antelope Mine.

#### 4.5.11 Land Use and Recreation

In addition to reducing livestock grazing and wildlife habitat, surface coal mining also disrupts conventional oil and gas development, releases CBM resources if they are not produced prior to mining and limits access to public lands. BLM policy regarding multiple mineral development and conflicts between CBM and coal development is discussed in Section 4.1.2.

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 and mule deer), and loss of recreational access to public lands (particularly for hunters).

There are no recreation facilities, wilderness areas, etc., in the immediate vicinity of the existing southern group of mines, and the majority of the land is seldom used by the public except for dispersed recreation (e.g., hunting), off-road vehicles, and sightseeing. Hunting and other public access is generally limited inside of the mine permit areas for safety reasons. However, approximately 80 percent of this land surface is private and access is controlled by the landowner. Leasing the Horse Creek LBA Tract would not affect access to public lands because no public lands are included on the tract.

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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. As an example, reclaimed lands at the Jacobs Ranch Mine have been declared crucial elk winter habitat by WGFD (Oedekoven 1994). 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 will support an increase in employment levels as coal production increases and will increase the years of production at the existing mine. The demand for outdoor recreational activities, including hunting and fishing, has increased proportionately. 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, in general, 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; and increased off-road activities have and will continue to

result in disturbance of wildlife during sensitive wintering or reproductive periods.

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. Converse County's recreational facilities are not as advanced, and development of the LBA tract and the ensuing employment increase may increase demand for recreational opportunities in Converse County.

#### 4.5.12 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<sup>2</sup> (640 acres) can be made based on inventories at existing mines in the area, and approximately 25 percent of these sites are typically eligible for the NRHP. Approximately 550 cultural resource sites will be impacted by already-approved mines, with an estimated 140 of these sites being eligible for nomination to the NRHP. Clearly, a number of significant sites, or 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 provided opportunities for regional and local archeological research projects.

#### 4.5.13 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 Horse Creek LBA Tract.

#### 4.5.14 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.

#### 4.5.15 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 and the draglines, 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 Antelope

Mine. Issuance of the LBA tract would not change this impact.

After mining, the reclaimed slopes might appear somewhat smoother than premining slopes and 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.

### 4.5.16 Noise

Existing land uses within the PRB (e.g., 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 and may augment the level of impacts to other resources (e.g., 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 utilizing 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.

### 4.5.17 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 Horse Creek LBA Tract. The transportation facilities for the Antelope Mine are already in place. Acquisition of the Horse Creek LBA Tract by ACC will support the planned increase in coal production to 30 mmtpy and in employment to 250. Traffic levels from the mine will be maintained for a longer period under the action alternatives.

### 4.5.18 Socioeconomics

Because of all the energy-related development that has been occurring in and around Converse and Campbell Counties 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 1998 valuation on minerals produced in 1997 was \$4,017,611,483. This was 54 percent of the State's total valuation and placed Wyoming among the top ten mineral producing states in the nation (Wyoming Department of Revenue, 2000). Because most minerals are taxed as a percentage of their assessed valuation, this makes the mineral industry a significant revenue base for both local and state government in Wyoming.

Coal production in the PRB was recently projected by BLM to reach a record high of 319 million tons in the year 2002 before declining to about 295 million tons in 2005 (BLM 1996a). That number has already been exceeded with 1999 production in Campbell and Converse Counties totaling 319,932,294 tons (Wyoming State Inspector of Mines, 2000). In contrast to BLM's projection, WSGS projects coal production in Campbell County to increase by about 1 percent per year from 2000 through 2005, while Converse County coal production is projected to remain steady at 25 mmtpy through this period. In 1998, Wyoming coal supplied approximately 29 percent of the United States' steam coal needs when PRB coal was used to generate electricity for public consumption in 25 states as well as Canada and

Spain (Lyman and Hallberg 1999). 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).

Two tracts, the Powder River and Thundercloud tracts, were recently leased in southern Campbell County and the surrounding area. Projected employment increases of up to 265 persons were predicted as a result of mining these tracts. Up to 70 additional jobs are predicted if the Horse Creek LBA Tract is mined. In combination, mining of these three LBA tracts could result in up to 335 jobs.

In addition to the Horse 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 North Rochelle Mine located southeast of Wright, WY has completed an \$83.6 million mine construction phase. Construction of the mine facilities began in June 1997 and is scheduled to be completed in 1999.

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Construction of the \$744 million ENCOAL plant was planned to coincide with the North Rochelle Mine expansion with construction starting in late 1997 and lasting approximately two years. A peak construction-phase work force of 1,560 persons was anticipated in the third quarter of 1998. The plant was scheduled to operate for at least 30 years and produce approximately 5,500 tons per day of solid fuel in full operation. The North Rochelle mine expansion and ENCOAL plant had been scheduled to go into operation in 1999 with a combined estimated operational work force of 222 persons. On August 29, 1997 ENCOAL announced that the contract for construction had been terminated. The company stated that they "...remain optimistic about the... technology...and...intend to continue to work toward construction of a commercial plant to meet the appropriate market timing..." (Zeigler Coal Holding Company, August 29, 1997). No additional plans for construction have been announced.

The Two Elk plant is currently in the developmental stage, and North American Power Group is working on permitting and marketing. According to a recent article in the Gillette News Record, construction of the Two Elk plant could begin in 2000; the cost for constructing the proposed plant is estimated at \$300 million; construction could last three years; and the construction-phase work force could peak at more than 600 persons. (Gillette News Record 2000).

According to information provided by the Dakota, Minnesota & Eastern

Railroad Corporation, construction of the DM&E railroad line was expected to start in 1999, take two years and cost \$1.5 billion. For Wyoming, the estimated direct construction-phase work force is 700 persons. DM&E in December 1998, got preliminary approval from the Surface Transportation Board, but must complete an environmental analysis as the next step of the approval process. The draft EIS may be available in summer 2000.

Currently, Gillette is experiencing a population increase as a result of CBM development in this area. According to a March 26, 2000 article in the Gillette News Record, in the past year Gillette's population has increased, unemployment has decreased, housing has becoming increasingly tight, and traffic and criminal activity have increased (Gillette News Record 2000a). School enrollment has not seen an increase over last year, however.

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, law enforcement, etc. in the communities in this area. The population increase would be expected to be somewhat dispersed among all of the communities in the area, which would include 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. It was previously estimated

that construction of the North Rochelle, ENCOAL and Two Elk projects could have added up to 2,900 people in northeastern Wyoming if they had been undertaken at the same time. As it has actually happened, development of these projects has not occurred concurrently. The North Rochelle construction project has been completed, CBM development is currently contributing to population in the Gillette area, construction at the Two Elk power plant could begin in 2000, construction of the proposed DM&E railroad is waiting on completion of the environmental analyses, and no progress is being reported on the ENCOAL project.

During the construction phase of the developmental projects, assistance money could total \$7.5 million for Gillette, \$4.43 million for Campbell County and \$527,000 for Wright (Planning Information Corp. 1997). Assuming local sales and use tax permits are required, the developmental projects if approved would generate about \$12.5 million for Gillette, Wright and Campbell County. The State of Wyoming would receive approximately \$16.99 million from the developmental projects. Ad valorem tax is paid on production and property (Wyoming; Department of Commerce, Energy Section 1997). If all three developmental projects had proceeded as planned, ad valorem tax paid in 2001 was estimated to approach \$10 million (Gillette News Record 1996b).

#### **4.6 The Relationship Between Local Short-term Uses of Man's Environment and the Maintenance and Enhancement of Long-term Productivity**

From 1999 on, the Antelope Mine would be able to produce coal at the permitted production level for another 17 years under the Proposed Action and for 18 years under Alternative 2. 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 of the LBA tracts, there would be a combined loss of native vegetation on 3,190 acres (Proposed Action) or 3,581 acres (Alternative 2) with an accompanying disturbance of wildlife habitat and grazing land. 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. Reduced topographic diversity in the breaks areas would make the area permanently less suitable for mule deer. 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.

There would be a deterioration of the groundwater quality in the lease area because of mining; however, 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 as much as five miles away from the pits in the coal aquifer. The water levels in the coal aquifer should return to premining levels at some time (possibly more 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 and Alternative 2 would extend the life of Antelope Mine by eight and nine years, thereby enhancing the long-term economy of the region.

#### **4.7 Irreversible and Irretrievable Commitments of Resources**

The major commitment of resources would be the mining and consumption of 246 million tons (Proposed Action) or 279 million tons (Alternative 2) of coal to be used for electrical power generation. CBM associated with this coal at the time it is mined would also be irreversibly and irretrievably lost. It is estimated that 1-2 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 3,190 acres (Proposed Action) or 3,581 acres (Alternative 2) 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.