4.0 ENVIRONMENTAL CONSEQUENCES

This chapter discloses the potential environmental consequences that may result from implementing the Proposed Action, Alternative 2, and the No-Action Alternative. 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. The impact of this consequence would depend on an individual's (or a population of individuals) preferred use of that area (e.g., opportunities for road-based recreation would be increased, but opportunities for primitive recreational activities and solitude would be decreased).

If the LBA tracts are leased to the applicants as maintenance tracts under one of the action alternatives, the permit areas for the adjacent mines would have to be amended to include the new lease areas before they can be disturbed. Table 4-1 shows the existing areas to be mined and disturbance areas for the applicants' mines (which represents the No-Action Alternative), and how those areas will change under the Proposed Action and Alternative 2. If the tracts are leased, the area that will have to be added to the existing permit areas would be the LBA tracts themselves 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 tracts 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 will be disturbed under each alternative is similar.

Surface mining and reclamation have been ongoing in the PRB for two decades. During this time, effective reclamation technology and mitigation measures have been developed and continue to be refined. Reclamation plans are based on a postmining topography design which incorporates stable land forms with topographic diversity, restoration of premining surface water flow and minimization of disturbance outside mining areas. Certain measures required by SMCRA and/or Wyoming statutes that reduce impacts are considered to be part of the Proposed Action, as discussed in Chapter 2. Some of these measures are also described in this section. The BLM and USFS also attach special stipulations to all coal leases (Appendix D). In addition, 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 operation will comply with the performance standards of the OSM-approved Wyoming program. Appendix A presents a list of federal and state permit approvals that would be necessary prior to mining either LBA tract. These regulations are designed to guarantee mitigation of impacts from surface coal mining. The impact assessment in the following sections considers all measures required by federal and state regulatory authorities as part of the action alternatives.

Section 4.1 analyzes the direct and indirect impacts associated with leasing and mining the LBA tracts under the Proposed Action and Alternative 2. Section 4.2 presents the probable environmental consequences of the No-Action Alternative (not issuing a lease for the tracts). Section 4.3 discusses regulatory compliance, mitigation, and monitoring in

Table 4-1. Comparison of Impacts of Alternative LBA Tracts on Mine Disturbance Area

Mine Configuration	Additional Area to be Mined (acres)	Additional Coal to be Mined[1] (million tons)	Total Area to be Mined (acres)	Percent Increase in Area to be Mined	Total Area to be Disturbed[2] (acres)	Percent Increase in Area to be Disturbed
North Antelope/Rochelle						
Existing Mine Permit	---	---	11,434	---	11,948	---
Proposed Action	4,023	489	15,457	35	16,574	39
Alternative 2	4,224	505	15,658	37	16,617	39
Jacobs Ranch						
Existing Mine Permit	---	---	6,955	---	8,122	---
Proposed Action	3,396	384	10,351	49	11,871	46
Alternative 2	3,546	389	10,501	51	11,956	47
Both Mines						
Existing Permit Area	---	---	18,389	---	20,070	---
Proposed Action	7,419	873	25,808	40	28,445	42
Alternative 2	7,770	894	26,159	42	28,573	42

Notes: [1] Additional coal to be mined = leased coal x recovery factor. For Powder River LBA Tract, additional leased coal = 515 million tons for Proposed Action and 532 million tons for Alternative 2 and recovery = 95% based on historic operations. For Thundercloud LBA Tract, additional leased coal = 427 million tons for Proposed Action and 432 million tons for Alternative 2 and recovery = 90% based on historic operations.

[2] Total disturbed area includes mined area and areas disturbed for construction of facilities, access roads, haulroads, rail facilities, stockpiles and miscellaneous areas. Disturbed area for this table assumes the LBA tracts would be mined as maintenance tracts for existing mines.

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 four projects that are in progress or proposed in the area of the LBA tracts 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 began in June of 1997; 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; and 4) the construction of the proposed DM&E Railroad line. 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 be beneficial or 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 tracts. Topsoil would be removed from the land, 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 tracts would be substantially changed during mining. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. Spoil and topsoil may be stockpiled for later use in reclamation. Mills and Shipley Draws and North Prong Little Thunder Creek (at the Thundercloud LBA Tract) and Porcupine Creek (at the Powder River LBA Tract) will 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 topographic features, but the basic drainage network would be restored. Following reclamation, the average surface elevation would be approximately 46 ft lower at the Powder River LBA Tract and 43 ft lower at the Thundercloud LBA Tract due to removal of the coal. (The removal of the coal would be partially offset by the overburden swelling that occurs when the overburden is 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 this 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 that would result from the lower and flatter terrain is reduced water runoff, which would allow increased infiltration and result in a minor reduction in peak flows. This may indirectly decrease erosion, 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.

Either action alternative would result in an increase in the area at the respective mines where topography would be permanently altered (Table 4-1).

The impacts on topography from mining and reclamation, as discussed above, are both beneficial and adverse. Since the area to be affected under the action alternatives represents an increase in the area that will be affected under current conditions, the impacts are considered moderate.

4.1.2 Geology and Minerals

For the Powder River LBA Tract, mining would remove an average of 228 ft of overburden and 73 ft of coal over about 4,023 acres under the Proposed Action or 4,224 acres under Alternative 2. Mining would remove an average of 195 ft of overburden and 68 ft of coal over about 3,396 acres for the Thundercloud LBA Tract under the Proposed Action, and 3,546 acres under Alternative 2.

The replaced overburden would be a relatively homogeneous (compared to the premining layered overburden) and partly recompacted mixture averaging about 256 ft deep on the Powder River LBA Tract and 220 ft deep on the Thundercloud LBA Tract. Depending upon the alternative, there would be an increase in tonnage to be mined of up to 52% at the North Antelope/Rochelle Mines and up to 80% at Jacobs Ranch. Approximately 942 million additional tons of coal would be leased under the Proposed Action, compared to 964 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 tracts under either action alternative. The subsurface characteristics of these lands would be radically changed by mining. The replaced overburden (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 tracts could not occur during mining; however, development of these resources could occur following mining. Coal bed methane associated with the removed coal would be irretrievably lost. There are currently oil wells present on both LBA tracts. In order to remove the coal, operating wells would have to be shut in during mining or abandoned if it is not economical to re-establish or redrill the wells following mining. 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. In the event of a conflict, BLM policy is to encourage negotiation and resolution of resource recovery issues between the conflicting interests.

4.1.3 Soils

Consequences to soil resources from mining the LBA tracts would include changes in the physical, biological, and chemical properties. Following reclamation, the soils would be unlike premining soils in texture, structure, color, accumulation of clays, organic matter, and chemical composition. The soils would be much more uniform in type, thickness, and texture. Since only the better soils would be salvaged for use in reclamation, the average quality of topsoil would be improved following reclamation. The replaced topsoil would support a stable and productive vegetation community adequate in quantity and quality to support planned postmining land uses (i.e., wildlife habitat and rangeland).

Surface coal mining and reclamation would directly impact 8,375 acres of soil resources on and adjacent to the LBA tracts (8,503 acres for Alternative 2) by increasing near-surface bulk density, which would then indirectly influence infiltration and runoff. The soils would tend to become more uniform in type, thickness, and texture (e.g., clayey and sandy soils may get mixed, resulting in a sandy clay loam). This uniform mixture would then be redistributed to a fairly even depth of about 18 to 24 inches in both LBA tracts. The chemical make-up and soil nutrient distribution would be more uniform in the mixed soils, resulting in more uniform vegetative productivity on the reclaimed land. Direct biological impacts would include a short-term reduction in soil organic matter, microbial populations, seeds, bulbs, rhizomes, and live plant parts for soil which is stockpiled before placement. Mining the tracts as extensions of existing mines will minimize the amount of both topsoil and spoil that must be stockpiled compared to mining the tracts as new-start mines.

Following reclamation, soil loss due to steep topography may decrease on the LBA tracts as a result of the topographic moderation. Due to state regulatory requirements, soil losses during mining will be minimal; sediment control structures will trap eroded soil and revegetation will reduce wind erosion. These measures are considered part of the action alternatives.

4.1.4 Air Quality

The WDEQ/AQD has issued air quality Permits to Construct for the North Antelope/Rochelle and Jacobs Ranch Mines. North Antelope and Rochelle are authorized to mine at a combined maximum rate of 65 million tons per year and Jacobs Ranch is authorized to produce at a maximum rate of 35 million tons per year. The actual production rates depend on market conditions and contracts. In 1996, the North Antelope/Rochelle combined production was 54.9 million tons, and production at Jacobs Ranch Mine was 24.5 million tons. As shown on Tables 2-1 and 2-2 of Chapter 2, anticipated annual production on the North Antelope and Rochelle Mines including the

Powder River LBA Tract is 65 million tons per year; at the Jacobs Ranch Mine including the Thundercloud LBA Tract production would be 35 million tons per year. Subject to market constraints, the mines plan to achieve their maximum permitted coal production rates by year 2002.

The air quality permits were based on the results of computer modeling that predicted no violation of air quality standards and demonstrated that emissions would have no significant cumulative effect when added to emissions from neighboring mines at currently permitted production rates. PRCC and KMCC would mine the LBA tracts and their existing leases using the same equipment with similar emission control methods. The overburden and coal thicknesses on the LBA tracts are similar to the existing leases. At the currently permitted maximum rates, acquisition of the LBA tracts would allow production to be extended for 7.5 to 7.8 years at the North Antelope/Rochelle Mines and 11.0 to 11.1 years at the Jacobs Ranch Mine, respectively. As a result, there would not be an increase in direct and indirect impacts to air quality, but there would be a continuation of the existing permitted impacts.

Air quality impacts resulting from, or associated with, mining operations would be limited primarily to the operational life of the mines. During the time the LBA tracts are mined, the elevated TSP levels in the vicinity of the mining operations would continue, as would the elevated concentrations of gaseous emissions due to fuel combustion. Compliance with all state and federal air quality standards would be attained. As with current operations, mining would occur near Highway 450, Highway 59, and Antelope and Mackey County Roads, making dust visible to the public. The required mitigation measures, which are discussed in Section 4.3.4, would minimize this impact.

Impacts from the Proposed Action and Alternative 2 would not be substantially different, except that a slightly larger area would be mined under Alternative 2. Haul distances from the pits to the preparation plants would increase slightly from current levels, so dust emissions may increase in proportion to this increased haul distance. Blasting is not a major source of emissions at PRB mines (PM_{10} emission inventories show that overburden and coal blasting comprise less than 1% of the total emissions). Overburden removal, wind erosion, and coal haul roads generate the majority of dust.

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 to evaluate their impacts on that Class I area.

4.1.5 Water Resources

Surface Water

Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tracts because of changes in the location of 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. However, sediment produced by large storms (i.e., greater than the 10-year,

24-hour storm) could adversely impact downstream areas. Since the tracts would be mined as extensions of existing mines 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.

Runoff rates might increase on the LBA tracts after reclamation due to loss of soil structure. However, 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. The probable decrease in average slope of the reclaimed land would increase infiltration and reduce peak flows.

After mining and reclamation are complete, surface water flow, quality, and sediment discharge from the LBA tracts would approximate premining conditions. The impacts described above would be similar for both the Proposed Action and Alternative 2.

Groundwater

Mining of the LBA tracts would impact the groundwater resource quantity in two ways: 1) Mining would remove the coal aquifer and any overburden aquifers on the mined land and replace them with unconsolidated overburden (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 tracts. The area subject to lower water levels would be increased roughly in proportion to the increase in area affected by mining.

Mining the LBA tracts would remove aquifers on 4,023.5 acres (Proposed Action) and 4,224.2 acres (Alternative 2) on the Powder River LBA Tract and 3,395.9 acres (Proposed Action) or 3,545.5 acres (Alternative 2) on the Thundercloud LBA Tract. Mining within the LBA tracts will remove both the coal and overburden aquifers and replace the two separate aquifer units with mine backfill (spoil) composed of an unlayered mixture of shale, siltstone, and sand that makes up the existing Wasatch Formation overburden. Impacts to the local groundwater system resulting from mining include completely dewatering the coal and overburden 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, drawdowns will extend further from the pit face than in materials with lower transmissivity. 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. Overburden monitor wells farther than 2,000 ft from the active pits showed less than 4 ft of drawdown at North Antelope/Rochelle and less than 2 ft of drawdown at Jacobs Ranch as of 1995 (Hydro Engineering 1996a). Because of the generally 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, as presented in the 15-year GAGMO report (Hydro Engineering 1996a) are generally in excess of 5 ft within four miles of the active pits at North Antelope/Rochelle Mines and within one mile of the active pit at Jacobs Ranch Mine.

The subcoal Fort Union aquifers are not removed or disturbed by coal mining, so they are not directly impacted by coal mining activity. Both PRCC and KMCC have water supply wells completed in aquifers below the coal. If the LBA tracts are leased by the applicants, water would be produced from these wells for a longer period of time; neither PRCC or KMCC will require additional sub-coal wells to mine the LBA tracts.

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

Groundwater quality within the backfill aquifer at the Thundercloud and Powder River LBA Tracts can be expected to be similar to the groundwater quality measured in wells completed in the backfill at the Jacobs Ranch and North Antelope Mines (to date no backfill wells have been completed at Rochelle Mine). TDS concentrations observed in the backfill aquifers at these mines are generally higher than those found in the undisturbed Wasatch or Wyodak Coal aquifers. At the North Antelope Mine, 1995 TDS concentrations in the backfill were variable and ranged from 1,954 mg/L to 15,307 mg/L (Hydro Engineering 1996b) with a geometric mean of 4,339 mg/L. Five of the seven backfill wells present at the North Antelope Mine show decreasing TDS concentration with time, decreasing an average of 30% from 1986 to 1995. Two wells are completed in the backfill at the Jacobs Ranch Mine, with 1995 TDS concentrations averaging 4,178 mg/L. A third well was completed in the Jacobs Ranch backfill in 1994; however, data from this well are insufficient to establish a trend. TDS concentrations in the Jacobs Ranch backfill wells have increased over time. 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 the permit documents are variable but in general comparable to the Wasatch Formation overburden and Wyodak Coal. At the Jacobs Ranch Mine, the hydraulic conductivity of the backfill has been measured at one well, and the average of two tests is 20 ft/day, which exceeds the high of 1.6 ft/day reported for the coal aquifer at the Jacobs Ranch Mine. At the North Antelope/Rochelle Mines, the backfill aquifer has been tested at four wells, and the average hydraulic conductivity is 36 ft/day,

which also exceeds the average hydraulic conductivity (9.5 ft/day) reported for the Wyodak Coal within one mile of the Powder River LBA Tract. 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 two LBA tracts 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 mine permitting regulatory authorities (state and federal) have not yet formally declared whether or not there are any AVF's within the two LBA tracts. However, within the two lease tracts the streams and agricultural uses appear similar to areas approved for mining downstream on the existing leases. Therefore, it is unlikely that any portions of the streams within the LBA tracts meet the criteria to be AVF's significant to agriculture.

Streamflows in Mills and Shipley Draws on the Thundercloud LBA Tract and Porcupine Creek and Corder Creek on the Powder River LBA Tract 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. Consequently, disruptions to streamflows which might supply downstream AVF's are expected to be negligible. Groundwater intercepted by the mine pits will be routed through settling ponds to meet state and federal quality criteria, and the pond discharges will likely increase the frequency and amount of flows in these streams, thereby increasing surface water supplies to downstream AVF's.

If the LBA tracts are mined as extensions of existing operations, the mining will extend upstream on streams already affected by mining. Therefore, no direct, indirect, or cumulative impacts are anticipated to off-site AVF's through mining of either of the LBA tracts.

4.1.7 Wetlands

All existing wetlands on the LBA tracts would be destroyed by mining operations. However, COE requirements to replace all impacted wetlands would mitigate this loss, so environmental impacts would be short-term (i.e., during mining and reclamation). During the period of time after mining and before wetland replacement, wetland functions would be lost. Also, the reclamation may not replace exact functions and landscape features.

4.1.8 Vegetation

Under the Proposed Action, mining of the LBA tracts would progressively remove the native vegetation on 4,626 acres on and near the Powder River LBA Tract and 3,749 acres on and near the Thundercloud LBA Tract. Acreage disturbed under Alternative 2 for the Powder River LBA Tract would be 4,669, while acreage affected under Alternative 2 for the Thundercloud LBA Tract would be 3,834 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 reseeding of any given area range from 2 to 4 years. This would be longer for areas occupied by stockpiles, haulroads, sediment-control structures, and other mine facilities. Some roads and facilities will not be reclaimed until the end of mining. No life-of-mine facilities would be located on the LBA tracts under the action alternatives, in which the LBA tracts would be mined as extensions of existing mines. A maximum of about 35% of the permit areas would be removed from livestock and wildlife production at any one time due to mining; grazing restrictions prior to mining and during reclamation would increase this to as much as 100% of the LBA areas. 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 reclamation. 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 with USFS input). The majority of the approved species are native to the LBA tracts. Initially, the reclaimed land would be dominated by grassland vegetation which would be less diverse than the premining vegetation. At least 20% of the area will 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 decreased big game habitat carrying capacity could be associated with this vegetative change. Within about 10 years following reclamation, a diverse, productive, and permanent vegetative cover would be established on the proposed lease lands. 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. Reclaimed areas at the Jacobs Ranch Mine, mined within the last decade, have already been declared crucial elk habitat by WGFD (1994). In areas of the LBA tracts where surface ownership is private (see Figures 3-14 and 3-15), the private landowners would have the right to manipulate the vegetation on their lands as they desire once the reclamation bond is released.

About 350 acres of surface disturbance per year of mining would occur on the Powder River LBA Tract at the proposed rates of production and 240 acres of surface disturbance would occur per year of mining on the Thundercloud LBA Tract regardless of which action alternative is selected. By the time mining ceases, over 70% of these disturbed lands will have been reseeded. The remaining 30% will be reseeded during the following 2 to 3 years as the life-of-mine facilities areas are reclaimed.

The reclamation plans for each LBA tract would also include steps to control invasion by weedy 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% in accordance with WDEQ policy. The average reclaimed slope will not be known until WDEQ's technical review of the permit revision applications is complete. However, since both LBA areas are fairly flat, no significant changes in average slope are predicted.

Following reclamation, the LBA tracts would be primarily mixed prairie grasslands with graminoid/forb-dominated areas, and the overall species diversity would be reduced, especially for the shrub component. The amount of playa grassland to be restored will be determined at the permit revision stage. Current WDEQ policy is that postmining depressions be similar to premining depressions in location, number, drainage area (±10%) and storage capacity (±25%) (WDEQ/LQD 1996). Playas with wetland characteristics will fall under the jurisdiction of the COE. Detailed wetland mitigation plans would be developed at the permitting stage to ensure no net loss of wetlands on the project area.

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.

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 tracts are leased under the Proposed Action or Alternative 2, the area of mining disturbance would be extended onto the LBA tracts and mining would be extended by up to 11.1 years.

Under the Proposed Action or Alternative 2, big game would be displaced from portions of the LBA tracts to adjacent ranges during mining. Pronghorn would be most affected; however there is no crucial pronghorn habitat on either of the LBA tracts. Mule deer, elk and white-tailed deer use these lands infrequently. 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 two tracts, 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 11.1 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 tracts. Sagebrush would gradually become re-established on the reclaimed land, but the topographic changes would be permanent.

Direct losses to small mammals would be higher than for other wildlife since the mobility of small mammals is limited and many would retreat into burrows when disturbed. Mammals such as coyotes, rabbits, etc., would be temporarily displaced to other habitats by mining and would return following reclamation. Populations of less mobile animals (such as mice) would decline during mining. However, these animals generally have a high reproductive potential and tend to re-invade and adapt to reclaimed areas quickly.

Mining of the LBA tracts would eliminate potential sage grouse habitat. However, very few sage grouse have been observed using the LBA tracts during annual wildlife monitoring surveys and specific baseline surveys completed for sage grouse.

No leks have been located within two miles of the Thundercloud LBA Tract although specific lek searches were completed in 1995 and 1996. One lek is located within 0.5 mile of the Powder River LBA Tract but only one male was observed in 1996 (Figure 3-12, Section 3.10). Annual wildlife monitoring completed for the adjacent Jacobs Ranch and Black Thunder Mines also did not reveal any leks or significant sage grouse activity in this area (Figure 3-13, Section 3.10). Additional surveys revealed that sage grouse use of this area was very restricted. Based on these inventories, sage grouse use of both LBA tracts is very limited, so impacts would be minor.

Raptor populations would not be adversely affected by mining either tract, but individual nesting pairs and birds will be impacted. In 1995 and 1996 only two raptor species, the Swainson's hawk and ferruginous hawk, were recorded nesting on or adjacent to the Thundercloud LBA tract. Nests for these two species will be destroyed or impacted by

mining. A total of five raptor species were recorded on or adjacent to the Powder River LBA Tract in 1995 and 1996. These species include the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, great horned owl and short-eared owl, and they will most likely be impacted by mining this tract. If the LBA tracts are leased, a raptor mitigation plan would have to be prepared and approved as part of a revised mining plan for each tract prior to mining. The raptor mitigation plans would be subject to USFWS review and approval before the mining plan is approved. Any nests that would be impacted by mining operations would have to be relocated in accordance with that plan. Prior to the disturbance of any raptor nest, special purpose permits would have to be secured from the USFWS and WGFD. All active raptor nests within the mine permit area would be protected further by buffer zones. Mine-related disturbances are not allowed to encroach in the near vicinity of any active raptor nest from March until hatching, and disturbances near raptor nests containing nestlings is strictly limited to prevent danger to, or abandonment of, the young. These required mitigation measures are part of the action alternatives.

Foraging habitat for raptors would be reduced until revegetation successfully attracts small mammals, which serve as their prey. The following required measures (which are part of the action alternatives) would also ensure that site-specific impacts would be minimized: All power lines would be made raptor safe (Avian Power Line Interaction Committee 1994), and successful revegetation would support substantial rodent (prey) populations.

Annual monitoring by other area mines has not documented any apparent declines in area eagle or hawk populations due to mining activities. Raptor sitings are common; however, reproductive rates are presently depressed in the area according to monitoring conducted by the WGFD, the BLM, and the USFS, and populations may be decreasing.

Mountain plovers have not been recorded on the Thundercloud LBA Tract or within two miles. This species has not been recorded on the Powder River LBA Tract but was recorded within one mile of that area. The required surveys would be completed if potential habitats within each LBA tract are to be disturbed. Mountain plover surveys, conducted in accordance with USFWS guidelines, would be required as part of the WDEQ permitting process. If plover habitat is identified on these lands, a habitat recovery and replacement plan would be required as part of the mine permit application. This plan, which would have to be approved by the USFWS, would be expected to reduce potential impacts to an acceptable level.

No other migratory birds of high federal interest (MBHFI) regularly use the LBA tracts, and raptors are the only MBHFI that breed in the area (see Section 3.10). Therefore, mining would have negligible impacts on these species.

Disturbance of stock ponds on the LBA tracts would impact waterfowl which utilize the ponds for resting and feeding during migration. The creation of sedimentation ponds, which is required, would partially mitigate this impact. WDEQ and the COE would also require creation of wetlands during reclamation which would minimize impacts. The LBA tracts currently have limited value for waterfowl production.

Resident songbirds would have to compete for available adjacent territories and resources as their habitats are disturbed by mining operations. Where adjacent habitat is

at carrying capacity, this competition would result in some mortality. Losses would be higher when habitat disturbance coincides with incubation and rearing of young. These effects would be short-term for grassland species but would last longer for shrub-dependent species. Several required measures would minimize these impacts. A diverse seed mixture with shrub groupings would provide food, cover, and edge effect, and tree plantings would produce perching and nesting sites.

USFS Region 2 sensitive species habitat may be directly or indirectly impacted by changing the surface character of the LBA tracts. Potential impacts may be either short-term (until reclamation) or long-term (persisting beyond successful completion of reclamation). If the LBA tracts are leased, the USFS will evaluate the tracts for these sensitive species in a Biological Evaluation prior to any habitat manipulation actions when the lessee files an application for a surface mining permit revision.

The impacts discussed above would apply to the original lease applications and proposed alternatives.

4.1.10 Threatened, Endangered, and Candidate Species

Mining the LBA tracts under the Proposed Action and Alternative 2 would not be expected to jeopardize the existence of any T&E species. No known critical habitat for T&E species exists on either LBA tract.

There are no prairie dog colonies on the LBA tracts, and surveys of nearby towns have produced no evidence of black-footed ferrets. Bald eagles could potentially nest or roost on the LBA tracts; however, there are no concentrated food sources for eagles on the LBA tracts and the loss of any potential prey habitat would be short-term. Peregrine falcon nesting habitat does not exist on either LBA tract, and there are no concentrated food sources for peregrines on the LBA tracts. In surveys completed in 1997, no Ute Ladies' Tresses orchids were found on the Powder River LBA Tract. Suitable habitat for Ute Ladies' Tresses orchid is not potentially present on the Thundercloud LBA Tract and no Ute Ladies' Tresses orchids have been found in surveys of that area. If any plants are found, development of a USFWS-approved mitigation plan would be required prior to mining. Mountain plover habitat may potentially occur on the LBA tracts, but no plovers have been documented. Surveys for plovers would be required prior to any mining activity and if any plovers are found, development of a USFWS-approved mitigation plan would be required prior to mining. No recent sightings of swift fox have been reported on or near the LBA tracts; however, much of the PRB is potential swift fox habitat.

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 8,375 acres (Proposed Action) or about 8,503 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. In addition, federally-owned surface on the two tracts would not be available for recreation during mining.

If some or all of the currently producing oil and gas wells on either tract are still producing at the time that coal removal begins, it would be necessary to remove the equipment associated with those wells and to

mine through those wells to recover all of the coal. Before this could occur, the coal lessee and the oil and gas well operator would have to negotiate a mutually acceptable agreement regarding the value of the unrecovered oil and gas resources and/or the cost of re-establishing production after mining and reclamation. New drilling would not be possible in areas of active mining, but could take place in areas not being mined or in reclaimed areas. Any coal bed methane resources on the LBA tracts would be lost when the coal is removed.

Hunting on the LBA tracts would be eliminated during mining and reclamation. Pronghorn, mule deer, and white-tailed deer occur on and adjacent to both tracts. Sage grouse, mourning dove, waterfowl, cottontail rabbit, and coyote also inhabit these tracts. Mining the Powder River LBA Tract would remove public access to approximately 2,675 acres of federal land in pronghorn Hunt Area 27 and mule deer Hunt Area 21. Mining the Thundercloud LBA Tract would remove public access to approximately 1,240 acres of federal land located in pronghorn Hunt Area 24 and mule deer Hunt Area 21. Following reclamation, the land would be suitable for grazing and wildlife use, which are the historic land uses. Following reclamation bond release, management of the privately-owned surface would revert to the private surface owner and management of the federally-owned surface would revert to the federal surface managing agency (USFS).

4.1.12 Cultural Resources

Cultural resources will be impacted by mining, but adverse impacts will be mitigated through data recovery and/or avoidance of significant properties. A Class III survey has been completed on the Powder River LBA Tract, and 45 prehistoric and historic sites have been recorded. A Class III survey has also been completed on the Thundercloud LBA Tract. Forty-two sites were located by the inventory. Three to six sites at the Powder River LBA Tract require further work to determine their significance. One site at the Thundercloud LBA Tract is considered eligible for nomination to the NRHP. Wyoming SHPO must concur with the evaluations of both tracts before any disturbance can occur.

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.

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 tracts. If such sites or localities are identified at a later date, they will be taken into consideration.

4.1.14 Paleontological Resources

No unique or significant paleontological resources have been identified on the LBA tracts, 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 will be taken to assess and protect the site (see Appendix D).

4.1.15 Visual Resources

Visual impacts would be evident during mining. Mining activities on the Powder River LBA tract and most of the Thundercloud LBA tract would not be visible from any major travel routes, and would be partly concealed by surrounding terrain. Mining of some parts of the Thundercloud LBA tract would be visible from State Highway 450.

Mining would affect landscapes classified by USFS as "common," and the landscape character would not be significantly changed following reclamation. After reclamation, 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 be distinguishable from the surrounding undisturbed terrain only to somebody very familiar with landforms and vegetation.

4.1.16 Noise

Noise levels on the LBA tracts would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since both LBA tracts would be mined as extensions of existing operations under the action alternatives, no rail car loading would take place on the LBA tracts. The Noise Control Act of 1972 indicates that a 24-hour equivalent level of less than 70 A-weighted decibels (dBA) prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact. OSM prepared a noise impact report for the Caballo Rojo Mine (OSM 1980) which determined that the noise level from crushers and a conveyor would not exceed 45 dBA at a distance of 1,500 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 at least 4,000 ft away from either LBA tract, there should be no significant noise impacts.

Because of the remoteness of the sites 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 reclamation is completed, noise would return to premining levels.

4.1.17 Transportation Facilities

No new or reconstructed transportation facilities will be required under the Proposed Action or Alternative 2. Essentially all of the coal mined on the LBA tracts would be transported by rail. Leasing the LBA tracts would extend the length of time that coal is shipped from the permitted Jacobs Ranch and North Antelope/Rochelle Mines. Active pipelines currently cross both LBA tracts, and any relocation of pipelines and utility lines 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 tracts.

4.1.18 Socioeconomics

Leasing and subsequent mining of the LBA tracts would extend the life of the already permitted Jacobs Ranch Mine by 11 to 11.1 years and the North Antelope/Rochelle Mines by 7.5 to 7.8 years. Leasing and mining the LBA tracts as production maintenance tracts would alter current employment levels in order to keep pace with currently permitted production increases. Over the revised mine life, employment levels would increase by about 45 persons at the Jacobs Ranch Mine and about 220 persons at the North Antelope/ Rochelle Mines.

Coal prices are projected to remain relatively constant throughout the lives of the mines (WSGS 1997), and the total direct fiscal benefit to the State of Wyoming from coal mining (taxes and royalties) has been estimated at $1.10/ton of coal mined (University of Wyoming 1994). Under the Proposed Action, the mining of 384 million tons of coal from the Thundercloud LBA Tract and 489 million tons of coal from the Powder River LBA Tract would generate a combined total of $960 million to the state. Under Alternative 2, the mining of 894 million tons from the two tracts would generate $983 million in state revenues. Assuming a price of $4.00 per ton, the combined sales of the recoverable coal from both LBA tracts would total $3.49 billion for the Proposed Action and $3.58 billion for Alternative 2. Estimated economic multipliers for determining the total economic impact to the local area (i.e., direct, indirect, and induced effects) range from 1.473 (University of Wyoming 1994) to 1.796 (Campbell County Economic Development Corporation 1993). Applying an average economic multiplier of 1.5 to these revenues, the total economic impact from leasing and subsequent mining of the LBA tracts would be about $5.24 billion (Proposed Action) to $5.37 billion (Alternative 2). These economic impacts would benefit the local and regional economies.

The federal government receives income from leased coal in the form of a lease bonus payment and royalties on production. Bonus payments are subject to competitive bid and have ranged from 11.1 cents/ton to 29.1 cents/ton on the LBA's sold to date (see Table 1-1). For the Powder River and Thundercloud LBA tracts, this suggests a bonus payment in the range of $104 million to $281 million. Federal royalties are 12.5% of the sales price of the coal. For a sales price of $4 per ton and a net production from the LBA tracts of 873 million to 894 million tons, the royalty payments would total $436.5 million to $447 million over the period of coal removal from the tracts. Both bonuses and royalty payments are divided equally between the state and federal governments.

If the LBA tracts are leased under the action alternatives and coal production increases as projected, total employment at the Jacobs Ranch and North Antelope/Rochelle Mines would increase by up to 265 employees. These increased employment levels would occur over the extended mine lives of up to 11.1 years at Jacobs Ranch and 7.8 years at North Antelope/Rochelle. The increase in employment of 265 persons represents just over 1% of the 25,200 persons in the May 1997 labor force in Campbell and Converse Counties (Wyoming Employment Resources Division, July 1997). Considering that the May 1997 unemployment in these counties

was 1,198 and that the unemployment rate rose from 4.4% to 4.8% between May 1996 and May 1997, it appears that the labor force could absorb the projected increase in employment. These employees will live in Gillette, Douglas, Wright or Newcastle, and those communities would benefit by having these residents maintain their jobs for these additional 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 Alternatives 1 or 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

Solid waste which may be produced by mining the LBA tracts consists of floor sweepings, shop rags, lubricant containers, welding rod ends, metal shavings, worn tires, packing material, used filters, and office and food wastes. Wastes of this type are currently being generated at the existing operations adjacent to both of the LBA tracts. The Jacobs Ranch, North Antelope and Rochelle Mines dispose of solid wastes within their permit boundaries in accordance with WDEQ-approved solid waste disposal plans. Sewage generated by mining the LBA tracts would be handled by existing WDEQ-permitted sewage systems currently present on the existing mine facilities. Maintenance and lubrication of most of the equipment used to mine the two LBA tracts would take place at existing shop facilities at the Jacobs Ranch, North Antelope, and Rochelle Mines. Major lubrication, oil changes, etc., of most equipment would be performed inside the service building lube bays, where waste oil is currently contained and deposited in storage tanks. The collected waste oils are then recycled offsite.

KMCC and PRCC have reviewed the EPA's *Consolidated List of Chemicals Subject to Reporting Under Title III of the Superfund Amendments and Re-authorization Act* (SARA) *of 1986* (as amended) and EPA's *List of Extremely Hazardous Substances* as defined in 40 CFR 355 (as amended), for hazardous substances proposed for use in mining the LBA tracts. Both companies maintain files containing Material Safety Data Sheets for all chemicals, compounds and/or substances which are or would be used during the course of mining at their respective properties.

KMCC and PRCC are responsible for ensuring that all production, use, storage, transport, and disposal of hazardous and extremely hazardous materials as a result of mining the LBA tracts would be in accordance with all applicable existing or hereafter promulgated federal, state, and local government rules, regulations, and guidelines. All mining activities involving the production, use, and/or disposal of

hazardous or extremely hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

KMCC and PRCC also comply with emergency reporting requirements for releases of hazardous materials. Any release of hazardous or extremely hazardous substances in excess of the reportable quantity, as established in 40 CFR 117, are reported as required by the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), as amended. The materials for which such notification must be given are the extremely hazardous substances listed in Section 302 of the *Emergency Planning and Community Right to Know Act* and the hazardous substances designated under Section 102 of CERCLA, as amended. If a reportable quantity of a hazardous or extremely hazardous substance is released, immediate notice must be given to the WDEQ Solid and Hazardous Waste Division and all other appropriate federal and state agencies.

Each mining company is also expected to prepare and implement several plans and/or policies to ensure environmental protection from hazardous and extremely hazardous materials. These plans/policies include:

- Spill Prevention Control and Countermeasure Plans;
- Spill Response Plans;
- inventories of hazardous chemical categories pursuant to Section 312 of SARA, as amended; and
- Emergency Response Plans.

All mining operations are also required to be in compliance with regulations promulgated under the Resource Conservation and Recovery Act, Federal Water Pollution Control Act (Clean Water Act), Safe Drinking Water Act, Toxic Substances Control Act, Mine Safety and Health Act, and the Federal Clean Air Act. In addition, mining operations must comply with all attendant state rules and regulations relating to hazardous material reporting, transportation, management, and disposal.

4.2 No-Action Alternative

Under the No-Action Alternative, these coal lease applications would be rejected and the areas 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 Jacobs Ranch, North Antelope and Rochelle mines 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, USFS Region 2 sensitive species, 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 Jacobs Ranch, North Antelope and Rochelle coal leases under the No-Action Alternative, but these impacts would not be extended onto the LBA tracts.

The general nature and magnitude of cumulative impacts as summarized in Table 2.5, 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 8,375 to 8,503 additional acres disturbed in the Proposed Action or Alternative 2, respectively. The economic benefits that would be derived from mining the LBA tracts during an additional 7.5 to 11.5 years of mining would be lost. Without the LBA tracts, operations at Jacobs Ranch Mine would end in about 2007, and at North Antelope/Rochelle Mines operations would end in 2012, when the existing leases are mined out. Not leasing these delineated suitable tracts at this time may also result in a bypass of this federal coal if the leases are not sold while the existing mines are still in operation and pits are in a position to expand into the LBA areas.

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. Mitigation and monitoring measures that are required by regulation are considered part of the action alternatives. To illustrate the types of mitigation and monitoring measures that are required by SMCRA and state law, some of these required measures are mentioned in the resource discussions in the previous section and in this section.

If impacts are identified during the leasing process that are not mitigated by existing required mitigation measures, then BLM or USFS can include additional mitigation measures as stipulations on the new lease. No mitigation or monitoring measures beyond those required by SMCRA or state law have been identified as necessary for the Powder River or Thundercloud tracts at this time.

4.3.1 Topography and Physiography

Given the WDEQ-mandated requirement to restore the postmining topography to the approximate original contour or an approved equivalent, no additional mitigation measures are recommended to address potentially adverse impacts.

4.3.2 Geology and Minerals

A WDEQ/LQD permit application requirement includes a drilling and sampling program to determine overburden geochemistry and reclamation suitability. If unsuitable overburden is present, the applicant will be required to design the mine and reclamation plan to minimize any adverse impacts. These measures typically include mixing and/or selective placement of spoil. No additional mitigation measures are recommended.

4.3.3 Soils

Selective placement of at least 4 ft of suitable overburden on the graded spoil surface prior to replacing topsoil is assumed. With an anticipated 18 inches of suitable topsoil placed on both LBA tracts, the top 5.5 ft of regraded surface material would meet WDEQ suitability guidelines for vegetation root zones. Monitoring of revegetation growth with corresponding application of appropriate soil amendments would ensure successful reclamation. These measures are required and are thus part of the action alternatives. No additional mitigation or monitoring will be needed.

4.3.4 Air Quality

Current air quality regulations and regulatory practices are designed for, and have been historically demonstrated to be effective in protecting ambient air from degradation from air pollutants generated by surface mining. Before the LBA tracts could be mined, even as an extension of approved operating permits, the existing air quality permits must be amended and approved by WDEQ/AQD. The required modeling is expected to verify

the previous analysis because there are no proposed changes in mining methods or rates under either action alternative.

The mitigation of impacts to air quality would be achieved through a combination of five regulatory activities: 1) dispersion modeling of mine plans for annual average particulate pollution impacts on ambient air; 2) use of particulate pollution control technologies; 3) use of specific work practices to minimize windborne fugitive particulate emissions; 4) on-site air quality monitoring to demonstrate compliance with ambient air quality standards; and 5) on-site compliance inspections of mining activities by state regulatory inspectors. Surface mines must comply with all five aspects of modeling, pollution control, pollution prevention, monitoring, and compliance inspection as conditions for obtaining and maintaining an air quality operating permit.

Potential air pollution is further mitigated at the source by the requirement that facilities utilize EPA- and state-mandated Best Available Control Technology (BACT). In the case of surface coal mining, BACT involves the use of fabric filtration or wet scrubbing of coal storage silo and conveyor vents to mitigate generation of particulates in ambient air. WDEQ also specifies certain other methods for mitigating windborne fugitive emissions of particulates, including watering or chemical dust suppression of haul roads and exposed soils, containment of truck dumps and primary crushers, covering of conveyors, and prompt revegetation of exposed soil. Such measures are estimated to be 50-60% effective in mitigating windborne fugitive particulate emissions from roads and exposed land (WDEQ 1979). These are regulatory requirements and are therefore considered part of the Proposed Action and Alternative 2.

WDEQ has also instituted local ambient air quality monitoring as a requirement for obtaining an air quality permit. Each mine in the PRB is required to install, maintain, and operate a certified ambient (off-site) monitor for PM_{10} or TSP as a surrogate for PM_{10}, and to submit monitoring data to WDEQ as a measure of compliance with ambient air quality standards. Specific compliance with both air quality regulations and operating permit requirements is further assured through the mine site inspection activities conducted by WDEQ.

No additional mitigation measures have been identified as necessary.

4.3.5 Water Resources

The cumulative hydrologic impacts associated with mining the LBA tracts would be evaluated by the WDEQ based on site-specific data before the tracts could be mined. Detailed mitigation plans would be developed at that time.

SMCRA and Wyoming State law obligate the coal mine operator 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 measure should adequately minimize potential impacts occurring to groundwater resources. WDEQ-required sedimentation ponds would continue to adequately mitigate surface water impacts. Extensive surface and groundwater monitoring would also be required as part of the mine permitting procedures. Since these measures are required by state and federal law, they are considered part of the Proposed Action and Alternative 2. No additional mitigation or monitoring measures have been identified.

4.3.6 Alluvial Valley Floors

A detailed study to identify alluvial valley floors is required by WDEQ prior to mine permitting. If any alluvial valley floors are identified, a detailed mitigation plan would be developed at that time. This plan would be designed to protect downstream alluvial valley floors during mining and restore essential hydrologic functions of any alluvial valley floors directly affected by mining. No additional mitigation or monitoring measures have been identified.

4.3.7 Wetlands

A detailed study to identify jurisdictional wetlands is required by the COE prior to mine permitting. If any jurisdictional wetlands are identified, a detailed mitigation plan will be developed at that time. The mitigation plan would include developing replacement plans for wetlands in the approved reclamation plan. No additional mitigation or monitoring measures have been identified.

4.3.8 Vegetation

Detailed reclamation plans, including a comprehensive revegetation plan, would be approved by WDEQ prior to mining. The revegetation plan would identify the permanent reclamation seed mixtures that would be used. The permanent reclamation seed mixtures, which must be approved by WDEQ, consist predominantly of species native to the area.

On reclaimed areas, levels of erosion and invasion by undesirable plant species are typically higher than premining levels prior to the successful establishment of the desired species. The reclamation plans would include specific measures to minimize erosion on reclaimed areas (e.g., mulching and the use of cover crops). Weed infestation would be chemically and mechanically controlled.

Vegetation on reclaimed land is generally less diverse than vegetation in undisturbed areas, and the reduction in topographic diversity further decreases the potential for vegetative diversity. Mitigation measures that may be used to increase vegetative diversity include using a diverse reclamation seed mixture, direct hauling of topsoil, selective planting of shrubs in riparian areas, planting of sagebrush, creation of depressions and rock piles, and special planting procedures around rock piles.

WDEQ also requires posting of a reclamation performance bond. This bond is held for a minimum of 10 years after seeding to assure that the reclamation meets all requirements and is self-sustaining. No additional mitigation measures have been identified.

4.3.9 Wildlife

Numerous mitigation measures are required by federal and state statutes to be incorporated into the mining and reclamation plans to minimize wildlife impacts. Required mitigation measures are considered to be part of the action alternatives. These measures generally include: 1) restoring the premining topography to the maximum extent possible; 2) planting a diverse mixture of grasses, forbs, and shrubs in configurations beneficial to wildlife; 3) designing fences to permit wildlife passage; 4) raptor-proofing power transmission poles; 5) creating artificial raptor nest sites; 6) placing rock clusters and creating shallow depressions to add topographic diversity in reclamation; 7) reducing vehicle speed limits to minimize wildlife mortality; and 8) instructing employees not to harass or disturb wildlife.

The permittees would also be required to prepare a raptor mitigation plan, which must be reviewed by the USFWS. Additionally, the mining operations are required to conduct extensive wildlife monitoring surveys, both before and during mining. No additional mitigation or monitoring measures have been identified.

4.3.10 Threatened, Endangered, and Candidate Species

The required mitigation and monitoring practices described above would ensure protection of any previously unreported T&E species. USFWS-approved surveys would be conducted for Ute ladies' tresses and mountain plovers prior to surface-disturbing activities. If prairie dogs invade the LBA tracts, ferret searches would be conducted prior to surface disturbance. The results of such surveys would be reviewed by USFWS and by the USFS on affected federal surface before mining could proceed. Employees would be instructed to avoid disturbing bald eagles, and revegetation would restore the disturbed foraging areas for their prey. All power lines would be made raptor safe. These measures are required by state or federal law and are therefore considered part of the action alternatives. No additional mitigation or monitoring measures have been identified at this time.

4.3.11 Land Use and Recreation

Since the majority of the land within the Powder River LBA Tract is public, access to this land will be restricted if the land is amended to the North Antelope/Rochelle Permit Boundaries. Since 1993, PRCC and the USFS have participated in a partnership in which PRCC has agreed to finance and contract for portions of or all of the necessary inventories and reports required to accomplish land exchanges in return for a commensurate reduction in annual Special Use Permit fees.

This partnership allows the USFS to exchange certain lands with private landowners to improve the scattered landownership pattern and provide additional wildlife habitat, public recreational opportunities and other public benefits. This partnership provides for mitigation of the temporary reduction of lands available for public recreation due to PRCC's mining operations. No additional mitigation or monitoring measures have been identified.

4.3.12 Cultural Resources

Direct impacts to cultural resources would be mitigated following procedures specified in 36 CFR 800. As part of the permitting process, Class I and Class III inventories would be conducted on all state and federal lands and on private lands affected by federal undertakings. All resources identified in these surveys would be evaluated for eligibility to the NRHP in consultation with SHPO. Eligible or listed sites identified would be avoided, as would areas with high potential for significant cultural deposits. If any NRHP (eligible or listed) historic or prehistoric sites found within the area cannot be avoided, a data recovery program would be implemented. Mining activities would be monitored by an archaeologist qualified by the appropriate federal agency on federal lands or by OSM or WDEQ on private lands. If historic or prehistoric materials are discovered during mining operations, appropriate BLM and USFS personnel would be notified immediately (see Appendix D). These required measures are part of the action alternatives.

Potential impacts to cultural resources would be reduced through informing all personnel of the importance of the resources and the

regulatory obligations to protect such resources. All personnel would be instructed that collection of cultural materials on public lands is prohibited. No additional mitigation or monitoring measures have been identified.

4.3.13 Native American Concerns

No mitigation measures are recommended, beyond what is currently required by state and federal law.

4.3.14 Paleontological Resources

No mitigation measures are recommended, beyond what is required by state and federal law. If potentially significant paleontological resources are discovered during surface-disturbing activities, those activities will be suspended and the resource will be evaluated (Appendix D). No additional mitigation or monitoring measures have been identified.

4.3.15 Visual Resources

No mitigation measures are recommended, beyond what is required by state and federal law.

4.3.16 Noise

No mitigation measures are recommended, beyond what is required by state and federal law.

4.3.17 Transportation Facilities

No mitigation measures are recommended, beyond what is required by state and federal law.

4.3.18 Socioeconomics

No mitigation measures are recommended, beyond what is required by state and federal law.

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 these LBA tracts. The postmining backfill may take in excess of 100 years to reach equilibrium water levels and water quality. Less time will be required near the mining boundaries. Water level and water quality in the backfill will be suitable to provide water to wells for

livestock use, but will 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

No residual impacts to wetlands would occur following mining.

4.4.8 Vegetation

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

4.4.9 Wildlife

Although the LBA tracts 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

Even with well-organized mitigation plans and associated procedures, impacts are unavoidable. It is neither possible nor practicable to mitigate all sites; thus, unmitigated sites will be permanently lost.

4.4.13 Native American Concerns

No residual impacts to Native American concerns are expected.

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 LBA tracts are 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 coal bed methane development is highly speculative.

Since decertification of the Powder River Federal Coal Region in 1990, the Wyoming State Office of the BLM has held ten competitive coal lease sales and sold seven federal coal leases containing approximately 1.42 billion tons of coal using the lease-by-application (LBA) process (Table 1-1). This leasing process has undergone the scrutiny of two appeals to the Interior Board of Land Appeals and one audit by the General Accounting Office.

The Wyoming BLM has received applications for five additional federal coal tracts containing approximately 2.0 billion tons of coal (Table 1-2). The Powder River Regional Coal Team (PRRCT) has reviewed all of these applications and has recommended processing four of them. At a public meeting held in Casper, Wyoming on April 23, 1997, the PRRCT recommended that the BLM not process the New Keeline lease application for a potential new mine start at this time. The BLM Wyoming State Director subsequently rejected that application without prejudice in a decision signed on June 13, 1997. This decision has been appealed. The four pending LBA's recommended for processing include approximately 1.3 billion tons of mineable federal coal.

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. The status check was updated prior to the 1997 PRRCT public meeting in Casper.

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 1996, Wyoming produced approximately 278.4 million tons of coal, according to the records of the Wyoming State Inspector of Mines. This is almost a three-fold increase since 1980, when 94 million tons of coal was produced in the 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% of Wyoming's coal sales.

There are currently 17 operating coal mines in Campbell and northern Converse counties (Figure 4-1). They are located just west of the outcrop of the Wyodak coal, where the coal is at the shallowest depth. These mines produce 85% to 95% of the coal produced in Wyoming each year. Table 4-2 summarizes predicted and actual Wyoming PRB coal production and related activity. The increasing production will probably result in a continuing demand for federal coal in the Wyoming Powder River Basin, as discussed in the coal leasing demand study that was completed by the BLM Wyoming State Office in 1996 (BLM 1996e). However, several mines have announced plans to decrease coal production at this time due to the low coal prices.

Oil production has decreased in the Wyoming PRB since 1990. In recent years, more wells have been plugged annually than have been drilled.

Natural gas production in the Wyoming PRB has increased since 1990. The increase is primarily due to the development of shallow coal bed methane resources in the area just west of the coal mines, which was not anticipated in the regional EIS's. Since 1992, five EA's and one EIS have been prepared to analyze the impacts of coal bed methane development projects in the PRB. About half of the oil and gas rights in the area of current coal bed methane development interest are federal; the remainder are private and state. Coal bed methane 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. Wells cannot be drilled on federal oil and gas leases until the BLM analyzes the individual and cumulative environmental impacts of that drilling, as required by NEPA.

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. The increase is partially due to higher uranium prices, particularly in 1996 and 1997.

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 Thundercloud and Powder River LBA Tracts are situated within a nearly continuous corridor of six coal mines in southern Campbell and northern Converse Counties, Wyoming. This southern corridor is approximately 24 miles long and 8 miles wide (see Figure 3-1). Five maintenance leases including approximately 10,300 acres of federal coal (Jacobs Ranch, West Black Thunder, North Antelope/Rochelle, Antelope

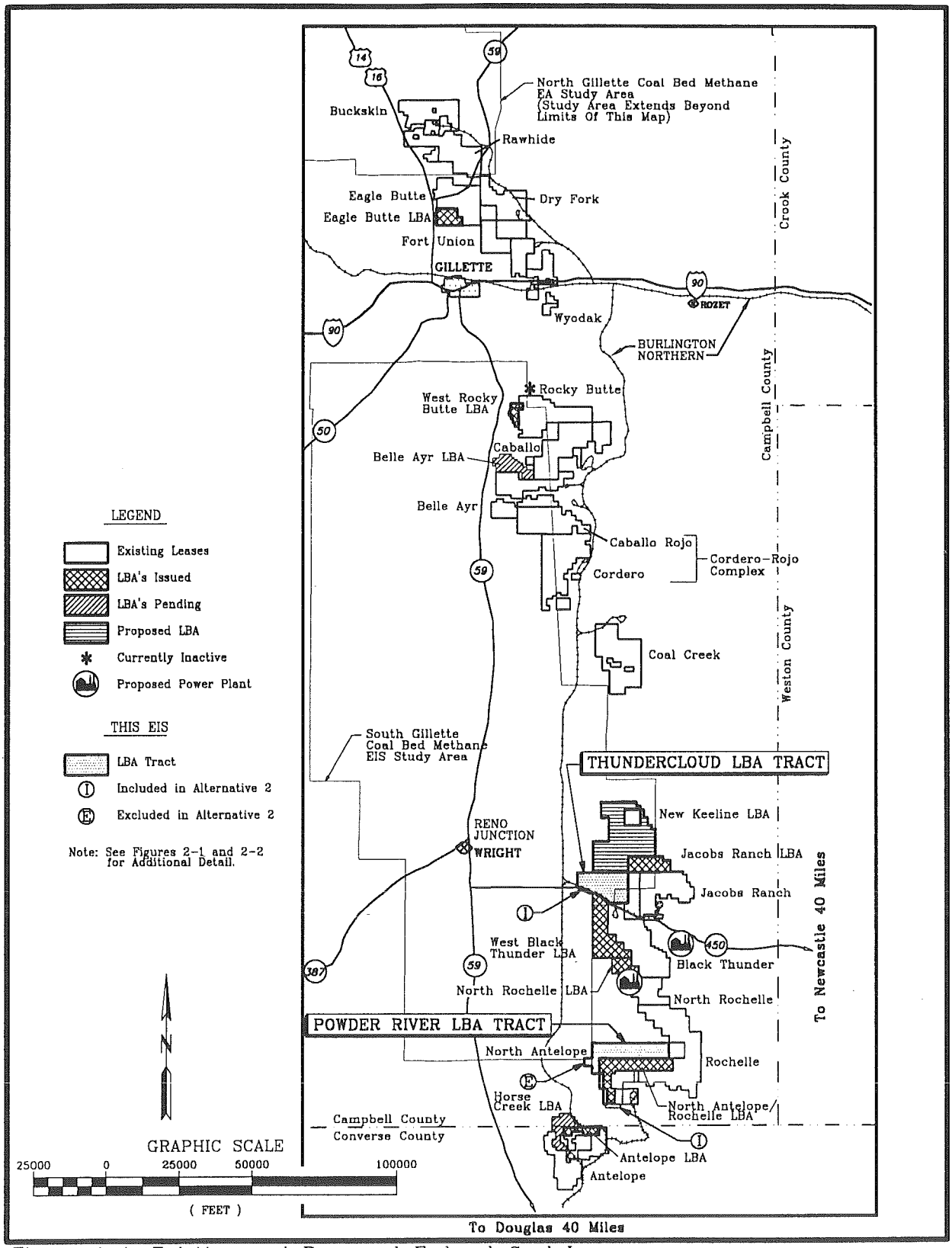

Figure 4-1. Existing and Proposed Federal Coal Leases.

Table 4-2. Coal Production & 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	$5.44
Potential by 1/1/2000	305.2	?	7	4	?	$5.13

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 and KFx-Fort Union
Proposed New Coal Enhancement	ENCOAL-North Rochelle and Carbon Tec-Caballo Rojo

Sources: 1979 and 1981 BLM Powder River Basin Regional EISs, Wyoming State Geological Survey Geo-notes-1996-97, and Wyoming State Inspector of Mines Annual Reports, 1990-95

and North Rochelle) have been issued to mines in this southern group since decertification, which has resulted in a 39% increase in the acres of leased federal coal in this group of mines since 1990 (Figure 4-1). There are three pending maintenance leases including approximately 8,900 acres of federal coal in this group of mines and LBA tracts (Thundercloud, Powder River and Horse Creek). Issuance of the Thundercloud and Powder River LBA Tracts under either action alternative would represent an increase of about 15% in acreage of leased federal coal in the southern group of mines. The New Keeline LBA, which represents a potential new mine start, is located north of and adjacent to the Jacobs Ranch Mine (Figure 4-1). As stated previously, the Wyoming State Director has rejected this application. There is also a potential for development of coal bed methane resources in a large area west of the coal mines. Two methane project areas are shown on Figure 4-1; both are in production.

In addition to the ongoing coal mining, the proposed maintenance coal leasing (the Powder River and Thundercloud LBA Tracts considered in this EIS and the Horse Creek LBA Tract), and the potential coal bed methane development, there are four other projects in progress or planned in the vicinity of the southern group of mines: 1) construction of the North Rochelle Mine facilities and rail loop which began in June of 1997; 2) the ENCOAL Plant, which has been proposed within the rail loop at the North Rochelle Mine; 3) the Two Elk power plant, which has been proposed east of the Black Thunder Mine; and 4) the construction of the proposed DM&E Railroad line. The ENCOAL and Two Elk projects could commence in 1998, however, the schedule for both projects is tentative. In a recent press release (Zeigler Coal Holding Company, August 29, 1997), it was announced that the construction contract for the plant had been terminated. The company stated its intention to "...work toward construction of a commercial plant to meet the appropriate market timing..." The DM&E Railroad currently proposes to acquire the necessary permits and start construction by 1999 and complete a new railroad line in 2001. These projects were proposed independently of the LBA tracts, and the schedules for some of these projects are uncertain. They are discussed in the cumulative impact discussion because, due to their location, the impacts related to these projects could overlap with the impacts of mining the LBA tracts.

The ENCOAL Plant could consist of three 5,500 ton/day parallel modules with an associated 240 megawatt (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 8 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.

Two Elk would be a coal-fired power plant located about 3 miles northeast of the Powder River LBA Tract and 3 miles southeast of the Thundercloud LBA Tract and would generate 250 Mw. The plant would burn low-Btu "waste coal" and coal fines 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. 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.

The DM&E Railroad recently announced that they have selected the southern of three proposed routes. They have not yet identified a specific route, but in general, DM&E proposes to build a new rail line that would enter Wyoming west of Oral, South Dakota, generally follow along, but not necessarily in, the Cheyenne River valley, and reach the "Common Corridor" east of the Black Thunder Mine (DM&E Newsletters 2 and 3, September 17, 1997 and November 25, 1997).

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 4-3, the regional EIS's assumed that reclamation would proceed at a faster pace than has actually occurred.

Table 4-3 compares the predicted total area of reclamation with the total number of acres that have been seeded with a final seed mixture as reported to WDEQ by all the mines. Reclamation is a process involving many steps; seeding with the final seed mixture happens near the end of the process. Therefore, Table 4-3 shows the area that is currently almost completely reclaimed but it does not reflect the total number of acres that are being reclaimed at this time.

At Jacobs Ranch Mine, 326 acres were disturbed in 1996 and 333 acres were seeded to the permanent vegetation species. Cumulatively through 1996, a total of 4,673 acres had been disturbed at Jacobs Ranch Mine and 2,760 acres had been reclaimed.

Table 4-3. Predicted and Actual Coal Mine Disturbance and Reclamation, Campbell and Converse Counties, Wyoming

	Coal Mine Operational Surface Disturbance (Acres)	Permanent Coal Mining Reclamation (Acres)
1979 Prediction for 1990	22,794	12,666
1981 Prediction for 1990	48,400	34,100
Actual 1990	31,797	6,994
Actual 1994	41,064	11,328
Actual 1996	47,018	12,165
Increase Since 1990	4.8%	74%

Sources: 1979 & 1981 BLM Powder River Basin Regional EIS's, Annual Mine Reports submitted to WDEQ/LQD, 1996 BLM Coal Development Status Check, and Dwight's Energydata Inc. Database

At the North Antelope/Rochelle Mines, 360 acres were disturbed in 1996 and 173 acres were seeded to permanent vegetation species. Cumulatively through 1996, a total of 4,369 acres had been disturbed and 490 acres reclaimed at North Antelope/Rochelle Mines. Reclaimed in this context means grading, topsoiling, and seeding have been completed, but does not necessarily mean that the reclamation performance bond has been released.

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 included 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). Mining the Thundercloud and Powder River LBA Tracts would increase the area of disturbance in the southern group of mines by about 22%.

4.5.2 Geology and Minerals

The PRB coal region encompasses an area of about 20,000 mi^2 and contains nearly 240 billion tons of sub-bituminous coal resources (BLM 1979). Campbell County has a total surface area of about 4,760 mi^2, of which approximately 4% 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. A group of six mines, including Jacobs Ranch, North Antelope and Rochelle, exist in the southern portion of the PRB. Production of coal in the southern mine group began in 1977 at the Black Thunder Mine. The current maximum permitted production rate is 152 million tons per year from the six mines. An estimated 3 billion tons of leased coal were originally contained within these six mines, and additional unleased deeper coal reserves are present adjacent to these mines. Approximately 55,000 acres are contained in the existing permit boundaries and will be disturbed. This disturbance area represents approximately 9% of the analysis area (see Figure 3.1). Mining of the LBA tracts under the Proposed Action or Alternative 2 would add approximately 10,000 acres to the 55,000 acres within permit boundaries, an increase of some 18%.

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) reserves. Removal of this coal is an irreversible and irretrievable impact. PRB coal was used to generate electricity for the public in 19 states and Canada in 1995. The members of the public in those states benefit from the low utility rates related to the price of coal, clean 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.

4.5.3 Soils

The six 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). Assuming 10 years from initial disturbance to utilization of a parcel of reclaimed land by domestic livestock, approximately 14,000 acres (44% disturbed by Jacobs Ranch and North Antelope/Rochelle) 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).

4.5.4 Air Quality

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

The nearest Class I area is located approximately 80 miles east of the analysis area at Wind Cave National Park in southwestern South Dakota. No impacts on air quality in excess of that permitted by regulation are known to have occurred in this area due to PRB mines.

WDEQ follows a modeling protocol which accounts for all mine-generated particulate air pollutants from all nearby mines (within 2 mi) to determine impacts to ambient air quality. Known as the "Mine A/Mine B" modeling procedure, this model evaluates the total impacts of a given mining operation, including those impacts from and on neighboring mines. The protocol is restricted as a matter of state regulatory policy to evaluation of the average annual impacts with respect to the ambient standard of $<50\ \mu g/m^3$ PM_{10}. The Wyoming air quality standard is $50\mu g/m^3$; however, the modeled scenarios allow for 15 $\mu g/m^3$ background concentrations. Therefore, in order to remain in compliance, modeled PM_{10} concentrations should not exceed 35 $\mu g/m^3$ at the permit boundary. If the LBA tracts are leased under the Proposed Action or Alternative 2, WDEQ would require that ambient air quality modeling be conducted that would consider all proposed mining at the North Rochelle, Black Thunder, and Jacobs Ranch Mines for incorporation of the Thundercloud LBA Tract and all proposed mining at the North Antelope/Rochelle Mines for incorporation of the Powder River LBA Tract.

Figure 4-2 was prepared using cumulative air quality modeling analysis prepared by the Black Thunder Mine in 1996 and the North Antelope and Rochelle Mines in 1993 and submitted to the Air Quality Division of WDEQ as part of two separate mine permit renewal packages (TBCC 1996; PRCC 1994). The figure illustrates modeled PM_{10} conditions in the year 2001, which is the predicted worst-case scenario for the Black Thunder, Jacobs Ranch, and North Rochelle mine complex, along with the predicted PM_{10}

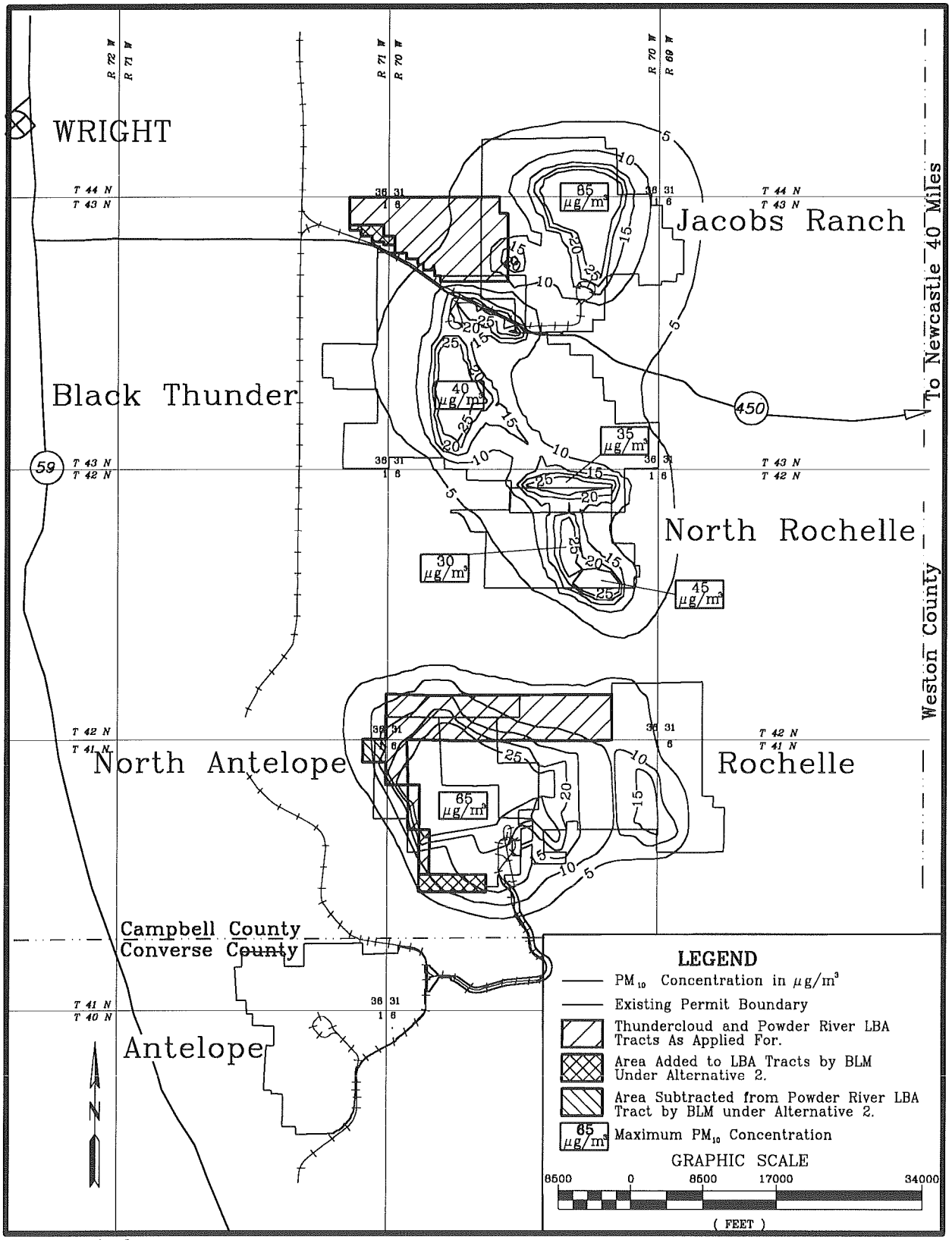

Figure 4–2. Modeled Average Annual PM_{10} Concentrations in 2001 Resulting from Removal of 140 Million Tons of Coal at Jacobs Ranch, Black Thunder, North Rochelle, North Antelope and Rochelle Mines.

concentrations in 2001 at North Antelope and Rochelle Mines. The figure depicts the relatively minimal off-site particulate impact of mining on ambient air quality and the rapid decay of PM_{10} concentration with increased distance from the mining areas. This combination of modeling efforts demonstrates that, given the total extraction of 162 million tons per year for the five mines in the modeled scenario, the 35 $\mu g/m^3$ annual average PM_{10} standard would not be exceeded outside of any of the mines' permit boundaries. Concentrations above 35 $\mu g/m^3$ are predicted in the areas of active pit, but the State standard requires only that particulate concentrations above 35 $\mu g/m^3$ cannot be exceeded at the mine's permit boundary.

In addition to the modeled scenario for the five mines discussed above, there are two additional projects proposed for the area of analysis that were not considered in particulate modeling depicted on Figure 4-2. The air quality impacts of the two projects, the ENCOAL and Two Elk projects, are discussed below.

Air quality modeling performed for the ENCOAL plant and submitted to WDEQ (ENCOAL 1996) indicates that the particulate emissions will be minimal, with predicted average annual PM_{10} concentrations not exceeding 3.9 $\mu g/m^3$. Off-site air quality impacts are not anticipated.

Air quality modeling conducted for the proposed Two Elk power generation facility and submitted to WDEQ (NAPG 1996) indicates that particulate emissions from the plant would be minimal, with predicted off-site emissions of 5 $\mu g/m^3$ extending no more than 1,140 meters from the facility.

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 $\mu g/m^3$ PM_{10} annual average) within 6 miles of active mining.

In the long term, impacts from PM_{10} emissions from mining the two LBA tracts would be negligible. If the two LBA tracts are mined, air quality will be decreased in the immediate area of active mining but will still continue to meet federal and state standards.

4.5.5 Water Resources

Surface Water

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 coal bed methane 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. (Coal bed methane development was not considered in the CHIA (Martin et al. 1988)). The EIS that was prepared to analyze the impacts of coal bed methane development south of Gillette estimates that an average surface discharge of 20 gpm from each of the 423 wells would result in an increase in flow of 0.5% to 2.4% 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 coal bed

methane produced water that ultimately reaches the major channels is reduced by infiltration into the ground and by surface landowners, who sometimes divert the produced water into reservoirs for livestock use because it is of relatively good quality.

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

Drainage from all six 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^2. The entire area of disturbance from these six mines as currently permitted would impact approximately 2% of the drainage basin of the Cheyenne River, and this disturbance would occur over about 50 years. Planned LBA's and the New Keeline Mine would raise this disturbance acreage to roughly 3% 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 planned 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.

Groundwater

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 southern mines pump an estimated 1,400 ac-ft per year from the pits and dewatering wells.

Extended consumption from water supply wells in aquifers below the coal will lower water levels in those aquifers. However, drawdowns in these deeper aquifers will not occur over wide areas because few wells are completed in these aquifers, the wells are generally more than a mile apart, and the water-bearing sandstones in these aquifers are generally discontinuous and have limited areal extent.

Coal bed methane is not currently being produced in the vicinity of the southern six mines, but based on current trends it is likely that development will continue southward in the direction of these mines. If coal bed methane is successfully developed adjacent to the six southern mines, the resulting groundwater drawdown in the Wyodak coal would overlap additively with drawdown caused by coal mining. Water levels in aquifers above the coal would not generally be impacted by coal bed methane development.

The water levels will gradually recover, as reclamation proceeds and coal bed methane

reserves are depleted. Coal companies are required by state and federal law to mitigate any water rights that are interrupted, discontinued, or diminished by mining. A group of coal bed methane operators and local landowners have developed a water well mitigation agreement that can be used on a case-by-case basis as development proceeds. As specified in the decision record for the Gillette South Coal Bed Methane Project EIS, BLM is requiring coal bed methane operators to offer landowners this water well mitigation agreement as part of the federal well approval process.

In 1987, the USGS, in cooperation with the WDEQ and OSM, conducted a study of the hydrology of the eastern PRB to provide hydrologic information necessary to perform required assessments. The resulting description of the cumulative effects of all current and anticipated mining (as of 1987) on the hydrologic system of the eastern PRB is presented in the CHIA (Martin et al. 1988). This report details the potential cumulative groundwater impacts of surface coal mining in the area and is incorporated by reference into this EIS.

A cooperative agreement "to provide a framework for hydrologic data exchange, access to data, data sharing, and scientific applications for Wyoming surface and ground water as it relates to coal production statewide" was signed in 1993 by WDEQ, BLM, OSM, the University of Wyoming, the Wyoming State Engineer's Office, and the Wyoming State Geological Survey. Under this agreement, a pilot study analyzing existing and potential surface and groundwater impacts due to coal mining and coal bed methane development in the Little Thunder Creek Drainage was completed in 1997. The Little Thunder Creek Drainage is located in the south-central portion of the PRB and includes the Jacobs Ranch, Black Thunder, and North Rochelle Mines. The pilot study was conducted at the Wyoming Initiative Laboratory of the University of Wyoming, with funding and direction from the cooperating agencies. Appendix G includes plates 14, 15, 16, and 17 of the pilot study, which show the modeled drawdown in the Wasatch Formation and Wyodak coal as a result of coal mining and coal bed methane development in the years 2005 and 2021. The pilot study investigated two predictive scenarios: surface mining alone from 1995 through 2021; and surface mining and coal bed methane production from 1995 through 2005 followed by surface mining alone from 2006 through 2021. The coal mining sequence was simulated from 1977 to the present and predictively modeled based on currently anticipated mining through 2021. Coal bed methane production was simulated in the area using the development scenario proposed in the 1995 BLM *Environmental Assessment for Lighthouse Coal Bed Methane Project*.

If the LBA tracts are leased, they must be permitted by WDEQ/LQD prior to mining. As part of this process, the applicants must assess the probable hydrologic consequences of mining the LBA tracts and the WDEQ/LQD must find that the cumulative hydrologic impacts of all anticipated mining would not cause material damage to the hydrologic balance outside the permit areas.

The cumulative hydrologic impacts associated with mining the LBA tracts will be re-evaluated by the WDEQ/LQD based on site-specific, current data before the tracts can be mined. Each time a mine permit application or a revision is made, the WDEQ/LQD assesses cumulative hydrologic impacts based on site-specific information, which is targeted to determine the cumulative impacts of the applicant's mine or changes in

the applicant's mining plan in combination with other mines or activities in the area.

Assessment of cumulative groundwater impacts in this EIS is based on impact predictions made by PRCC for mining the Powder River LBA Tract and extrapolating drawdown predictions made by KMCC in 1994 for the mining of the Jacobs Ranch Mine into the Thundercloud LBA Tract. Figure 4-3 depicts the 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 to assess the extent of impact to the groundwater system caused by the different mining operations. In Figure 4-3, these predictions are compared to the predictions in the CHIA and monitoring information gathered since publication of the CHIA. In the area of the Jacobs Ranch and Black Thunder Mines, drawdowns in the Wasatch Formation overburden have not been modeled because of the limited extent of saturated sand aquifers. Therefore, Figure 4-3 shows only the predicted drawdowns in the coal aquifer due to coal mining. The plates included in Appendix G also consider potential coal bed methane development.

Monitoring programs are required by WDEQ/LQD and are administered by the mining companies. Each mine is required to monitor groundwater levels in the coal and in the shallower aquifers in the area surrounding their operations. There are also requirements for drilling monitoring wells in the backfill areas of the mines to record water level recovery.

GAGMO, a voluntary group formed in 1980, assembles and reports annual hydrologic monitoring data collected by the coal mining companies operating in the eastern PRB of Wyoming. Members of GAGMO include most of the companies with operating or proposed mines in this area, WDEQ, Wyoming State Engineer's Office, BLM, USGS, and OSM.

Each year, GAGMO contracts with an independent firm to publish the results of the monitoring for that year. In 1991, GAGMO published a 10-year report which summarized the water monitoring data collected from 1980 to 1990 in the Wyoming PRB (Hydro Engineering 1991b). In 1996, a 15-year summary report was published (Hydro Engineering 1996a). The major groundwater issues related to surface coal mining that have been identified by scoping are:

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

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

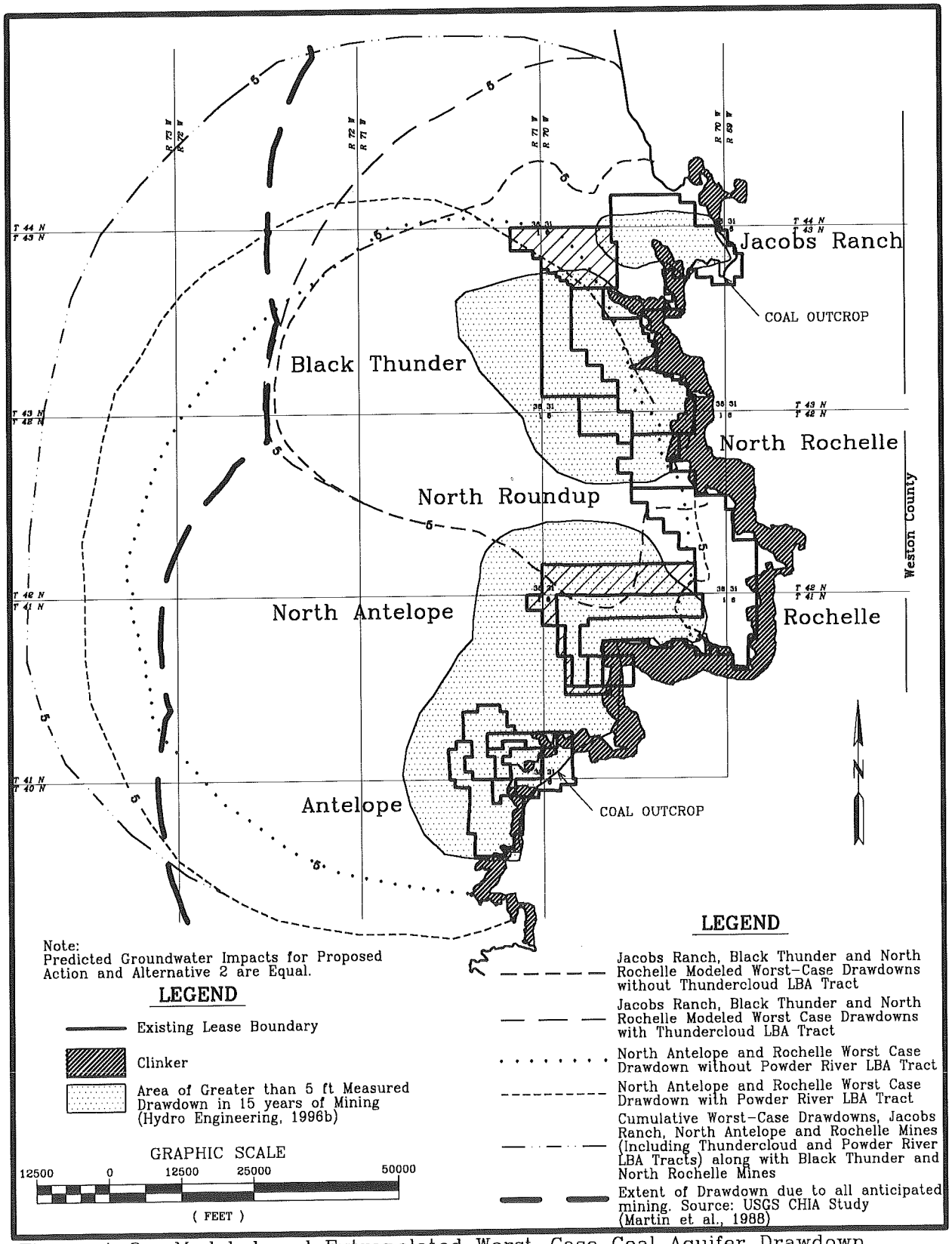

Figure 4-3. Modeled and Extrapolated Worst-Case Coal Aquifer Drawdown Scenarios Showing Extent of Actual 15-Year Drawdowns and USGS Predicted Cumulative Drawdowns.

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 1996 verify that recharge is continuing in the backfill (Hydro-Engineering 1991a, 1992, 1993, 1994, 1995, 1996b). 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 89% of the backfill wells reported for that year. In the 1996 GAGMO 15-year report, 85% of the 58 backfill wells measured contained water. The discrepancy is due to the fact that more wells were measured in the 15-year report, some of which were recently drilled and did not contain water.

The cumulative size of the backfill area in the PRB and the duration of mining activity would be increased by mining of the recently issued leases and the currently proposed LBA tracts. 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 leasing actions.

The North Rochelle Mine is projected to become fully operational in 1997. Groundwater impacts associated with mining of the North Rochelle LBA Tract have not been considered in the worst-case predictions made by the mines surrounding North Rochelle. Mining of the North Rochelle LBA Tract should not increase the westward extent of current and anticipated drawdowns in the coal aquifer because the North Rochelle LBA Tract does not extend the areas of coal removal farther west than the existing Black Thunder lease and the rate of production is not anticipated to increase beyond that already permitted (BLM 1996h).

Clinker, also called scoria, the baked and fused rock formed by prehistoric burning of the Wyodak-Anderson coal seam, occurs all along the coal outcrop area (Figure 4-3) and is believed to be the major recharge source for the spoil aquifer, just as it is for the coal. However, not all clinker is saturated. Some clinker is mined for road-surfacing material, but saturated clinker is not generally mined 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 tracts 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 4-3, 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 4-3 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 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 some 11 miles past the cumulative drawdown prediction in the 1988 CHIA. To date, the CHIA predictions have not been exceeded, but with mining projected to continue at least another 20 years even without the addition of the two LBA tracts, the predictions in the 1988 CHIA are now projected to be exceeded.

The 1988 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" as referred to in the 1988 CHIA 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 Jacobs Ranch, North Antelope and Rochelle, were considered in the CHIA analysis (Martin et al. 1988). The study predicts that water supply wells completed in the coal may be affected as far away as 8 miles from mine pits, although the effects at that distance were predicted to be minimal.

Although the drawdowns predicted in this EIS exceed those predicted in the 1988 CHIA, 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. Based on premine water levels, there is approximately 300 ft of available drawdown at the western edge of the Thundercloud LBA Tract. 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.

Based on the above assumptions, the CHIA estimated that about 3,000 wells in the area would be subject to impact by current and anticipated mining in Wyoming's PRB. Of these, about 1,200 wells are outside the actual mine areas (i.e., will not be removed by mining). About 1,000 of these supply water for domestic or livestock uses, and about 200 supply water for other uses. The remaining 1,800 wells are used by coal mining companies: about 1,700 wells are monitor wells only, and the other 100 are used for water supply and/or dewatering at mine sites.

Wyoming State Engineer's Office records indicate a total of 585 permitted water wells located within three miles of the two LBA tracts. The majority (420) are owned by coal mining companies and are used for groundwater monitoring and water supply. Of the 165 non mine-related wells, 93 are permitted for stock watering, 7 are permitted for domestic use, 3 for filling reservoirs, 2 for industrial use, 1 for irrigation use and 9 for miscellaneous use. The 50 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 Jacobs Ranch, North Antelope, Rochelle and the adjacent mines. In compliance with SMCRA and Wyoming regulations, KMCC and PRCC would be 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 Proposed Action. The most probable source of replacement water would be one of the aquifers underlying the coal.

Appendix E contains a list of wells which are predicted in the current North Antelope/Rochelle mine permit documents to be affected by drawdowns from currently approved mining operations. The Jacobs Ranch mine permit states that no stock or domestic wells will be impacted by currently approved mining operations. The operators which acquire these LBA tracts will be required to update the list of potentially impacted wells during the permit process necessary to obtain approval to mine the tracts.

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 both LBA tracts are depicted on Figure 4-3. Currently, the drawdown in the coal aquifer in the vicinity of the Jacobs Ranch and Black Thunder mines is expressed in two separate cones of depression; drawdown cones between the North Antelope/Rochelle and Antelope mines have coalesced. These cumulative drawdowns will be increased by

mining the Powder River LBA Tract, which is located between Antelope and North Antelope.

Dewatering activities associated with reasonably foreseeable coal bed methane development has the potential to extend the drawdown in the coal aquifer over a larger part of the southern PRB. As distance from the mines increases, drawdowns due to coal bed methane development would substantially exceed drawdowns that would occur due to mining alone. The Abandoned Mine Land Research Program has funded a grant to model relative drawdowns from coal mining and coal bed methane development in the area of the Cordero, Belle Ayr, and Caballo Mines and adjacent coal bed methane project areas (Figure 4-1). That work is currently in progress.

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 reccive 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.

In addition to the ENCOAL plant, the proposed Two Elk project, if constructed, will 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 (1991), 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 1 mile of the pumped wells (Crist 1991; Martin et al. 1988). The mine facilities in the PRB are separated by a distance of 1 mile or more, so little interference between mine supply wells would be expected.

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

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

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

- In the Gillette area, water levels in this aquifer are probably declining because the city of Gillette and several subdivisions are 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.

Prior to amending the LBA tracts into their existing WDEQ mine permits, the applicants (KMCC and PRCC) will either 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 tracts or use the drawdown predictions in the pending CHIA. Both applicants have installed monitoring wells which would be used to measure drawdowns predicted by modeling. This modeling would be required as part of the WDEQ mine permitting procedure discussed in Section 1.2.

The mines adjacent to the proposed maintenance LBA's all have permits from the State Engineer for deeper wells. Extending the lives of these mines with the LBA's would result in additional water being withdrawn from the Tullock Aquifer. The additional water withdrawals 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.

According to the State Engineer's Office, the only permitted wells drilled below 1,000 ft in a 100 mi^2 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 1 mile of pumped wells. The Thundercloud and Powder River LBA's, about 12 miles and 21 miles southeast of Wright, respectively, 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.

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 10 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-Anderson 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), TDS values in backfill wells have ranged from 400 to 25,000 mg/L. Of the 52 backfill wells measured and reported in the 1996 annual GAGMO report (Hydro Engineering 1996a), TDS in 80.5% were less than 5,000 mg/L, TDS in 17% were between 5,000 and 10,000 mg/L, and TDS in 2.5% were 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 tracts would be to increase the total volume of spoil and, thus, the time for equilibrium to re-establish.

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 Powder River and Thundercloud LBA Tracts.

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 not affected. Therefore, the impacts to wetlands as a result of surface coal mining are 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. The Jacobs Ranch Mine has been authorized to impact 80 acres of wetlands, the Rochelle Mine 21 acres of wetlands, and the North Antelope Mine 5 acres of wetlands. These numbers would increase if the LBA tracts are leased (see Section 3.8).

Wetlands must be replaced during reclamation, so the impacts to wetlands are not expected to be permanent; however, there is a period of time between disturbance and reclamation when wetland functions are lost. In addition, reclaimed wetlands may not function in the same way as the affected wetlands did before mining.

4.5.8 Vegetation

Most of the land that is being or will 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% of the land use in Campbell and Converse 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 will 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, will 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 six existing southern surface coal mines would not be reclaimed to the point of planting with permanent seed mixtures. Over the life of the six southern mines, a total of about 55,000 acres would be disturbed. This disturbed area includes all leases currently proposed, including federal, state and private coal. 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 will occur as a result of operations at these six mines. Most of the surface disturbance would occur in two vegetation types: mixed grass prairie (25%) and Wyoming big sagebrush (40%). The big sagebrush vegetation type comprises 38% of the Thundercloud LBA Tract disturbance area and 33% of the Powder River LBA Tract disturbance area, similar to the percentage for the six-mine southern cluster. Upland grassland comprises 29% of the disturbance area of both tracts. All six 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 cultivated and agricultural 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 cultivated. The areas mapped as disturbed lands (see Section 3.9) would not be restored to premining conditions. Also, the breaks grassland on the Powder River LBA Tract will not be replaced due to their poor soils and rough topography. Consequently, 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 with the exception of disturbed lands and lands which were cultivated at one time but have not been used for crop raising for many years. 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 tracts, 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 tracts. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent.

Cumulative impacts to most wildlife will increase as additional habitat is disturbed but will 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 contributors to the decline in their breeding habitat. Therefore, surface occupancy and disturbance restrictions, as well as seasonal restriction stipulations, have been applied to operations occurring on or near these crucial areas on public lands. These restrictions and stipulations have helped to protect important raptor and grouse habitat. 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.

Significant cumulative impacts to pronghorn resulting from existing concentrated mining and related disturbance were predicted in the regional EIS's (BLM 1974, 1979, 1981, and 1984b) 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 LBA tracts would increase the area of habitat disturbance in the southern group of mines by 22%, and would enlarge the area where daily movement is restricted. There is little use of the LBA tracts by other big game species (mule deer, 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 tracts, 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 tracts, 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.

Cumulative impacts to USFS Region 2 Sensitive Species will be evaluated in a Biological Evaluation specific to this group when the lessee files an application for a surface mining permit, prior to mine development.

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 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 1 year of surface disturbance, either as a commitment in the mine plan or as a permit stipulation. USFWS requirements also 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. Any potential impacts to T&E species would be mitigated as required. Thus, no significant cumulative impact to T&E species are projected, with or without leasing of the LBA tracts.

4.5.11 Land Use and Recreation

In addition to reducing livestock grazing and wildlife habitat, surface coal mining also disrupts oil and gas development and limits access to public lands, although the majority of the surface area being mined is privately owned.

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% of this land surface is private and access is controlled by the landowner.

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, reclamation at the Jacobs Ranch Mine has 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 tracts will support an increase in employment levels as coal production increases and will increase the years of production at the existing mines. The demand for outdoor recreational activities, including hunting and fishing, have 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.

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^2 (640 acres) can be made based on inventories at existing mines in the area, and approximately 25% of these sites are typically eligible for the NRHP. 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 be expected 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 are expected to occur as a result of leasing and subsequent mining of the Powder River and Thundercloud LBA Tracts.

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 silos 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 tracts as extensions of existing mines. Issuance of the LBA tracts 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 mines 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 tracts 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 5 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

No new cumulative impacts to transportation facilities are expected to occur as a result of leasing and subsequent mining of the Thundercloud and Powder River LBA Tracts. The transportation facilities for Jacobs Ranch and North Antelope/Rochelle Mines are already in place. Employment levels will not change as a direct effect of mining the LBA tracts, but employment will increase to support coal production increases and the length of employment will be extended. Traffic levels from both mines 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 Campbell County during the past 30 years, socioeconomic impacts are a major concern. Wyoming's economy has been structured around the basic industries of extractive minerals, agriculture, tourism, timber, and manufacturing. Each of these basic industries is important, and the extractive mineral industry has long been a vital part of Wyoming's economy. Many Wyoming communities depend on the mineral industry for much of their economic well being. The assessed valuation on total minerals produced in 1990 accounted for 91% of the state's total assessed valuation. Because most minerals are taxed as percentage of their assessed valuation, this makes the mineral industry a significant revenue base for both local and state government in Wyoming (Department of Commerce, Economic and Community Development Division, Energy Section 1992).

Coal production in the PRB is projected to reach a record high of 319 million tons in the year 2002 before declining to about 295 million tons in 2005 (BLM 1996a). Coal prices are projected to remain relatively constant throughout this period (BLM 1996e). By 2005, annual coal production is projected to generate about $2.6 billion of total economic activity, including $351 million of personal income, and would support the equivalent of nearly 15,885 full-time positions (BLM 1996a).

In addition to the Thundercloud and Powder River LBA Tracts, a number of mineral and related developments are anticipated in Campbell County and the surrounding area. The North Rochelle Mine located southeast of Wright, WY is currently approaching an $83.6 million mine expansion phase (Gillette News Record 1996b). The mine expansion was permitted in July 1995 by WDEQ/LQD. Construction of the mine facilities began in June 1997 and is scheduled to last about two years. A peak construction-phase work force of 246 persons is anticipated in the fourth quarter of 1997 (Planning Information Corp. 1997).

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 would produce approximately 5,500 tons per day of solid fuel when the plant is 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, 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..." (Ziegler Coal Holding Company, August 29, 1997).

The Two Elk plant is currently in the developmental stage, and North American Power Group is working on permitting and marketing. Construction of the plant was expected to begin in the third quarter of 1997, however, construction has not yet begun. The cost for constructing the proposed plant is estimated at $290 million. Construction is expected to last approximately two years with a peak construction-phase work force of approximately 752 persons anticipated in the fourth quarter of the construction period.

According to information provided by the Dakota, Minnesota & Eastern Railroad Corporation, construction of the DM&E railroad line is 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.

If the North Rochelle, ENCOAL and Two Elk projects had all started in 1997 as scheduled, increased employment in Campbell County would have peaked at 2,429 persons in the second quarter of 1998 during the construction phase, and construction would have been completed on all three projects in late 1999. There would potentially have been some construction-phase overlap with the anticipated start of construction of the DM&E rail line in 1999. Depending on when construction begins on the ENCOAL and Two Elk plants, there still could be overlapping construction employment with either or both the North Rochelle and the DM&E Railroad construction phases. At the end of the construction phases, it is estimated that a total of 452 workers would be employed by all four projects.

If all of these new projects are undertaken, it is estimated that the local populations of the communities in northeastern Wyoming would grow. If construction of North Rochelle, ENCOAL, and Two Elk had begun in 1997, as previously anticipated, it was estimated that non-local populations in northeastern Wyoming would have grown by 2,900 persons during the second half of 1998. The populations of Wright, Douglas, Newcastle, and Upton were projected to increase by approximately 1,751, while populations in other areas of Campbell, Converse, and Weston counties could have increased by 1,172. Under that scenario, the number of additional residents related to those three projects was expected to have been 455 after the construction phase. Currently, the North Rochelle construction project is underway and is projected to end in 1999; the ENCOAL and Two Elk construction schedules are uncertain; and DM&E is projecting that its construction would begin in 1999. If ENCOAL and/or Two Elk construction begins in 1998 or 1999, there

would be some overlap with both the North Rochelle construction and the DM&E construction. If construction on those two projects is delayed beyond 1999, there would be conflict with the DM&E construction phase.

According to the Planning Information Corporation (1997), if construction had proceeded as planned for the North Rochelle Mine, the ENCOAL plant and the Two Elk plant, the Gillette area could have experienced a demand for 545 dwelling units during the second quarter of 1998, with the demand dropping to 75 dwelling units at the end of the construction phase. The number of dwelling units in demand in Wright could have increased to 273 during the peak phase of construction and dropped to 37 after the construction phase. Other areas that could have experienced some demand in housing during the peak phase on construction included Douglas, Newcastle and Upton. This could have created some housing shortages, especially in the temporary housing market. Such shortages still could occur if all of the potentially planned projects are undertaken by 1999 or 2000, however, the projected housing shortage situation could be offset by the increase in vacancy rates in Gillette that was discussed in a recent article in the Gillette News Record (Gillette News Record, 1997). The reduction in Gillette population and increase in vacancy rates were not anticipated in the Planning Information Corporation study.

The effects of the three developmental projects could temporarily increase the total school enrollment during two years of coincidental construction. The total number of students added to the Gillette and Wright school systems is projected at 140 and 70 students, respectively. This growth was anticipated to occur in the fourth quarter of 1998.

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 (Planing 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 (State of Wyoming; Department of Commerce, Energy Section 1997). If all three developmental projects proceed as planned, ad valorem tax paid in 2001 is estimated to approach $10 million (Gillette News Record 1996).

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

From 1997 on, the Jacobs Ranch Mine would be able to produce coal at the permitted production level for another 18.1 years under the Proposed Action and for 18.6 years under Alternative 2. The North Antelope/Rochelle Mines could produce coal at the permitted production level for about 19 years. 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 tracts provide would be temporarily lost during mining and reclamation. During mining of the LBA

tracts, there would be a combined loss of native vegetation on 8,375 acres (Proposed Action) or 8,503 acres (Alternative 2) with an accompanying disturbance of wildlife habitat and grazing land. This disturbance would occur over a period of years. The mine sites would be returned to equivalent or better forage production capacity for domestic livestock before their performance bonds are 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 tracts 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 5 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 visual resources of the area on a short-term basis. Following removal of surface facilities and completion of reclamation, 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 North Antelope and Rochelle Mines by 7.5 and 7.8 years, respectively. The Proposed Action would extend the life of Jacobs Ranch Mine by 11 years while Alternative 2 would extend the mine life by 11.5 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 873 million tons (Proposed Action) or 894 million tons (Alternative 2) of coal to be used for electrical power generation. Coal bed methane associated with this coal would also be irreversibly and irretrievably lost. It is estimated that 1-2% 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 8,375 acres (Proposed Action) or 8,503 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.