3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources in the general analysis area for the Maysdorf LBA[1] Tract (the affected environment) and analyzes the direct and indirect impacts to those resources that would be associated with mining the tract if it is leased under the Proposed Action or Alternatives 2 or 3 (the environmental consequences). The probable environmental consequences of the No Action Alternative (Alternative 1, not issuing a lease for the tract) with respect to each of the environmental resources are also considered in this analysis.

> Additional, more detailed information about the affected environment in the general analysis area is contained in a separate document entitled *Supplementary Information on the Affected Environment in the General Analysis Area for the Maysdorf Coal Lease Application EIS*, which is available on request.

This chapter also considers regulatory compliance, mitigation, monitoring, residual impacts, the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible and irretrievable commitments of resources that would occur with implementation of the Proposed Action or Alternatives 2 and 3. As discussed in Chapter 2, regulatory compliance and mitigation and monitoring measures that are required by federal and/or state law are considered to be part of the Proposed Action and Alternatives 2 and 3.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the Proposed Action or Alternatives 2 and 3 include air quality, cultural resources, Native American religious concerns, T&E species, migratory birds, hazardous or solid wastes, water quality, wetlands/riparian zones, floodplains, invasive non-native species, and environmental justice. Four other critical elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, and wilderness) are not present in the analysis area and are not addressed further. In addition to the critical elements that are potentially present in the general analysis area, this EIS discusses the status and potential effects of mining the LBA tract on topography and physiography, geology and mineral resources, soils, water quantity, alluvial valley floors, vegetation, wildlife, land use and recreation, paleontological resources, visual resources, noise, transportation resources, and socioeconomics. The resources that are addressed in this EIS were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

[1] Refer to page xv for a list of abbreviations and acronyms used in this document.

Figure 3-1 shows the general analysis area for most environmental resources. The general analysis area for the tract includes the BLM study area for the Maysdorf LBA Tract (the tract as applied for and the additional area evaluated under Alternatives 2 and 3), and the anticipated permit amendment study area for the Cordero Rojo Mine. The anticipated permit amendment study area is defined as those lands adjacent to and outside of the mine's current permit area that the applicant anticipates would be included within the amended mine permit area if they acquire the tract.

Table 3-1 shows the acreage leased and disturbance area for the existing Cordero Rojo Mine (which represents the No Action Alternative), and how the leased area and disturbance area would change under the Action Alternatives. A portion of the LBA tract lies inside the current mine permit area (Figure 3-1). If the tract is leased, the area that would have to be added to the existing mine permit area would be that portion of the LBA tract that lies outside the existing permit boundary plus an adjacent strip of land that would be used for highwall reduction after mining and such mine-related activities as construction of diversions, flood and sediment control structures, roads, and stockpiles. Portions of the LBA tract that are contiguous to the existing mine will be disturbed under the current mining plans in order to recover the coal in the existing coal leases. The environmental consequences of implementing the Proposed Action or Alternatives 2 and 3 would be similar in nature, but selection of the Proposed Action would disturb a smaller area of land surface.

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

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

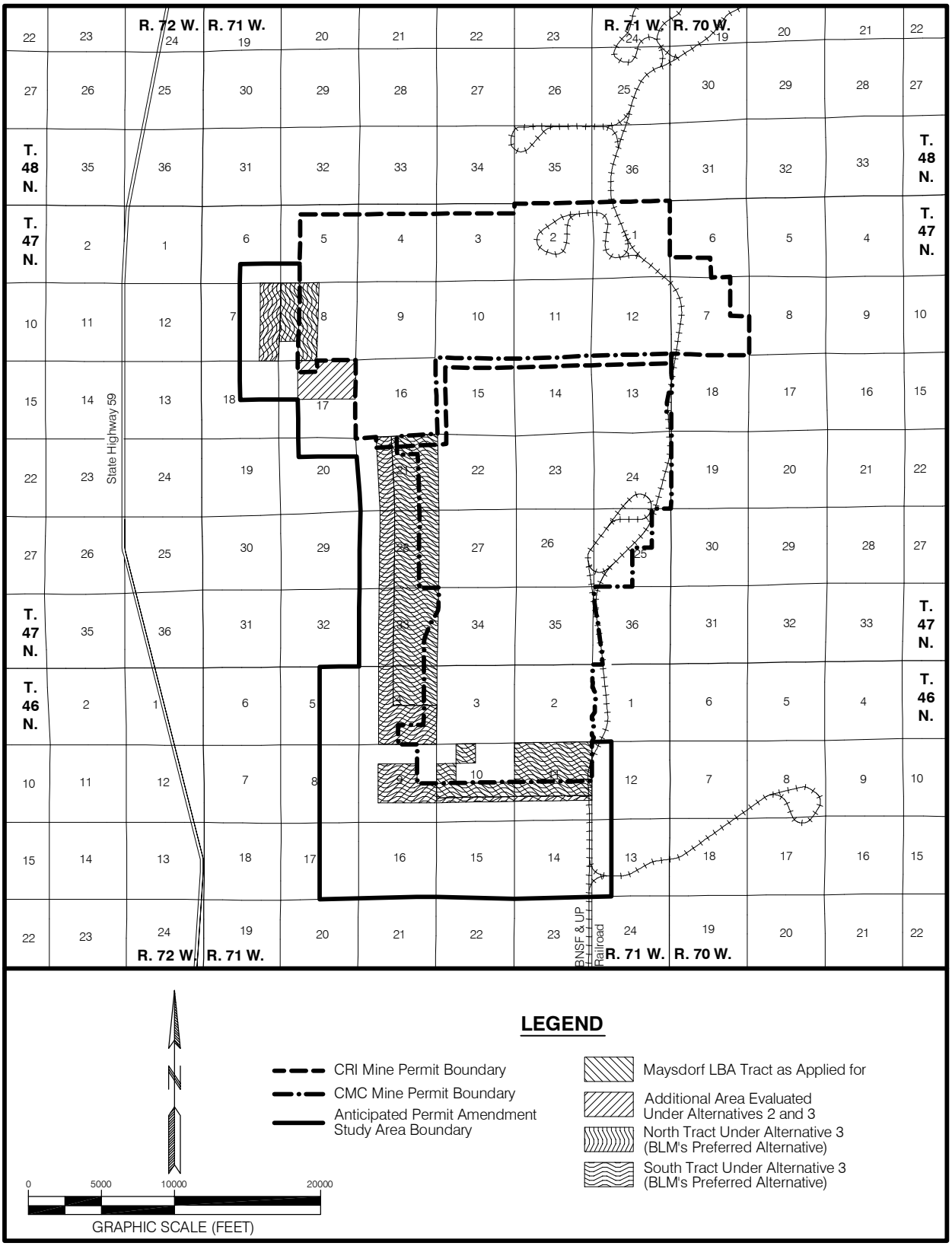


Figure 3-1. General Analysis Area.

Table 3-1. Comparison of Existing and Proposed Cordero Rojo Mine Disturbance Area and Mining Operations.

	No Action Alternative (Existing Permit Area)	**Proposed Action**	**Alternative 2**	**Alternative 3 North Tract**	**Alternative 3 South Tract**
Additional Lease Area (Acres)	---	2,219.4	3,346.1	445.9	2,900.2
Total Lease Area (Acres)[1]	13,269.1	15,488.5	16,615.2	13,715.0	16,169.3
Increase in Lease Area (Percent)	---	16.7	25.2	3.4	21.9
Estimated Additional Mine Disturbance Area (Acres)[2]	---	2,558.2	4,024.7	825.8	3,198.9
Estimated Total Mine Disturbance Area (Acres)	14,694.0	17,252.2	18,718.7	15,519.8	17,892.9
Increase in Estimated Disturbance Area (Percent)	---	17.4	27.4	5.6	21.8
Estimated Additional Recoverable Coal (Million Tons)[3]	---	216.5	317.6	49.6	268.0
Estimated Recoverable Coal for Mine as of 1/06 (Million Tons)	364.8	581.3	682.4	414.4	632.8
Increase in Estimated Recoverable Coal as of 1/06 (Percent)	---	59.3	87.1	13.6	73.5

1 Includes federal, state, and private coal.
2 Total Disturbance Area = area to be mined + area disturbed for mine facilities, access roads, haul roads, highwall reduction, railroad facilities, stockpiles, etc.
3 Estimated Recoverable Coal Resources = tons of mineable coal × recovery factor (94 percent).

analyses. Impact significance may range from negligible to substantial; impacts can be significant during mining but be reduced to insignificance following completion of reclamation.

3.1 General Setting

The general analysis area is located in the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. Vegetation is primarily sagebrush and mixed grass prairie.

3.1.1 Climate and Meteorology

The climate in the general analysis area is typical of a semi-arid, high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. The average annual precipitation at a NOAA meteorological station (Gillette 9ESE), located about 18 miles northwest of the Cordero Rojo Mine, is 15.64 inches (WRCC 2006). June (2.72 inches) and May (2.60 inches) are the wettest months, and February (0.55 inch) is the driest. Snowfall averages 56.7 inches per year, with most occurring in March (10.4 inches) and April (8.6 inches). Potential evapotranspiration, at approximately 31 inches (NOAA 1969), exceeds annual precipitation. Summers are relatively short and warm, while winters are longer and cold. The average daily mean temperature is 45.2 degrees F. The highest recorded temperature was 107 degrees F and the lowest was minus 40 degrees F. July is the warmest month, with a mean daily temperature of 71 degrees F, and January is the coldest month, with a mean daily temperature of 21.7 degrees F. The frost-free period is 100-130 days.

In the general analysis area, surface wind speeds range from more than 30 mph during the winter and spring to 10 to 12 mph during the summer. The area also experiences extreme wind gusts, especially during thunderstorm activity that occurs in June, July, and August. Distinct diurnal changes occur, with average wind velocities increasing during the day and decreasing during the night. Local variations in wind speed and direction are primarily due to differences in topography. Wind speeds are highest in the winter and spring (October through April) and are predominantly from the western and northern sectors. During the warmer months (May through September), wind directions are more random, although winds from the northern or southeastern sectors are slightly more predominant.

During periods of strong wind, dust may impact air quality across the region. An average of 15 air-stagnation events occurs annually in the PRB with an average duration of two days each (BLM 1974).

3.2 Topography and Physiography

3.2.1 Affected Environment

The general analysis area is a high plains area within the eastern portion of the PRB. The PRB is an elongated, asymmetrical structural downfold that is bounded by the Black Hills on the east; the Big Horn Mountains on

the west; the Hartville Uplift, Casper Arch, and Laramie Mountains on the south; and the Miles City Arch and the Yellowstone River on the north. The Cordero Rojo Mine is located on the gently dipping eastern limb of the structural downfold. The regional dip in the area of the mine is to the west.

Landforms of the area consist of a dissected rolling upland plain with low relief, broken by low red-capped buttes, mesas, hills, and ridges. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. Elevations in the PRB range from less than 2,500 ft to greater than 6,000 ft above sea level. The major river valleys have wide, flat floors and broad floodplains. The drainages dissecting the area are incised, typically are ephemeral or intermittent, and do not provide year-round water sources.

The general analysis area is drained by the Belle Fourche River, which is the most prominent topographic feature. The topography is comprised of the Belle Fourche River bottomlands, rough breaks, and gently rolling uplands. Elevations range from about 4,510 ft to 4,770 ft above sea level and slopes range from flat to around 40 percent. Predominant habitat types within the LBA tract and adjacent area consist of sagebrush-grassland with areas of upland-grassland. Rough breaks and bottomland or riparian areas occur in the southern portion. The Belle Fourche River passes through the southern part of the tract from west to east. Overall, the Maysdorf LBA Tract is similar in topography to the rest of the Cordero Rojo Mine permit area.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action and Alternatives 2 and 3

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

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography of the Maysdorf LBA Tract ranges from relatively flat to gently rolling hills. Slopes range from flat to around 40 percent, as discussed above, and the average slope is about four to five percent. The expected postmining topography would be similar to the premining topography, but somewhat gentler and more uniform. Following reclamation, the average surface elevation on the LBA tract as proposed would be

approximately 20.5 ft lower due to coal removal. The removal of the coal would be partially offset by the swelling that occurs when the overburden (and interburden, if present) is blasted and removed. Table 3-2 presents the approximate postmining surface elevation change for the LBA tract as applied for under the Proposed Action and Alternatives 2 and 3. After the coal is removed, the land surface would be restored to approximate original contour or to a configuration approved by WDEQ/LQD when the mining and reclamation permit for the existing mine is amended to include coal removal from the LBA tract.

Direct adverse impacts resulting from topographic moderation 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. These impacts, which would be greater in those areas characterized as rough breaks, may result in a long-term reduction in the carrying capacity for some species. A direct beneficial impact of the lower and flatter terrain would be reduced water runoff, which would allow increased infiltration and result in a minor reduction in peak flows. This may help counteract the potential for increased erosion that could occur as a result of higher near-surface bulk density of the reclaimed soils (Section 3.8.2). It may also increase vegetative productivity, and potentially accelerate recharge of groundwater.

The approximate original drainage pattern, including the diverted portion of the Belle Fourche River, would be restored. Stockponds 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

Table 3-2. Comparison of Average Overburden and Coal Thicknesses and Approximate Postmining Surface Elevation Changes Under the No Action and Action Alternatives.

	No Action Alternative (Existing Leases)	**Proposed Action (As Applied For LBA Tract)**	**Alternatives 2 and 3**
Average Overburden Thickness (ft)	140.0	222.0	238.5
Average Coal Thickness (ft)	60.0	62.1	61.9
Swell Factor (percent)	17	17	17
Coal Recovery Factor (percent)	94	94	94
Postmining Elevation Change[1]	32.6 ft lower	20.5 ft lower	17.6 ft lower

[1] Reclaimed (postmining) elevation surface change calculated as:
(coal thickness × coal recovery factor) – (swell factor × overburden thickness).

would be designed to adequately support anticipated land use.

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

3.2.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the LBA tract. Mining operations and the associated impacts to topography and physiography would continue as permitted on the existing Cordero Rojo Mine leases. Table 3-2 presents the approximate postmining surface elevation change for the existing mine. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.2.3 Regulatory Compliance, Mitigation and Monitoring

The mined-out area must be restored to approximate original contour or other topographic configuration approved by WDEQ/LQD. The topographic configuration would be developed and approved as part of the required mining and reclamation plan for the Cordero Rojo Mine. WDEQ/LQD monitors topographic restoration by checking the as-built topography in the annual report filed by the mine to see if it conforms to the approved topography.

3.2.4 Residual Impacts

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

3.3 Geology, Mineral Resources, and Paleontology

3.3.1 General Geology and Coal Resources

3.3.1.1 Affected Environment

Stratigraphic units that would be impacted if the tract under consideration for leasing is mined include, in descending order, recent (Quaternary age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal seam). Figure 3-2 is a chart showing the stratigraphic relationships of the surface and subsurface geologic units in the general analysis area. Additional information about these units is included in the Groundwater section of this document (Section 3.5).

Surficial deposits in the general analysis area include alluvial and eolian deposits and weathered

Geologic Unit			Hydrologic Characteristics
RECENT ALLUVIUM HOLOCENE			Typically fine grained and poorly sorted sands interbedded with silts and clays in ephemeral drainages. Occasional, very thin, clean, interbedded sand lenses. More laterally extensive, thicker, and coarse-grained along the larger stream courses. Excessive dissolved solids generally make this aquifer unsuitable for domestic and agricultural use and marginal for livestock (Class III) use standards. Low infiltration capacity in ephemeral draws unless covered by sandy eolian blanket.
CLINKER HOLOCENE TO PLEISTOCENE			Baked and fused bedrock resulting from burning coal seams which ignite on the outcrop from lightning, manmade fires or spontaneous combustion. The reddish clinker (locally called scoria, red dog, etc.) formed by melting and partial fusing of overburden above the burning coal. The baked rock varies greatly in the degree of alteration; some is dense and glassy while some is vesicular and porous. It is commonly used as a road construction material and is an aquifer wherever saturated. Considered to be part of the Wasatch Formation.
WASATCH FORMATION EOCENE			Lenticular fine sands interbedded in predominantly very fine-grained siltstone and claystone may yield low to moderate quantities of poor to good quality water. The discontinuous nature and irregular geometry of these sand bodies result in low overall permeabilities and very slow groundwater movement in the overburden on a regional scale. Water quality in the Wasatch Formation generally does not meet Wyoming Class I (drinking water) standards due to the dissolved mineral content. Some wells do, however, produce water of considerably better quality that does meet the Class I standard.
FORT UNION FORMATION PALEOCENE	TONGUE RIVER MEMBER	W — A, C	The coal serves as a regional groundwater aquifer and exhibits highly variable aquifer properties. Permeability and porosity associated with the coal arise almost entirely from fractures. Coal water typically does not meet Class I or Class II (irrigation) use standards. In most cases, water from coal wells is suitable for livestock use. The coal water is used throughout the region as a source of stock water and occasionally for domestic use. W = Wyodak Coal; A = Anderson Coal; C = Canyon Coal
	LEBO MEMBER		The Lebo member, also referred to as the "Lebo Confining Layer" or "Lebo Shale". Has a mean thickness of 711 ft in the PRB and a thickness of about 400 ft in the vicinity of Gillette. The Lebo typically yields small quantities of poor quality groundwater. Where sand content is locally large, caused by channel or deltaic deposits, the Lebo may yield as much as 10 gpm.
	TULLOCK MEMBER		The Tullock member has a mean thickness of 785 ft in the PRB and a mean sand content of 53 percent which indicates that the unit generally functions well as a regional aquifer. Yields of 15 gpm are common but vary locally and may be as much as 40 gpm. Records from the SEO indicate that maximum yields of approximately 300 gpm have been achieved from this aquifer. Water quality in the Tullock Member often meets Class I standards. The extensive sandstone units in the Tullock Member are commonly developed regionally for domestic and industrial uses. The City of Gillette is currently using eight wells completed in this zone to meet part of its municipal water requirements.
LANCE FORMATION UPPER CRETACEOUS	UPPER LANCE		Silty, calcareous sandstones and interbedded sandy shales, claystones, and coals. Provides yields generally less than 20 gpm. Higher yields can occur where sand thicknesses are greatest. Water quality is typically fair to good. Also referred to as the "Upper Lance Confining Layer".
	FOX HILLS SANDSTONE		Marine sandstones and sandy shales. Has a mean thickness of 666 ft and a mean sand content over 50 percent in the PRB. Yields up to 200 gpm are common; however, yields can be significantly less. Water quality is good, with TDS concentrations commonly less than 1,000 mg/L. The City of Gillette is currently using five wells completed in this aquifer to meet municipal water requirements.
LEWIS FORMATION UPPER CRETACEOUS	PIERRE SHALE		This unit is comprised predominantly of marine shales with only occasional local thin sandstone lenses. Maximum yields are minor and overall the unit is not water bearing. Water obtained from this unit is poor with high concentrations of sodium and sulfate as the predominant ions in solution.

Compiled from Hodson et al. (1973) and Lewis and Hotchkiss (1981).

Figure 3-2. Stratigraphic Relationship and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, PRB, Wyoming

Wasatch Formation. Alluvial deposits occupy the Belle Fourche River valley and the lower portions of tributary draws where they join the river.

The Eocene Wasatch Formation forms most of the overburden in the general analysis area. The boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation is not distinct. From a practical standpoint, the top of the mineable coal zone is considered as the contact between the two formations. As indicated in Table 3-2, overburden thicknesses in the Maysdorf LBA Tract as applied for and under Alternatives 2 and 3 average about 222 feet and 239 feet respectively. As discussed in Section 3.2.1, the regional dip in this area is to the west; as a result, the overburden thickness is generally thinner to the east and increases to the west.

As shown in Figure 3-2, the Fort Union Formation is divided into three members: the Tongue River, the Lebo, and the Tullock, in descending order.

The mineable coal seams in the PRB are part of the Tongue River Member of the Fort Union. At the Cordero Rojo Mine and within the Maysdorf LBA Tract, there is one mineable coal seam. Locally, this coal zone is referred to as either the Wyodak or the Wyodak-Anderson. On the Maysdorf LBA Tract as applied for and Alternatives 2 and 3, the Wyodak coal seam averages about 62 ft in thickness (Table 3-2). Up to five noncoal splits or partings occur within the seam, but they are typically local, discontinuous lenses of carbonaceous clay or shale that are less than one ft thick.

As discussed in Chapter 2, a "no-coal" zone is present within the tract. It trends east-west throughout the central portion of Section 4, T.46N., R.71W. It is postulated that an ancient drainage channel (or paleochannel) eroded and removed the coal in this area and replaced it with unconsolidated fine sand, occasional gravel, and silty clays (CMC 2004a).

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined in the PRB has a higher heating value and lower sulfur content south of Gillette than north of Gillette. According to the analyses (which were done on an as-received basis) of exploration drilling samples collected in the LBA tract as proposed, the average heating value of the coal is approximately 8,445 Btu/lb, with an average of about 0.3 percent sulfur, and 1.3 percent sodium. For Alternatives 2 and 3, the average heating value of the coal is approximately 8,470 Btu/lb, with an average of about 0.3 percent sulfur, and 1.3 percent sodium, according to the coal exploration samples analyzed. [See Section 2.4 for a discussion of BLM's estimate of coal quality under BLM's preferred alternative (Alternative 3).]

3.3.1.2 Environmental Consequences

3.3.1.2.1 Proposed Action and Alternatives 2 and 3

The geology from the base of the coal seam mined to the land surface would be subject to permanent change after the coal is removed on the LBA tract under the Proposed Action or Alternatives 2 and 3. The subsurface characteristics of these lands would be radically changed by mining. The replaced overburden and interburden (backfill) would be a mixture of the geologically distinct layers of sandstone, siltstone, and shale that currently exist. As a result, there would be an alteration of the physical characteristics of the backfill.

Mining would remove an average of 222 ft of overburden and 62 ft of coal on about 2,076 acres under the Proposed Action. Mining would remove an average of 238.5 ft of overburden and 62 ft of coal on about 3,160 acres under BLM's preferred tract configuration for Alternatives 2 and 3. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternatives 2 and 3. Table 3-2 presents the average overburden and coal thicknesses for the Maysdorf LBA Tract as applied for and Alternatives 2 and 3.

The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 264 ft in thickness under the Proposed Action and about 283 ft in thickness under Alternatives 2 and 3. Approximately 216.5 million additional tons of coal would be recovered under the Proposed Action, compared to an estimated 317.6 million tons under BLM's preferred tract configuration for Alternatives 2 and 3.

3.3.1.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the Maysdorf LBA Tract. Table 3-2 presents the average overburden and coal thicknesses for the existing Cordero Rojo Mine permit area, which represents the No Action Alternative. Mining operations and associated impacts would continue as permitted on the existing adjacent Cordero Rojo Mine coal leases for about nine additional years. There would be impacts to the overburden on portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine as a result of recovery of the remaining coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.3.1.3 Regulatory Compliance, Mitigation and Monitoring

Drilling and sampling programs are conducted on existing leases by all mine operators to identify overburden material that may be unsuitable for reclamation (i.e., material that is not suitable for use in reestablishing vegetation or that may affect groundwater quality due to high

concentrations of certain constituents, such as selenium, or adverse pH levels). As part of the mine permitting process, each mine operator develops a management plan to ensure that this unsuitable material is not placed in areas where it may affect groundwater quality or revegetation success. Each mine operator also develops backfill monitoring plans as part of the mine permitting process to evaluate the quality of the replaced overburden. These plans are in place for the existing Cordero Rojo Mine and would be developed for the Maysdorf LBA Tract if it is leased.

3.3.1.4 Residual Impacts

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

3.3.2 Other Mineral Resources

3.3.2.1 Affected Environment

3.3.2.1.1 Conventional Oil and Gas

The Maysdorf LBA Tract overlies geologic structures that contain producible quantities of oil. WOGCC records indicate that 277 conventional wells have been drilled in T.46N., R.71W. and T.47N., R.71W. The Pennsylvanian-Permian Minnelusa Formation and Cretaceous Muddy Formation have produced oil and gas in the vicinity of the Maysdorf LBA Tract (WOGCC 2005a). The Minnelusa is the only formation presently producing. IHS Energy reports as of May 2005 indicate that no non-Minnelusa wells have been completed for production in the area of the LBA tract since 1981.

The wells completed in the Minnelusa Formation produce from discontinuous, marginal marine, eolian sandstone deposits. As a result, Minnelusa Formation reservoirs tend to be small and irregularly distributed. Most of the Minnelusa wells in this area were drilled in the early 1980s, and development has tended to occur on a 40-acre well spacing. There are currently four Minnelusa wells that are capable of producing in the Maysdorf LBA Tract as applied for. Cumulative production from these four wells is more than 600,000 barrels of oil.

See Section 3.11 for discussion of the ownership of the oil and gas resources in the LBA tract.

3.3.2.1.2 Coal Bed Natural Gas (CBNG)

The following discussion is based on a report on conventional oil and gas and CBNG resources in the area of the Maysdorf LBA Tract prepared by the Wyoming BLM's Reservoir Management Group (BLM WSO-RMG 2005a).

CBNG has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field, west of the Eagle Butte Mine (De Bruin and Lyman 1999). The predominant CBNG production to date in the PRB has occurred from coal beds of the Wyodak - Anderson zone, which is the same zone that is being mined by the

surface coal mines in the PRB. CBNG is being produced locally from other deeper seams in the PRB. Several wells in the vicinity of the Maysdorf LBA Tract are completed in the deeper Pawnee coal seam. These wells have produced substantial amounts of water but little to no gas, and are currently shut-in (WSO-RMG 2005a, WOGCC 2006).

Extensive development of CBNG in the Wyodak-Anderson coal has occurred in the vicinity of the Maysdorf LBA Tract. WOGCC records show that as of late May, 2005, more than 350 wells had been drilled for CBNG production in Ts.46 and 47N., R.71W. The most extensive CBNG development has occurred west of the LBA tract. Twenty-four wells have been completed and are (or have been) capable of producing from the Wyodak-Anderson coal zone in the sections that include the Maysdorf LBA Tract under the Proposed Action.

CBNG wells were initially drilled on 40-acre spacing in the Wyoming PRB. Production/reservoir analyses that have been submitted to the WOGCC in various public hearings have indicated that CBNG wells in the PRB will produce reserves from larger areas than 40 acres. As a result, the WOGCC established an 80-acre spacing pattern as the default spacing for CBNG wells completed in the PRB within the Fort Union and Wasatch Formations. Most CBNG wells on and near the Maysdorf LBA Tract were drilled on a 40-acre pattern, either because the wells were drilled before the spacing was changed to 80 acres or under the authorization of spacing exceptions granted by WOGCC. Certain townships in the PRB are exempt from the 80-acre spacing pattern rule, including Ts.46 and 47N., R.71W. (WOGCC 2005b). Although CBNG has been produced in this area for almost 10 years, there are still undrilled 40-acre spacing units in and around the Maysdorf LBA Tract and there has been little recent interest in drilling additional wells in this area. According to WSO-RMG, no new CBNG wells have been completed on or adjacent to the LBA Tract since 1998.

The ownership of oil and gas resources in the LBA tract, which includes the CBNG resources, is discussed in Section 3.11.

3.3.2.1.3 Other Minerals

Bentonite, uranium, and scoria are commercially produced in the PRB in addition to conventional oil and gas and CBNG (WSGS 2004a and 2005a).

Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined around the edges of the PRB. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including drilling mud and cat litter. No mineable bentonite reserves have been identified on the Maysdorf LBA Tract under any of the alternatives.

There are substantial uranium resources in Campbell and Converse Counties. There are currently two operating in-situ uranium recovery

sites in the PRB, which were recently combined into one operation that is located in central Converse County (WSGS 2005b). No known uranium reserves exist within the general analysis area.

Scoria, also called clinker or burn has been and continues to be a major source of aggregate for road construction in the area due to the shortage of more competent materials. Scoria consists of sediments that were baked, fused, or melted in place when the underlying coal burned spontaneously. Scoria is present within the Cordero Rojo Mine permit area, predominantly east of the coal limit. Scoria does not occur on the LBA tract as applied for under the Proposed Action or within the additional area evaluated under Alternatives 2 and 3. See Section 3.5.1.1.2 for additional information on scoria.

A search of the BLM mining claim index revealed that no active mining claims are presently located on the Maysdorf LBA Tract.

3.3.2.2 Environmental Consequences

3.3.2.2.1 Proposed Action and Alternatives 2 and 3

During mining, other minerals present on the LBA tract could not be developed. Some of these minerals could, however, be developed after mining. Before mining operations could begin, all oil and gas wells would have to be abandoned, and all oil and gas production equipment would have to be removed to a level below the coal.

The conventional oil and gas reservoirs and the CBNG reservoirs below the Wyodak-Anderson coal, including the Pawnee coal, would not be directly disturbed by removal of the Wyodak-Anderson coal. The oil and gas lessee could re-complete old wells or drill new wells to recover oil and gas resources from any subcoal oil and gas reservoirs following mining and reclamation. This would only occur if they believe that the value of the reserves would justify the expense of recompleting or drilling wells.

The BLM WSO-RMG reviewed the existing conventional oil and gas production data in the general analysis area (WSO-RMG 2005a). Sufficient production data are available from Minnelusa wells in the vicinity of the tract to prepare reserve estimates using decline analyses. As discussed above, WOGCC records show that there are currently four Minnelusa wells located on the LBA tract as applied for that are capable of producing. These wells include two producers, one shut-in well and one injector well. According the WSO-RMG's evaluation, these wells appear to have exhausted most of their recoverable reserves and there has been little interest in exploration and development of Minnelusa reservoirs in this area in recent years.

CBNG resources that have not been recovered from the Wyodak-Anderson zone prior to mining would be lost when the coal is removed. Coal seam dewatering in advance of, and as a result of, open pit mining also reduces the hydrostatic pressure,

which may allow CBNG to desorb and escape from the coal bed.

For the purposes of this EIS, the BLM WSO-RMG reviewed the existing CBNG resource and production data in the general analysis area (WSO-RMG 2005a). CBNG development was initiated in this area in the mid- to late-1990s, which is relatively early in the PRB CBNG play. As a result, there is generally sufficient production data available to estimate well life and reserves for existing CBNG wells on the Maysdorf LBA Tract.

WSO-RMG prepared decline analyses, using IHS Energy's "Powertools" software, for all the CBNG wells in Ts.46 and 47N., R.71W. Decline analyses prepared for 24 wells located in the sections containing the LBA tract are considered to be most representative of the tract itself. Combined, these 24 wells have an approximate average cumulative production of 80,000 mcf and an average estimated ultimate recovery of 86,000 mcf. Typical economic life for these wells might range from 3.7 to 7.3 years.

WSO-RMG analyzed production in two sections in the vicinity of the Maysdorf LBA Tract (Section 6 and 7, T.47N., R.71W.) which have had wells drilled and produced on most of the 16 possible 40-acres spacing units. This analysis indicated that cumulative production and estimated ultimate recoveries for the 24 wells drilled in these two sections are roughly half what would be projected by a combined 24-well analysis assuming uniform 40-acre reservoir drainage. This supports the concept that the wells in the area of the Maysdorf LBA Tract are draining more than 40 acres and helps explain the recent lack of applications to drill the remaining undrilled 40-acre parcels in and adjacent to the tract.

In 2000, the WSO-RMG and USGS collected data, including coal gas content, from the Wyodak-Anderson zone in a coal core hole located within the Caballo Mine area (Section 16, T.48N., R.71W.) about five miles north of the Maysdorf LBA Tract. Based on the core desorption analysis, the average gas content of the coal cores when they were taken was approximately 8.3 scf/ton (USGS 2005). The coal cores that were collected at the Caballo Mine site had a slightly higher apparent rank than the coal in the Maysdorf LBA Tract area. As a result, the coal cores would be expected to have slightly higher gas content than the coal within the LBA tract. In their lease application, CMC estimated that the Maysdorf LBA Tract includes approximately 234.8 million tons of in-place coal resources, as applied for. Assuming a gas content of 8.3 scf/ton in 2000, WSO-RMG estimated that 234.8 million tons of coal would have contained approximately 1,948,840 mcf of CBNG. Total cumulative production from the 24 wells in the sections containing the LBA tract has actually been 1,919,793 mcf of CBNG, with a total estimated ultimate CBNG recovery of 2,061,319 mcf. The EUR is greater than the gas-in-place estimated for the tract, but the estimate is within the range of uncertainty resulting from production and reservoir

depletion that occurred in this area before the coal cores that were collected desorbed.

These analyses suggest that most of economically recoverable CBNG resources in the vicinity of the LBA tract have been recovered from the Wyodak-Anderson zone and that there are insufficient remaining reserves to support additional drilling. This conclusion is further supported by the lack of new drilling activity on the LBA tract since 1998. Therefore, mining the Maysdorf LBA Tract is unlikely to affect, or be affected by, production of CBNG from the Wyodak-Anderson zone.

Section 3.11.1 includes a discussion on the ownership of the oil and gas resources on the LBA tract and the oil and gas facilities in the area of the tract.

3.3.2.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the Maysdorf LBA Tract. Mining operations would continue to limit the development of other mineral resources described above and in Table 2-3 on the existing adjacent Cordero Rojo Mine coal leases and on portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine, which would be disturbed to recover the coal in the existing leases. Mineral development limitations related to mining operations at the Cordero Rojo Mine would not be extended onto portions of the LBA tract that will not be affected under the current mining and reclamation plan.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.3.2.3 Regulatory Compliance, Mitigation and Monitoring

The reservoir analyses conducted by the BLM WSO-RMG indicate that most of the recoverable conventional oil and gas and CBNG resources on the Maysdorf LBA Tract have probably been produced by the existing wells. Potential does exist for conflicts between coal operations and CBNG wells completed in coal zones below the Wyodak-Anderson seam.

If the federal coal in the tract is leased and conflicts do develop between the operators of the oil and gas wells and the surface coal mine operator, there are several mechanisms that can be used to facilitate recovery of the conventional oil and gas and CBNG resources prior to mining. These include:

- BLM will attach a Multiple Mineral Development stipulation to the Federal coal lease, which states that BLM has the authority to withhold approval of coal mining operations that would interfere with the development of mineral leases issued prior to the coal lease (see Appendix D).

- Conventional oil and gas wells must be abandoned while

mining and reclamation operations are in progress but could be recompleted or redrilled following mining if the value of the remaining reserves would justify the expense of reestablishing production.

- BLM has a policy in place on CBNG-coal conflicts (BLM Instruction Memorandum No. 2006-153), which directs BLM decision-makers to optimize the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006a). This memorandum offers royalty incentives to CBNG operators to accelerate production in order to recover the natural gas while simultaneously allowing uninterrupted coal mining operations. In addition, this memorandum also states that it is the policy of the BLM to encourage oil and gas and coal companies to resolve conflicts between themselves; when requested, the BLM will assist in facilitating agreements between the companies.

- Mining of the Maysdorf LBA Tract cannot occur until the coal lessee has a permit to mine the tract approved by the WDEQ/LQD and a MLA mining plan approved by the Secretary of the Interior. Before the MLA mining plan can be approved, BLM must approve the R2P2 for mining the tract. Prior to approving the R2P2, BLM can review the status of CBNG and conventional oil and gas development on the tract and the mining sequence proposed by the coal lessee. The permit approval process generally takes the coal lessee several years, during which time CBNG resources can be recovered.

- Prior to mining the Federal coal, the coal lessee can negotiate an agreement with owners and operators of existing oil and gas facilities on the tract, including owners and operators of oil and gas well and pipeline facilities, regarding removal and relocation of those facilities prior to mining.

3.3.2.4 Residual Impacts

CBNG resources not recovered prior to mining would be vented to the atmosphere and permanently lost.

3.3.3 Paleontology

3.3.3.1 Affected Environment

The formation exposed on the surface of the Maysdorf LBA Tract is the sedimentary Eocene Wasatch Formation, which is known to produce fossil vertebrates of scientific significance throughout Wyoming, including the PRB (Delson 1971, Winterfeld 1978, EVG 2001).

BLM ranks areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The Wasatch Formation is ranked as fulfilling BLM Paleontology Condition No. 1, which is described in the

Paleontological Resource Management Handbook 8270-I as "areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils." According to the handbook, "consideration of paleontological resources will be necessary if the Field Office review of available information indicates that such fossils are present in the area".

The BLM in Wyoming uses an additional planning tool, called the PFYC, to classify geological units, usually at the formation or member level, according to the probability that they will yield paleontological resources that are of concern to land managers. This classification system is based largely on how likely a geologic unit is to produce scientifically significant fossils. BLM considers the Wasatch Formation to fulfill either the PFYC Class 4 or Class 5, depending on the nature of bedrock exposures present. PFYC classes 4 and 5 are described as follows:

> Class 4 - These geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.
>
> Class 5 - Fossilferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant non-vertebrate (plant and invertebrate) fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

Although the Wasatch Formation is known to produce fossil vertebrates of scientific significance in Wyoming, outcrops of the Wasatch Formation in the PRB are not generally well-exposed and the conditions of deposition of the formation have contributed to a low preservation potential for fossils. Vertebrate fossils that have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores, and multituberculates; reptiles such as crocodilians, alligators, lizards, and turtles; birds; eggs; amphibians; and fish. Non-marine invertebrates such as mollusks and ostrocods have also been described from the Wasatch.

Fossil plant material is common in the Wasatch Formation. The fossil plants inventoried are primarily leaves and fossilized wood. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. Fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

A paleontological resource evaluation of the Maysdorf general analysis area was conducted in June 2005 by EVG. The evaluation included a pre-field

geology and paleontology review and a pedestrian field examination for fossils along rock outcrops. A primary goal of the evaluation was to locate unique localities of fossilized vertebrate skeletal material and evidence (trace fossils) such as those reported to occur in the Wasatch Formation within the PRB. Seven fossil localities were identified as a result of the records search, none of which were unique finds or occur within the LBA tract under the Proposed Action or within the area added under Alternatives 2 and 3. Five fossil localities (two plant, one invertebrate, and two vertebrate) were identified during the field survey. These localities occur in exposures of the Wasatch Formation south of the Belle Fourche River in Sections 9, 10, and 14, T.46N., R.71W. None of the fossil material found at these localities is considered to have much scientific significance and as a result no specimens were collected. Vertebrate fossils appear to be very scarce. Fossil wood is much more common and observed at many unrecorded locations, particularly associated with coal.

No significant or unique paleontological resource localities have been recorded on federal lands in the general analysis area and no specific mitigation has been recommended for paleontology.

3.3.3.2 Environmental Consequences

3.3.3.2.1 Proposed Action and Alternatives 2 and 3

The rock outcrops present on the Maysdorf LBA Tract were examined for the presence of fossils, as discussed above, and no scientifically significant fossils were located. Fossils with scientific significance could be present on the tract but not exposed at the surface. If the tract is leased under the Proposed Action or Alternatives 2 and 3, paleontological resources located on the tract that are not exposed on the surface would be destroyed when the overburden is removed.

3.3.3.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the Maysdorf LBA Tract. Mining operations and the associated potential impacts to paleontological resources described above would continue as permitted on the existing adjacent Cordero Rojo Mine coal leases and on portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine, which would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.3.3.3 Regulatory Compliance, Mitigation and Monitoring

If the Maysdorf LBA Tract is leased, BLM will attach a stipulation to the lease requiring the operator to report significant paleontological finds to the authorized federal agency and suspend production in the vicinity of the find until an approved

paleontologist can evaluate the paleontological resource (Appendix D).

3.3.3.4 Residual Impacts

Paleontological resources that are not identified and removed prior to or during mining operations would be lost.

3.4 Air Quality

3.4.1 Background

The air quality of any region is controlled primarily by the magnitude and distribution of pollutant emissions and the regional climate. The transport of pollutants from specific source areas is strongly affected by local topography. In the mountainous western United States, topography is particularly important in channeling pollutants along valleys, creating upslope and downslope circulations that may entrain airborne pollutants, and blocking the flow of pollutants toward certain areas. In general, local effects are superimposed on the general weather regime and are most important when the large-scale wind flow is weak.

Wyoming can be characterized as having a combination of both highland and mid-latitude semiarid climates. The dominant factors that affect the climate of the area are elevation, local relief, and the mountain barrier effect. This barrier effect can produce marked temperature and precipitation differences between windward and leeward slopes. Generally, temperature decreases and precipitation increases with increasing elevation. See Section 3.1.1 for additional information about the climate in the general analysis area.

The general analysis area, shown in Figure 3-1, is located in the east-central portion of the PRB, a part of the Northern Great Plains that includes most of northeastern Wyoming. As discussed in Section 3.2.1, the topography is primarily rolling plains and tablelands of moderate relief (with occasional valleys and buttes). Elevations range from about 4,510 ft to 4,770 ft above sea level. The Big Horn Mountains lie approximately 60 miles to the west and the Black Hills lie approximately 60 miles to the east.

3.4.1.1 Regulatory Framework

Regulations applicable to surface coal mining may include NAAQS/WAAQS, PSD, NSPS, and the Federal Operating Permit Program (Title V). These regulatory programs are described below.

Air pollution impacts are limited by local, state, tribal, and federal air quality regulations and standards, and implementation plans established under the federal CAA and the CAAA of 1990. In Wyoming, air pollution impacts are managed by WDEQ/AQD under the WAQSR and the EPA approved State Implementation Plan. A fundamental requirement of both federal and state regulations is that ambient concentrations for specific pollutants do not exceed allowable levels, referred to as the Ambient Air

Quality Standards (or AAQS). The EPA and the State of Wyoming have established these standards at levels deemed necessary to preclude adverse impacts on human health and welfare. The National AAQS (or NAAQS) set nationwide thresholds for maximum acceptable concentrations of various pollutants. Currently the EPA has established NAAQS for six pollutants, which are also known as "criteria pollutants". The State of Wyoming has also established ambient air quality standards (or WAAQS) for those pollutants that are as stringent as or more stringent than the NAAQS, and are enforceable under WAQSR. Selected NAAQS and WAAQS are shown in Table 3-3. The NAAQS and WAAQS are health-based criteria for the maximum acceptable concentrations of criteria pollutants at all locations to which the public has access.

Pursuant to the CAA, the EPA has developed classifications for distinct geographic regions known as air basins and for major MSAs. Under these classifications, for each federal criteria pollutant, each air basin (or portion of a basin or MSA) is classified as in "attainment" if the area has "attained" compliance with (that is, not exceeded) the adopted NAAQS for that pollutant or is classified as "non-attainment" if the levels of ambient air pollution exceed the NAAQS for that pollutant. Areas for which sufficient ambient monitoring data are not available are designated as "unclassified" for those particular pollutants. States designate areas within their borders as being in "attainment" or "non-attainment" with the AAQS. Existing air quality throughout most of the PRB in Wyoming is in attainment with all ambient air quality standards, as demonstrated by comparing the background concentration levels with the AAQS concentration levels presented in Table 3-3. However, the Sheridan, Wyoming area has been designated as a non-attainment area (PM_{10} – moderate) where the applicable standards have been violated in the past.

A company initiating a project must go through the WDEQ/AQD New Source Review permitting process to obtain either a construction or modification permit or a permit waiver. During the New Source Review permitting process, applicants must demonstrate compliance with the AAQS standards; this can be done by modeling or other methods approved by the WDEQ/AQD Administrator. A project will typically model for criteria pollutants that would be emitted by the project in order to show the project's contribution to ambient air quality concentrations. The assumed background pollutant concentrations included in Table 3-3 were provided by WDEQ/AQD (BLM 2005a). The assumed background pollutant concentrations are below applicable NAAQS and WAAQS for all criteria pollutants and averaging times.

The PSD regulation is intended to prevent deterioration of air quality in areas that are in attainment with the NAAQS. The CAA requires EPA to place each airshed within the U.S. into one of three PSD area classifications. PSD Class I is the

Table 3-3. Assumed Background Air Pollutant Concentrations, Applicable AAQS, and PSD Increment Values (in µg/m³).

Criteria Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,336[3]	40,000	40,000	40,000	---	---
	8-hour	1,381	10,000	10,000	10,000	---	---
Nitrogen dioxide	Annual	5[4]	100	100	100	2.5	25
Ozone	8-hour	140[5]	157	157	157	---	---
Sulfur dioxide	3-hour	181[6]	---	1,300	1,300	25	512
	24-hour	62[6]	365	---	260	5	91
	Annual	13[6]	80	---	60	2	20
PM_{10}[7]	24-hour	54[8]	150	150	150	8	30
	Annual	13[8]	--	--	50	4	17
$PM_{2.5}$[7]	24-hour	19[9]	35	35	65	---	---
	Annual	7.6[9]	15	15	15	---	---

1 Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.
2 Primary standards are designed to protect public health; secondary standards are designed to protect public welfare.
3 Data collected by Amoco at Ryckman Creek for an eight-month period during 1978-1979, summarized in Riley Ridge EIS (BLM 1983).
4 Data collected at TBNG, Campbell County, Wyoming in 2002 (Source: WDEQ).
5 Data collected at TBNG, Campbell County, Wyoming in 2001-2003 (8-hour); 2002 (1-hour). (Source: WDEQ).
6 Data collected by Black Hills Power & Light at Wygen 2, Campbell County, Wyoming, in 2002.
7 On October 17, 2006, EPA published final revisions to the NAAQS for particulate matter which took effect on December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 µg/m³ and revokes the annual PM_{10} standard of 50 µg/m³. The State of Wyoming will enter into rulemaking to revise the WAAQS.
8 Data collected by AMAX coal at the Eagle Butte Mine, Campbell County, Wyoming, in 2002.
9 Data collected in Gillette, Wyoming in 1999.

Source: (BLM 2005a).

most restrictive air quality category. Mandatory federal Class I areas were designated by Congress and include international parks, national wilderness areas greater than 5,000 acres in size, national memorial parks greater than 5,000 acres in size, and national parks greater than 6,000 acres in size which were in existence on August 7, 1977 [40 CFR 52.21(e)]. These classifications may not be redesignated. All areas not established as Class I were designated as Class II areas, which allow a relatively greater deterioration of air quality over that in existence in 1977, although still within the NAAQS. No Class III areas, which would allow air quality to degrade to the NAAQS, have been designated. The federal land managers have also identified certain federal assets with Class II status as "sensitive" Class II areas for which air quality and/or visibility are valued resources. The federal CAA also provides for specific visibility protection of mandatory federal Class I areas.

Table 3-4 is a list of mandatory federal Class I areas, tribal Class I areas, and federal Class II areas that are of special interest in the region and their distance from the Maysdorf tract general analysis area. Wind Cave National Park, Badlands Wilderness Area, and the Northern Cheyenne Indian Reservation are the closest Class I areas to the Maysdorf LBA Tract. Most of the PRB in Wyoming is designated as PSD Class II with less stringent requirements. Even though the development activities being considered in this EIS would occur within areas designated as PSD Class II, the potential impacts are not allowed to cause incremental effects greater than the more stringent Class I thresholds to occur inside any distant PSD Class I area.

The PSD regulation prevents deterioration of air quality in attainment areas by establishing increments, or maximum allowable increases in the ambient concentration of PM_{10}, NO_2, and SO_2 for Class I and Class II areas. As shown in Table 3-3, the allowable incremental impacts for NO_2, PM_{10}, and SO_2 within PSD Class I areas are very limited.

Future development projects that have the potential to emit more than 250 tpy of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tpy) would be required to undergo a regulatory PSD increment consumption analysis under the federal New Source Review permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of BACT and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, or SO_2. Modifications to existing major PSD sources are also subject to PSD regulation if the modification results in a significant net emissions increase of any regulated pollutant. The net emissions increase is determined by adding the modification to the permits issued after a baseline date. In the PRB, the PM_{10} baseline year is 1997; the NO_2 baseline year is 1988.

To date, there are no coal mines within the State of Wyoming that

Table 3-4. Approximate Distances and Directions from the Maysdorf Tract General Analysis Area to PSD Class I and Class II Sensitive Receptor Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I Area		
Badlands Wilderness Area[1]	130	ESE
Bridger Wilderness Area	215	SW
Fitzpatrick Wilderness Area	210	WSW
Gates of the Mountain Wilderness Area	380	WNW
Grand Teton National Park	245	W
North Absaroka Wilderness Area	205	WNW
Red Rocks Lake Wilderness Area	325	WNW
Scapegoat Wilderness Area	420	NW
Teton Wilderness Area	220	W
Theodore Roosevelt National Park (North Unit)	270	NNE
Theodore Roosevelt National Park (South Unit)	225	NNE
U.L. Bend Wilderness Area	270	NNW
Washakie Wilderness Area	185	W
Wind Cave National Park	100	ESE
Yellowstone National Park	220	W
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	290	N
Northern Cheyenne Indian Reservation	110	NNW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	205	WNW
Agate Fossil Beds National Monument	135	ESE
Badlands National Park	130	ESE
Bighorn Canyon National Recreation Area	145	NW
Black Elk Wilderness Area	85	E
Cloud Peak Wilderness Area	80	WNW
Crow Indian Reservation	100	NW
Devils Towner National Monument	50	NE
Fort Belknap Indian Reservation	310	NNW
Fort Laramie National Historic Site	130	SSE
Jewel Cave National Monument	70	ESE
Mount Rushmore National Memorial	90	E
Popo Agie Wilderness Area	205	SW
Soldier Creek Wilderness Area	120	SE

[1] The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory Federal PSD Class I area. The remainder of Badlands National Park is a PSD Class II area.

have been subject to PSD review in the permitting process. Existing surface coal mining operations in the PRB, including the Cordero Rojo Mine, are not subject to PSD regulations for two reasons: 1) surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation; and 2) point-source emissions from individual mines have not exceeded the PSD emissions threshold. A new mine would be classified as a major source and subject to PSD review if potential emissions of any regulated pollutant would equal or exceed 250 tpy. Fugitive emissions are not included in the definition of potential emissions except for certain specified source types [40 CFR 52.21, (b)(1)(iii)]. Mining-related fugitive emissions are exempt from the applicability determination. This NEPA analysis compares potential air quality impacts from the Proposed Action and Alternatives 2 and 3 to applicable ambient air quality standards, PSD increments, and AQRVs (such as visibility), but it does not constitute a regulatory PSD analysis; rather, it is strictly for informational purposes.

All sources being permitted within the State of Wyoming must utilize BACT, not just sources subject to PSD review. During the New Source Review permitting process, a BACT analysis is performed for the proposed construction or modification. The BACT process evaluates possible control technologies for the proposed action on the basis of technical feasibility and economic reasonability. Decisions about which technology should be applied are made on a case-by-case basis and are mandated through the permit. See Section 3.4.2.3 for a discussion of BACT measures that have been applied at coal mines.

The NSPS were established by the CAA and adopted by reference into the WAQSR. The standards, which are for new or modified stationary sources, require the sources to achieve best-demonstrated emission control technology. The NSPS apply to specific processes that are listed in the standards. For surface coal mining in the PRB, this includes certain activities at coal preparation plants. The requirements applicable to these existing units can be found in 40 CFR Part 60, Subpart Y (Standards of Performance for Coal Preparation Facilities).

Major sources of air pollutants must obtain an operating permit from WDEQ/AQD Operating Permit Program (also known as Title V). A “major source” is, generally, a facility that emits over 100 tpy of any criteria pollutant, 25 tpy of combined HAPs or 10 tpy of an individual HAP. The operating permit compiles all applicable air quality requirements for a facility and specifies compliance assurance in the form of testing, monitoring, reporting, and recordkeeping requirements.

3.4.1.1.1 Surface Coal Mine Regulatory Framework

The WDEQ/AQD administers a permitting program to assist the agency in managing the state's air resources. Under this program, anyone planning to construct, modify,

or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category. A new coal mine or a modification to an existing mine must be permitted by WDEQ/AQD under WAQSR Chapter 6, Section 2 and must demonstrate that mining operations will comply with all applicable aspects of WAQSR. The following summarizes the construction/modification permitting analysis for surface coal mines.

When a company decides to construct a new surface coal mine or proposes a modification to an existing surface coal mine that will cause an increase in pollutant emissions, they must submit an application, which is reviewed by the WDEQ/AQD New Source Review staff and the applicable WDEQ/AQD Field Office. Typically, a company will meet with the WDEQ/AQD prior to submitting an application to determine issues and details that need to be included in the application. A surface coal mining application will include the standard application, BACT measures that will be implemented, an inventory of point and fugitive sources in the area, and modeling analyses.

BACT must be utilized for all sources being permitted within the State of Wyoming. WAQSR Chapter 6, Section 2(b)(v) lists BACT measures to be utilized by (but not limited to) large mining operations. Applicants use these and other BACT measures in the development of their own PM_{10} and NO_2 point and fugitive source inventories (see Section 3.4.2.3 for a discussion of mining BACT measures). During the application review, WDEQ/AQD can also require further control measures through the BACT review process.

For a coal mine PM_{10} modeling analysis, an applicant must put together an emission inventory of PM_{10} from their facility and surrounding sources. For PM_{10}, both point sources and fugitive dust emissions are quantified. The emissions are based on the facility's potential to emit in the highest production year. The applicant also examines the facilities at surrounding coal mines and their previous air quality permits to determine the worst-case emission year for those facilities, based on potential to emit. They then choose two or more years for modeling analyses.

Long-term PM_{10} modeling is conducted for the permit application to demonstrate compliance with the annual PM_{10} standard. Per WDEQ/AQD guidance, the Industrial Source Complex Long-Term Model, Version 3 (ISCLT3) is used for point sources. For fugitive emission sources, the FDM is used. A PM_{10} background concentration of 15 $\mu g/m^3$ and a NO_x background concentration of 20 $\mu g/m^3$ are used, which WDEQ/AQD has chosen as representative of background ambient air quality in the area prior to operation of coal mine sources. Potential emissions corresponding to the maximum production level from the coal mine undergoing permitting and other coal mines in the area are added to this background. The resulting particulate levels are then

compared to the average annual PM_{10} standard of 50 µg/m^3 and the average annual NO_x standard of 100 µg/m^3 to determine compliance with the annual WAAQS. This constitutes a demonstration of compliance with the "long-term" or annual WAAQS.

The background concentrations for PM_{10} and NO_x concentrations chosen by WDEQ/AQD are different than the background PM_{10} and NO_x concentrations shown in Table 3-3. The background values chosen by WDEQ/AQD are representative of background ambient air quality prior to coal mining. The values shown in the table are based on recently monitored values in the PRB and include all sources operating at the time the value was measured, including existing coal mine operations located around Gillette. The annual background values shown in Table 3-3 for PM_{10} and NO_x are based on data collected for a recent evaluation of potential cumulative air quality impacts in the PRB conducted by ENSR for the Wyoming and Montana (BLM 2006b), which is discussed in Chapter 4.

Short-term PM_{10} modeling is not required by WDEQ/AQD, nor does WDEQ/AQD consider it to be an accurate representation of short-term impacts. The CAAA (Section 234) mandates the Administrator of the EPA to analyze the accuracy of short-term modeling in regard to fugitive particulate emissions from surface coal mines. A June 26, 1996 letter from EPA Region VIII to Wyoming State Representatives states the results of a study where the short-term model failed to meet evaluation criteria and tended to over-predict 24-hr impacts of surface coal mines. The Memorandum of Agreement of January 24, 1994 between EPA Region VIII and the State of Wyoming allows WDEQ/AQD to conduct monitoring in lieu of short-term modeling for assessing coal mining-related impacts in the PRB. This regulatory procedure remains in place and in effect. Ambient particulate monitoring is required of each coal mine through conditions of their respective permits.

Coal mines in the PRB are also required to quantify NO_2 emissions from their facilities. Dispersion modeling is required to demonstrate compliance with the ambient standard. Potential emissions from diesel powered mining equipment and blasting are modeled. Train locomotive engine emissions are also quantified and included in the NO_2 modeling analysis.

The application is reviewed by WDEQ/AQD to determine compliance with all applicable air quality standards and regulations. This includes review of compliance with emission limitations established by NSPS, review of compliance with ambient standards through modeling analyses, and establishment of control measures to meet BACT requirements. The WDEQ/AQD-proposed permit conditions are placed on public notice for a 30-day review period, after which a final decision on the permit is made.

3.4.1.2 Emission Sources

Air quality conditions in rural areas in the PRB are likely to be very good, as they are characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and good atmospheric dispersion conditions, resulting in relatively low air pollutant concentrations. Occasional high concentrations of CO and particulate matter may occur in more urbanized areas (e.g., cities of Gillette, Sheridan, and Buffalo) and around industrial facilities, especially under stable atmospheric conditions that occur during winter.

The major types of emissions that come from surface coal mining activities are in the form of fugitive dust and tailpipe emissions from large mining equipment. Activities such as blasting, excavating, loading and hauling of overburden and coal, and the large areas of disturbed land all produce fugitive dust. Stationary or point sources are associated with coal crushing, storage, and handling facilities. In general, particulate matter (PM_{10}) is the major significant pollutant from coal mine point sources.

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous, orange-colored clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, as discussed in Section 3.4.3. NO_2 is one of several products resulting from the incomplete combustion of explosives used in the blasting process. Wyoming's ambient air standards for NO_2 are shown in Table 3-3.

Other existing air pollutant emission sources within the region include:

- exhaust emissions (primarily CO and NO_x) from existing natural gas fired compressor engines used in production of natural gas and CBNG; gasoline and diesel vehicle tailpipe emissions of combustion pollutants (VOCs, CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2);

- dust (particulate matter) generated by vehicle travel on unpaved graded roads, windblown dust from neighboring areas, agricultural activities such as plowing, and paved road sanding during the winter months;

- transport of air pollutants from emission sources located outside the region;

- emissions from railroad locomotives used to haul coal (primarily NO_2 and PM_{10}); and

- SO_2 and NO_x from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 80 miles south-southwest of the Maysdorf LBA Tract, and the Wyodak, Wygen, and Neil Simpson plants, located about 15 miles north of the Maysdorf LBA Tract.

3.4.2 Particulate Emissions

3.4.2.1 Affected Environment for Particulate Emissions

Until 1989, the federally regulated particulate matter pollutant was measured as TSP. This measurement included all suspendable dust (generally less than 100 microns in diameter). In 1989, the federally regulated particulate matter pollutant was changed from a TSP-based standard to a PM_{10}-based standard. PM_{10} is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. Wyoming added PM_{10} based standards to match the federal standards in 1989 and retained the TSP standards as state standards until March 2000. Wyoming's ambient air standards for PM_{10} are shown in Table 3-3. On September 21, 2006, EPA announced final revisions to the NAAQS for particulate matter, which were published in the *Federal Register* on October 17, 2006 and took effect December 18, 2006. The revision strengthens the 24-hour $PM_{2.5}$ standard from 65 to 35 µg/m^3 and revokes the annual PM_{10} standard of 50 µg/m^3. EPA retained the existing annual $PM_{2.5}$ standard of 15 µg/m^3 and the 24-hour PM_{10} standard of 150 µg/m^3. The State of Wyoming will enter into rulemaking to revise the Wyoming Ambient Air Quality Standards. Wyoming adopted 24-hour and annual $PM_{2.5}$ standards in March 2000, which are shown in Table 3-3.

3.4.2.1.1 Regional Particulate Emissions

As a result of WDEQ/AQD requirements for the PRB mines to collect air quality data, which is discussed in Section 3.4.2.3, the eastern PRB one of the most intensely monitored areas in the world. There are numerous monitors located at and adjacent to mining operations in the PRB (Figure 3-3). These include six TSP monitors, four $PM_{2.5}$ monitors and 30 PM_{10} monitors. Data for TSP date back to 1980 and data for PM_{10} date back to 1989. Through 2004, nearly 57,000 TSP and 27,000 PM_{10} samples had been collected. Table 3-5 uses the annual arithmetic average of all sites to summarize these data from 1980 through 2004.

As indicated in Table 3-5, the long-term trend in particulate emissions remained relatively flat through 1998. The overall average annual TSP concentration from 1980 through 1998 was 33.1 µg/m^3, with annual averages ranging between 27.8 µg/m^3 and 39.4 µg/m^3. There were increases in 1988 and 1996, which may have been the result of fires in the region during those years. Annual average PM_{10} concentrations from 1989 through 1998 were similarly relatively flat, ranging between 12.9 µg/m^3 and 16.5 µg/m^3, with an overall average of 15.4 µg/m^3.

This time period (1980-1998) was associated with significant growth in the surface coal mining industry. Coal production increased from about 59 mmtpy to over 293 mmtpy (an increase of almost 500 percent), and

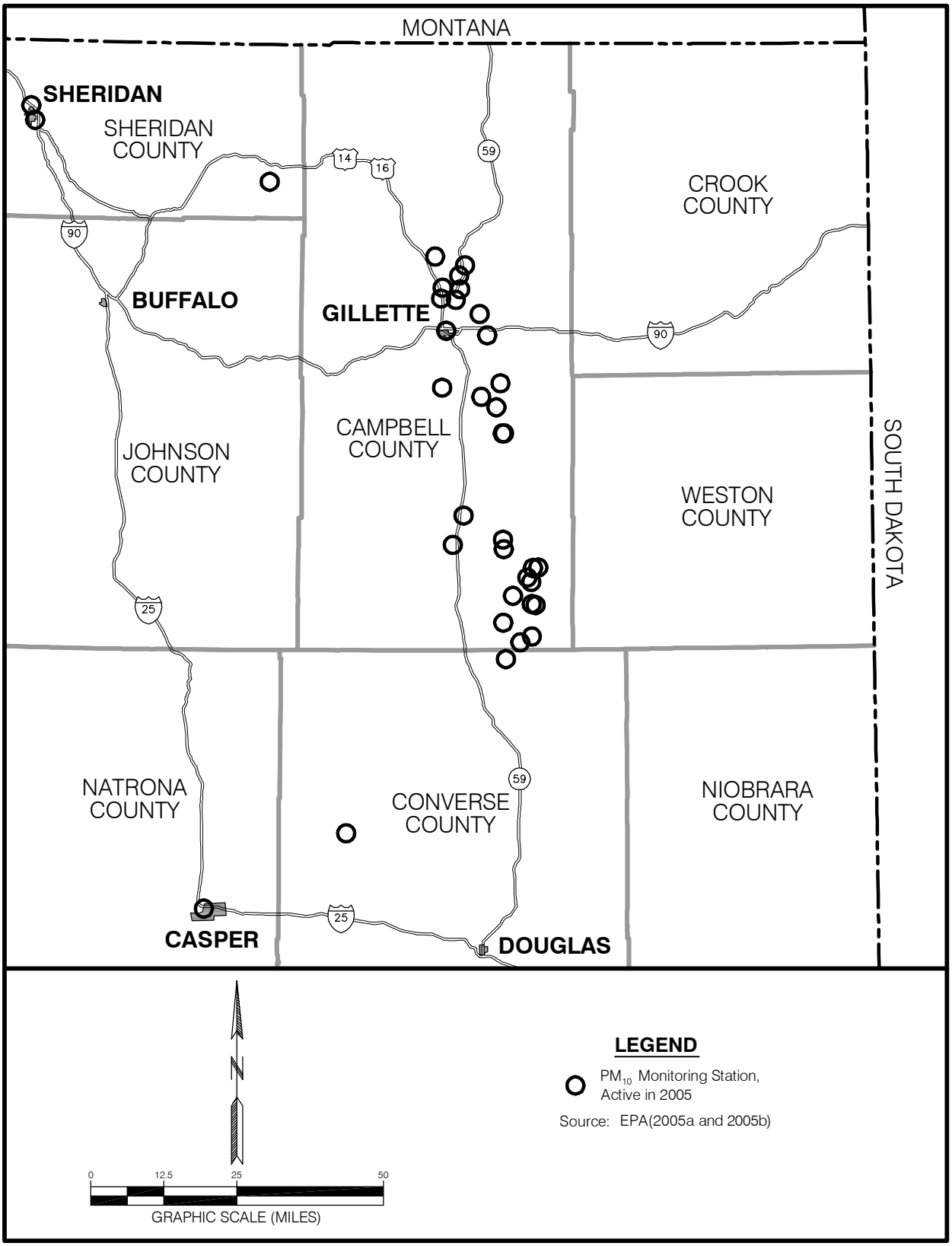


Figure 3-3. Active PM_{10} Monitoring Stations in Northeastern Wyoming.

Table 3-5. Summary of WDEQ/AQD Reports on Air Quality Monitoring in Wyoming's PRB, 1980-2004.

Year	Coal Produced (mmtpy)	Overburden Moved (mmbcy)	Number of Mines Operating/ Monitoring TSP/ Monitoring PM_{10}[1]	Number of TSP/PM_{10} Monitoring Sites[2]	TSP Average (µg/m³)	PM_{10} Average (µg/m³)
1980	58.7	105.3	10/14/0	34/0	35.5	na[3]
1981	71.0	133.4	11/13/0	35/0	39.4	na
1982	76.1	141.1	11/14/0	40/0	31.2	na
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	na
1986	111.2	165.7	16/17/0	45/0	29.3	na
1987	120.7	174.6	16/17/0	43/0	31.7	na
1988	138.8	209.7	16/17/0	43/0	37.7	na
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	220.1	17/17/5	47/5	34.3	14.8
1991	171.4	242.3	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	293.5	669.0	16/17/12	36/17	33.9	15.9
1999	317.1	762.9	15/17/12	36/18	55.3	21.6
2000	322.6	868.9	15/15/12	31/17	56.1	23.4
2001	354.1	927.7	12/11/12	29/29	57.5	27.2
2002	359.7	1,032.1	13/11/13	23/38	56.0	23.3
2003	363.6	1,044.2	13/10/13	16/34	51.9	20.8
2004	381.6	1,184.4	13/5/13	6/36	--[4]	20.0

1 Mines include Buckskin, Rawhide, Eagle Butte, Dry Fork, Fort Union (acquired by Dry Fork), Clovis Point (acquired by Wyodak), Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Rochelle, North Antelope, Rochelle, Antelope, and Dave Johnston.

2 Some sites include more than one sampler, so the number of samplers is greater than the number of sites.

3 Not applicable because no monitoring for PM_{10} was done.

4 Data no longer pertinent due to paucity of monitoring sites.

Sources: 1980 through 1996 emissions and production data from April 1997 report prepared by WMA for WDEQ/AQD. 1997 through 2004 emissions data from EPA AirData and WDEQ/AQD databases (EPA 2005a, WDEQ/AQD 2005b). 1997 through 2004 production data from WDEQ/AQD and Wyoming State Inspector of Mines (WDEQ/AQD 2005c and Wyoming Department of Employment 1997-2004).

associated overburden production increased from 105 mmbcy to 669 mmbcy per year (an increase of over 600 percent). From 1990 through 2004, the average annual increase in coal production was 6.5 percent, while annual overburden production increased an average of 13.1 percent over the same time period. The larger annual increase in overburden production is probably due to the fact that the mines are gradually moving into deeper coals as the shallower reserves are mined out.

The relatively flat trend in particulate emissions from 1980 through 1998 is due in large part to the Wyoming Air Quality Program that requires BACT at all permitted facilities. BACT control measures, which include watering and chemical treatment of roads, limiting the amount of area disturbed, temporary revegetation of disturbed areas to reduce wind erosion, and timely final reclamation, are discussed in Section 3.4.2.3.

The average annual TSP concentration increased from 33.9 $\mu g/m^3$ in 1998 to 55.3 $\mu g/m^3$ in 1999, and has remained greater than 50.0 $\mu g/m^3$ since that time. The average annual PM_{10} concentration increased from 15.9 $\mu g/m^3$ in 1998 to 21.6 $\mu g/m^3$ in 1999, and has remained equal to or greater than 20 $\mu g/m^3$ since that time. The increases in coal production over those six years (an average of 4.6 percent per year and 14.7 mmtpy over the six-year period) and associated overburden production (an average of 10.0 percent per year and 85.9 mmbcy over the six-year period) were not larger than any of the six-year increases during the previous 18 years, but the particulate concentration increase was much larger than in previous years. There were no major fires in the region between 1998 and the present but since 1999, the PRB of northeastern Wyoming has experienced extreme drought conditions as well as the dramatic increase in surface disturbance activities associated with CBNG development, which have exacerbated particulate emissions. The potential causes of and development of effective measures to limit the increasing annual particulate levels that have been documented through monitoring are of concern to air quality regulators as well as to oil and gas and coal operators in this area.

The PRB's monitoring history shows no exceedances of the annual PM_{10} standard to date. There were no exceedances of the 24-hour PM_{10} standards anywhere in the PRB through year 2000. From 2001 through 2005, there were 29 monitored exceedances of the 24-hour PM_{10} standard at seven operating mines in the Wyoming PRB, five of which are located within the southern portion of the basin. Nineteen of these exceedances occurred in 2001 and 2002, while two, three, and five exceedances occurred in 2003, 2004, and 2005, respectively (Shamley 2006). Most of the exceedances (26) took place in the group of mines located south and east of the town of Wright; the remaining three exceedances occurred in the group of mines located north and east of Gillette (Figure 1-1). The group of mines

located between Gillette and Wright, which includes the Cordero Rojo Mine, has not recorded any exceedances of the 24-hour PM_{10} standard. Each of the monitored exceedances of the PM_{10} 24-hour standard was associated with high winds and blowing dust following prolonged periods of low precipitation, which resulted in low soil moisture content.

According to the WDEQ/AQD, the circumstances associated with the exceedances have provided adequate reason to believe that high wind events and blowing dust have caused exceedances of the NAAQS that otherwise would not have occurred (WDEQ/AQD 2006). In response to the measured exceedances of the PM_{10} NAAQS and in anticipation of possible future exceedances, the WDEQ/AQD has collaborated with the Wyoming Mining Association to develop a Natural Events Action Plan for the coal mines of the PRB, based on EPA Natural Event Policy guidance. A report describing the plan, which has been submitted to the EPA for comment and approval, can be accessed on the WDEQ/AQD's website on the Internet (WDEQ/AQD 2006). If a Natural Events Action Plan is designed and implemented to minimize PM_{10} concentrations, EPA will exercise its discretion, under Section 107(d)(3) of the CAA, not to redesignate areas as nonattainment, provided that the exeedances are demonstrated to be the result of natural events. Based on EPA's Natural Events Policy, PM_{10} concentrations due to dust raised by unusually high winds will be treated as uncontrollable natural events under the following conditions: 1) the dust originated from non-anthropogenic sources, or 2) the dust originated from anthropogenic sources controlled with BACM.

The WDEQ/AQD Natural Events Action Plan includes a public education plan, a public notification and health advisory program, and a plan to abate or minimize appropriate contributing controllable sources of PM_{10}, which includes three categories of control measures. The three categories of control measures are discussed in Section 3.4.2.3, below. The Natural Events Action Plan currently proposed by WDEQ/AQD only includes measures for control of coal mine sources since it is the ambient monitoring systems around the large surface coal mines that have experienced exceedances of the NAAQS. If it is demonstrated that there are non-coal sources contributing to elevated measurements in an area of concern, WDEQ/AQD may address these additional sources separately from the proposed Natural Events Action Plan or as a future update of the plan.

3.4.2.1.2 Site Specific Particulate Emissions

For the Cordero Rojo Mine air quality monitoring sites, historical particulate matter ambient air quality data generally show the same results as described above for the PRB as a whole. The locations of PM_{10} and TSP particulate emission monitoring samplers at the Cordero Rojo Mine are shown on Figure 3-4. The progression of mining operations

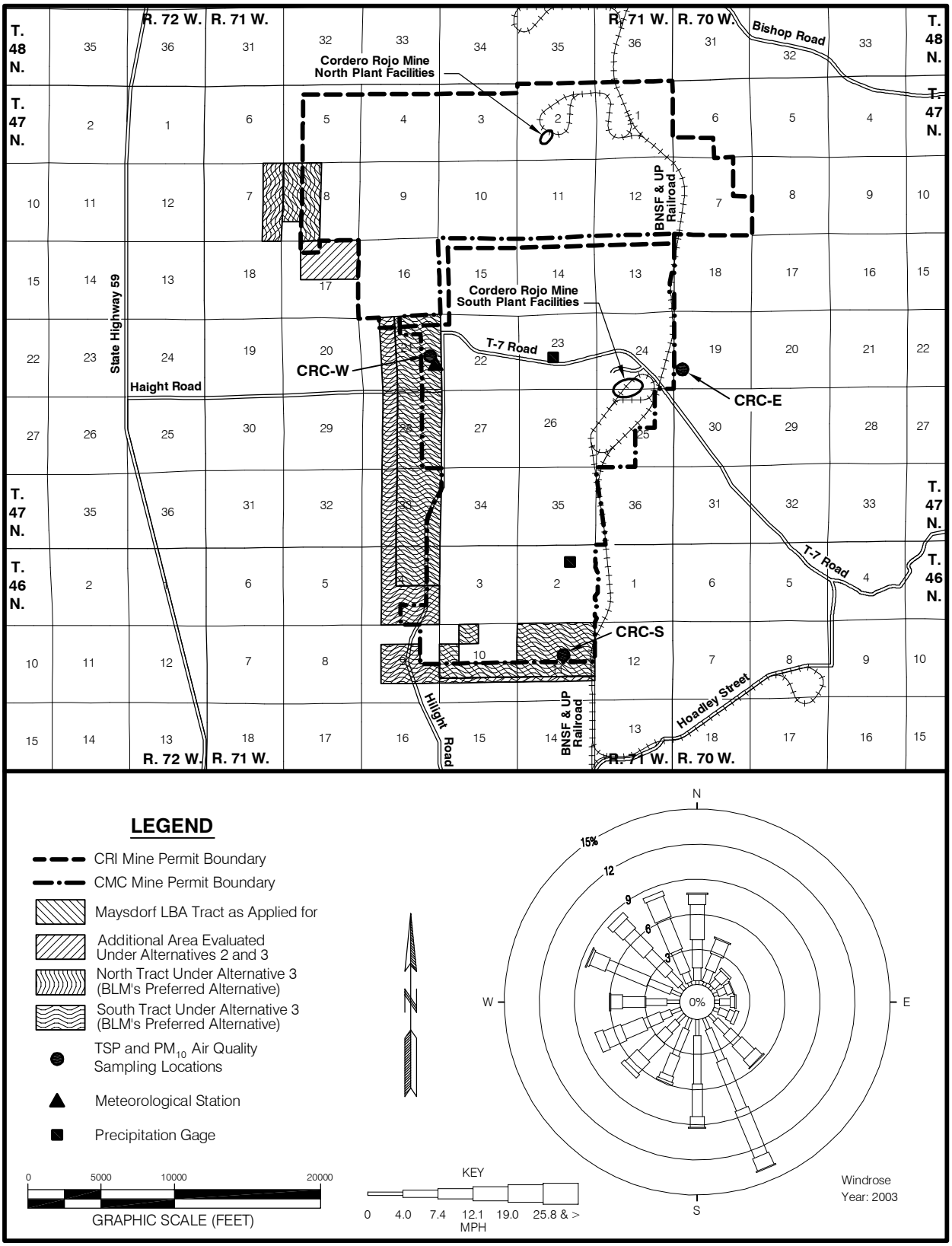


Figure 3-4. Wind Rose, Air Quality and Meteorological Stations at the Cordero Rojo Mine.

requires that the location and number of particulate monitors be adjusted in order to provide the best documentation of the ambient air quality. Figure 3-5 presents the average annual TSP and PM_{10} emission measured at Cordero Rojo Mine's particulate monitors from 1995 through 2004. Annual coal and overburden production for the Cordero Rojo Mine for these years (also shown on Figure 3-5) have generally increased like the overall coal and overburden production in the PRB as a whole.

As discussed above, TSP was the federally regulated pollutant until 1989 and was retained as a state regulated pollutant until 2000. PM_{10} became a federal standard in 1989 and was also adopted by the State of Wyoming. Until recently, TSP measurements have been used as a surrogate for PM_{10} in lieu of having to replace and/or co-locate an existing TSP sampler with a new PM_{10} sampler. The average annual TSP emission measured at Cordero Rojo Mine's Site CRC-E was exceeded in 1999 and 2000 (Figure 3-5); however, no violations of either the 24-hour or annual particulate standards (TSP or PM_{10}) at the Cordero Rojo Mine have been issued by the WDEQ/AQD. (See Chapter 7 for the definitions of "exceedance" and "violation".)

3.4.2.2 Environmental Consequences Related to Particulate Emissions

Particulates include solid particles and liquid droplets that can be suspended in air. Particulates, especially fine particles, have been linked to numerous respiratory-related illnesses and can adversely affect individuals with pre-existing heart or lung diseases. They are also a major cause of visibility impairment in many parts of the United States. While individual particles cannot be seen with the naked eye, collectively they can appear as black soot, dust clouds, or gray hazes.

3.4.2.2.1 Proposed Action and Alternatives 2 and 3

The Maysdorf LBA Tract would be mined as an integral part of the Cordero Rojo Mine. The average annual coal production is anticipated to remain at the projected post-2005 rate of 40 million tons, with or without the Maysdorf LBA Tract. Coal production is anticipated to increase to a maximum rate of 46 mmtpy, then taper off during the mine's later years, with or without the Maysdorf LBA Tract. Cordero Rojo Mine's currently approved air quality permit from the WDEQ/AQD limits annual coal production to 65 million tons of coal. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 40 mmtpy for a longer period of time (from six to nine years). Potential particulate emissions related to mining operations at the existing Cordero Rojo Mine are described below. Because of the similarities in mining rates and mining operations, the potential impacts of mining the Maysdorf LBA Tract have been inferred from the projected impacts of mining the existing coal leases as currently permitted.

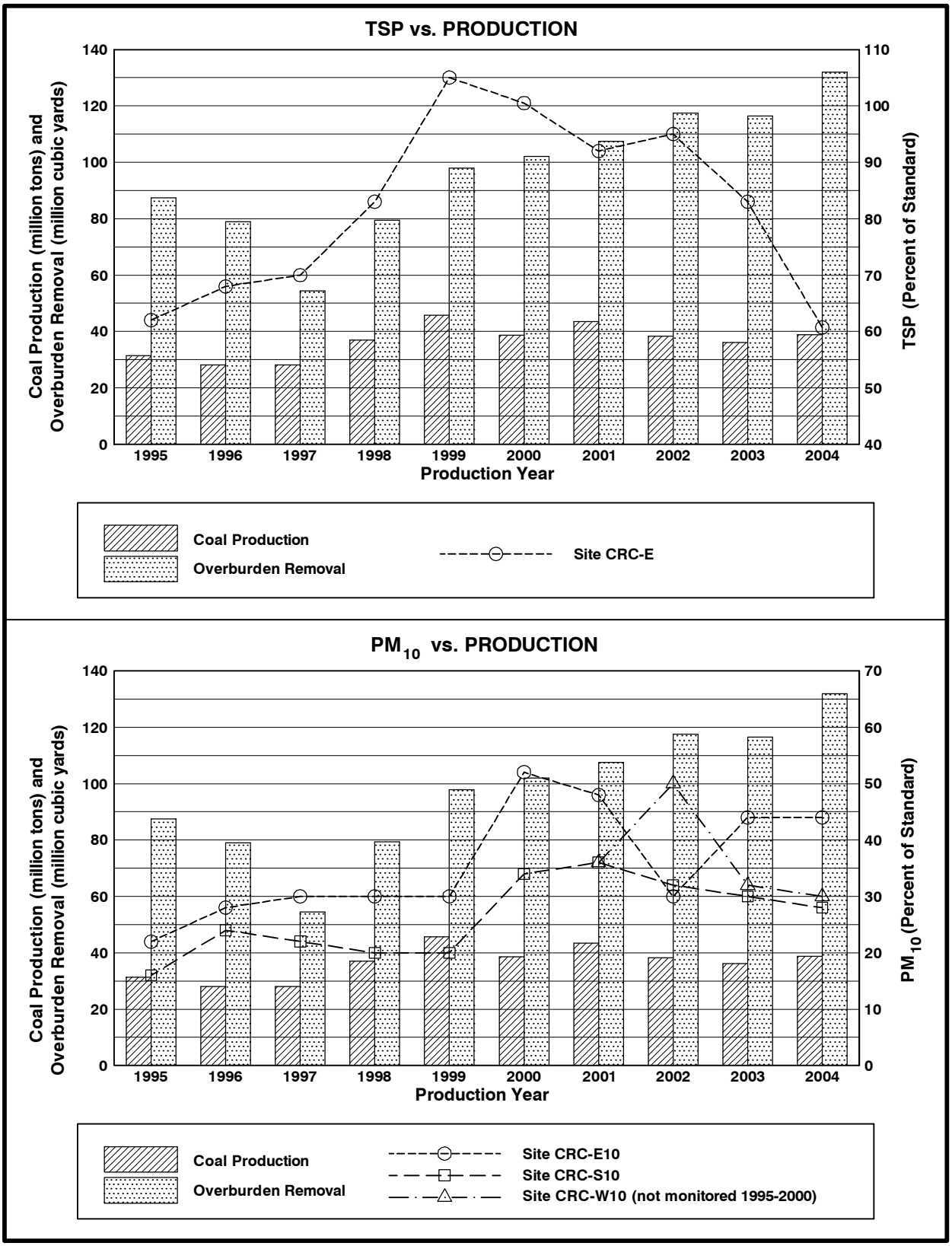


Figure 3-5. Annual Coal Production and Overburden Removal vs. Ambient Particulates for Cordero Rojo Mine (1995 through 2004).

WDEQ/AQD issued air quality permit MD-457A for the Cordero Rojo Mine on May 2, 2000. This air quality permit was issued based on an analysis using emission factors, estimation methods, and model selection consistent with WDEQ/AQD policy. This air quality permit consolidated the former Caballo Rojo and Cordero Mines into one facility called the Cordero Rojo Complex (now called the Cordero Rojo Mine) and reflects analyses based on a revised mine plan, a new LNCM boundary, and increase in the maximum coal production level from 60 mmtpy to 65 mmtpy (CMC 1999). WDEQ/AQD issued air quality permit MD-1058 on September 17, 2004 to modify operations at the Cordero Rojo Mine with the addition of atomizer/fogger dust control systems, which replaced existing conventional baghouses. Material movement utilizes draglines, shovels, and trucks for removal of overburden, and shovels and trucks for removal of coal (CMC 1999).

Particulate emission inventories for the mining activities at Cordero Rojo Mine were prepared for all years in the currently anticipated life of the mine. Two years, 2005 and 2007, were then selected for worst-case dispersion modeling of PM_{10} based on mine plan parameters and emission inventories. Area and line sources were modeled using the FDM to estimate average annual PM_{10} concentrations and the ISCLT3 Model was used to model all point sources.

Receptor locations were placed at approximately 500-meter intervals along the ambient air quality (or LNCM) boundary (see Figures 3-6 and 3-7). As discussed in Section 3.4.1.1.1, a PM_{10} concentration of 15 µg/m^3 was added to all modeled emissions to account for background fugitive dust. Predicted PM_{10} emissions from the other regional mining operations were inventoried using those mines' most recent WDEQ/AQD air quality permit applications. Impacts on ambient air from the Cordero Rojo Mine and other regional mines vary by year due to annual changes in emission strength, emission density, pit proximity to defined ambient air boundaries, and pit configuration. Emissions for each year are ranked and candidate worst-case years are further evaluated regarding proximity to neighboring mining operations and emissions. The total PM_{10} concentration at each receptor was determined by summing the concentration due to each active mine in the general area and adding the background concentration of 15 µg/m^3. The resulting particulate levels were then compared to the average annual PM_{10} standard of 50 µg/m^3 to determine compliance with the annual WAAQS. This constitutes a demonstration of compliance with the "long-term" or annual WAAQS.

Long-term modeling indicates the currently projected mine activities will be in compliance with the annual PM_{10} ambient air standard for the life of the Cordero Rojo Mine. Based on mine plan parameters and highest emissions inventories, the years 2005 and 2007 were selected as the worst-case years. The dispersion model showed a maximum concentration of 46.56 µg/m^3 in 2005 and 45.66 µg/m^3 in 2007. Coal production in both years was projected to be the

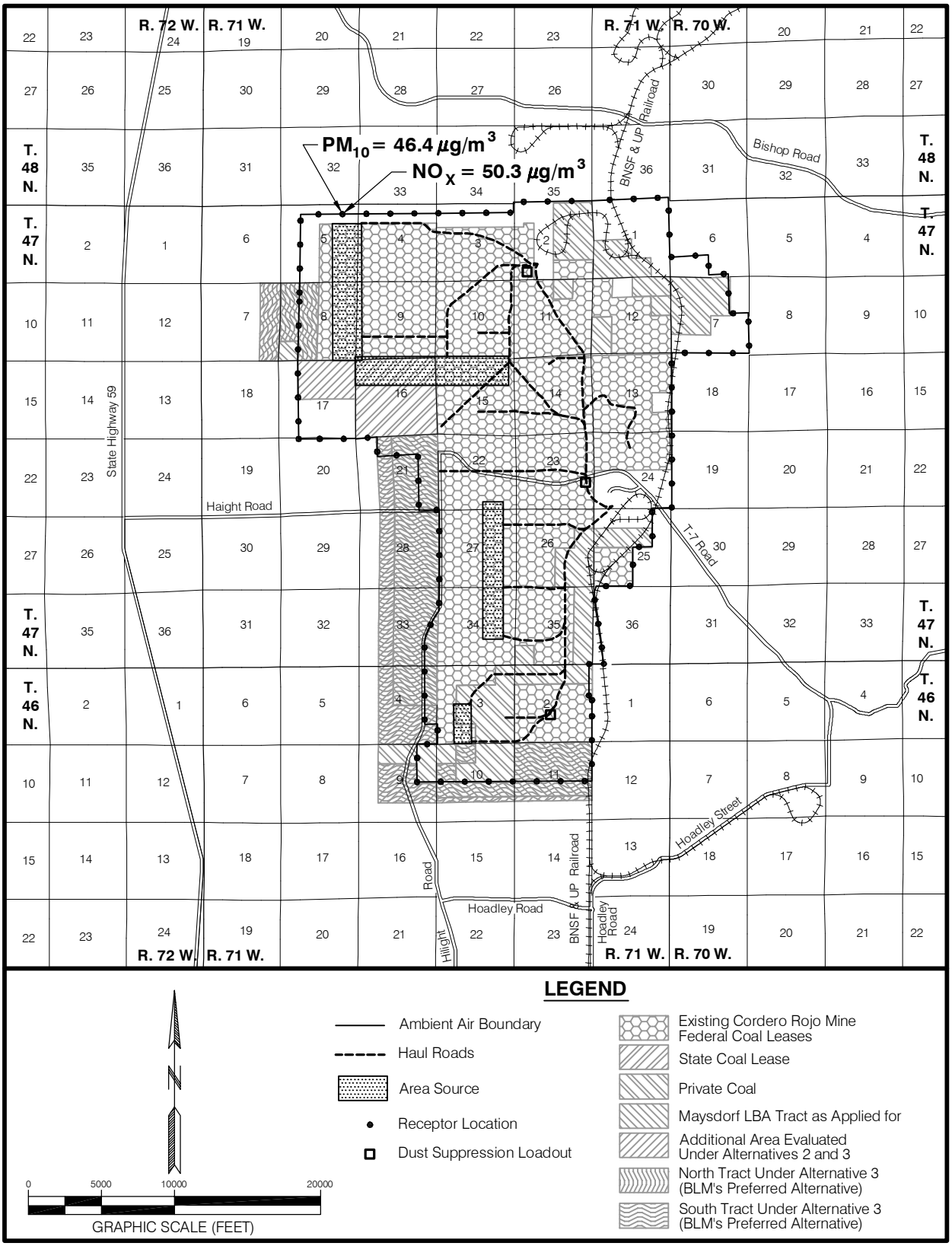


Figure 3-6. Maximum Modeled PM_{10} and NO_X Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2005.

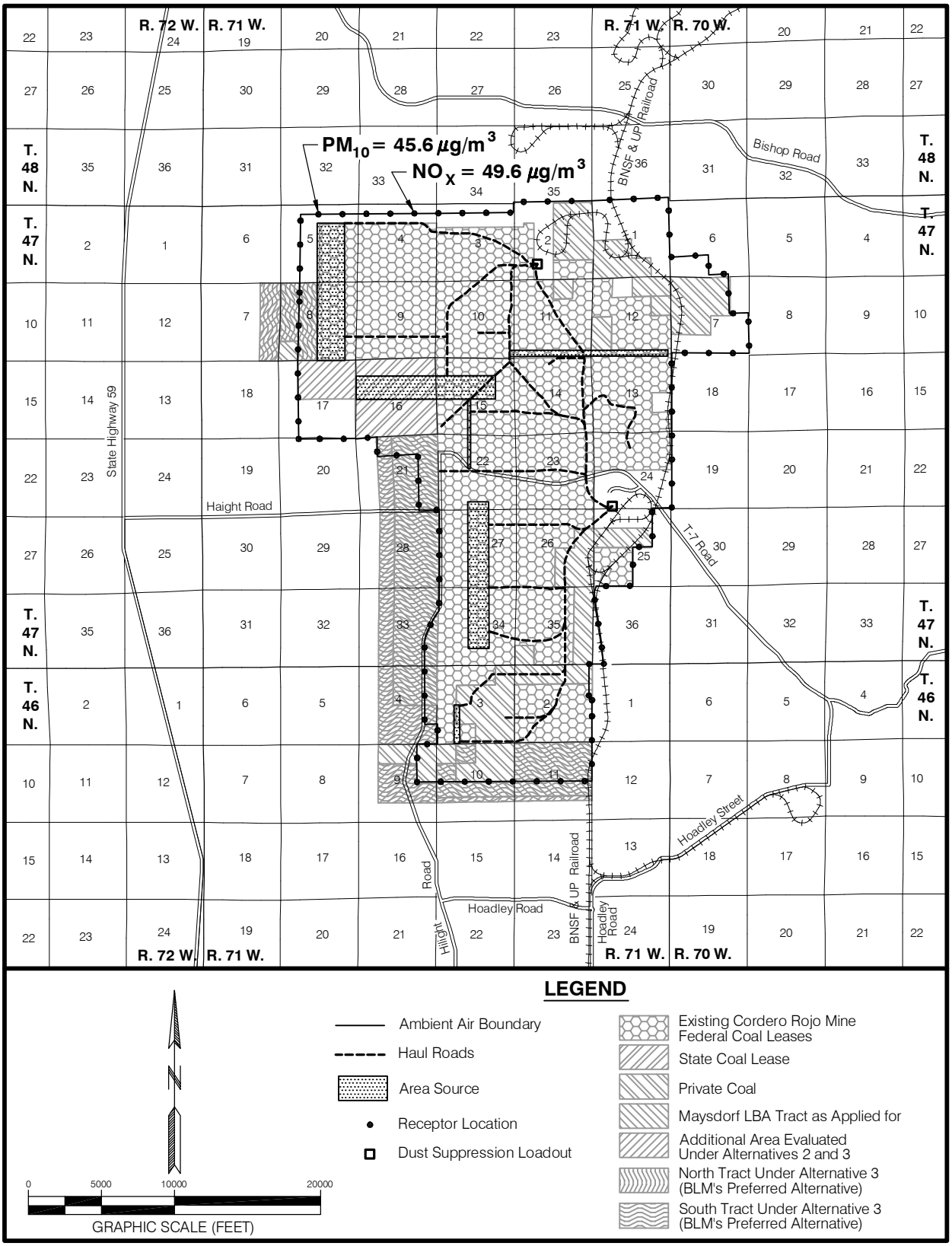


Figure 3-7. Maximum Modeled PM_{10} and NO_X Concentrations at the Cordero Rojo Mine Ambient Air Boundary for the Year 2007.

maximum permitted production level of 65 million tons (CMC 1999). The locations of the maximum-modeled PM_{10} concentrations for 2005 and 2007 are shown on Figures 3-6 and 3-7, respectively.

As discussed in Section 3.4.1.1, surface coal mines in the Wyoming PRB have not been subject to PSD requirements. Only some fraction of the mine emissions included in the WDEQ/AQD air quality permit analyses consumes increment based on permits in place in the baseline year of 1997. As a result, the concentrations predicted by the WDEQ/AQD air quality permit analyses should not be compared to PSD increments.

The Cordero Rojo Mine point source emissions inventory includes the coal preparation plants from both the Cordero and Caballo Rojo Mines. All point source parameters for the regional mining operations, which were obtained from WDEQ/AQD files, were also considered in the modeling analysis. As discussed in Section 3.4.1.1, a proposed new point source that has the potential to emit more than 250 tpy of any criteria pollutant (the primary pollutant being particulate matter) must undergo a regulatory PSD increment consumption analysis as well as a BACT review. An inventory of all point sources, controls, and emissions for the MD-457A air quality permit showed a potential to emit of 241 tpy; therefore, a PSD increment consumption analysis was not necessary.

The MD-457A air quality permit showed a potential to emit over 100 tpy of particulates; as a result, it was considered a major source, as defined by Chapter 6, Section 3 of the WAQSR, and required a Title V Operating Permit. However, when WDEQ/AQD issued air quality permit MD-1058 on September 17, 2004 to modify operations at the Cordero Rojo Mine, the replacement of the 14 existing conventional baghouses by the atomizer/fogger dust control systems reduced point source particulate emission levels such that the facility is no longer considered a major source and is no longer required to have a Title V Operating Permit (WDEQ/AQD 2004).

In Wyoming, monitoring results have been used in lieu of short-term (24-hour) modeling for assessing short-term coal mining-related impacts in the PRB. WDEQ has chosen this procedure in accordance with an agreement between EPA and the State of Wyoming. That agreement recognizes that appropriate models do not exist to accurately predict 24-hour impacts. Twenty-four-hour impacts have been estimated from recent monitoring and emission control activities. There have been no violations for exceeding the 24-hour or annual ambient air standards at the Cordero Rojo Mine through 2005 and none are expected from mining the LBA tract.

The average overburden thickness is greater in the LBA tract than within the current leases, but the thickness of the coal in the LBA tract is about the same as in the existing mine area (see Table 3-2). If the Cordero Rojo

Mine acquires and mines the Maysdorf LBA Tract, this could result in an increase in fugitive emissions per ton of coal mined from current levels due to the increased volume of overburden that would have to be removed to recover the coal. The increase in fugitive dust emissions could potentially be moderated somewhat if removal of the larger volume of overburden material results in a slower rate of mining advancement through the LBA tract. This would potentially decrease the number of acres disturbed annually and cause haul distances to increase more slowly.

Current mining techniques (i.e., haulage, blasting, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permit. Material movement of overburden and coal would continue to utilize draglines, shovels, and trucks in overburden and shovels and trucks in coal. Facilities shown in the current air quality permit would not change as a result of proposed mining of the LBA tract. There are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tract. In addition, current BACT measures for particulates would continue to be employed.

Modeling conducted for the current Cordero Rojo Mine permit predicted no exceedances of the annual PM_{10} NAAQS at a 65-mmtpy production rate and there have been no exceedances of the 24-hour and annual PM_{10} NAAQS. If the Cordero Rojo Mine acquires and mines the Maysdorf LBA Tract, they estimate that the mine would produce at an average annual rate of 40 mmtpy. At that average rate of production, there would be an extension of up to nine years in the time the mine would produce and there would be an increase in overburden thickness, but fugitive dust emissions are projected remain within daily and annual AAQS limits.

Public exposure to particulate emissions from surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings and school bus stops located in the vicinity of the mine, including several along State Highway 59, which is located from two to three miles west of the Maysdorf LBA Tract. Roads, highways, currently occupied dwellings, and school bus stops in the vicinity of the Maysdorf LBA Tract are shown in Figure 3-8.

3.4.2.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the Cordero Rojo Mine would continue to operate as currently permitted for about nine more years. A discussion of the currently permitted mining operations and potential impacts related to PM_{10} emissions is included in Section 3.4.2.2.1, above. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases. Impacts related to mining operations at the Cordero Rojo

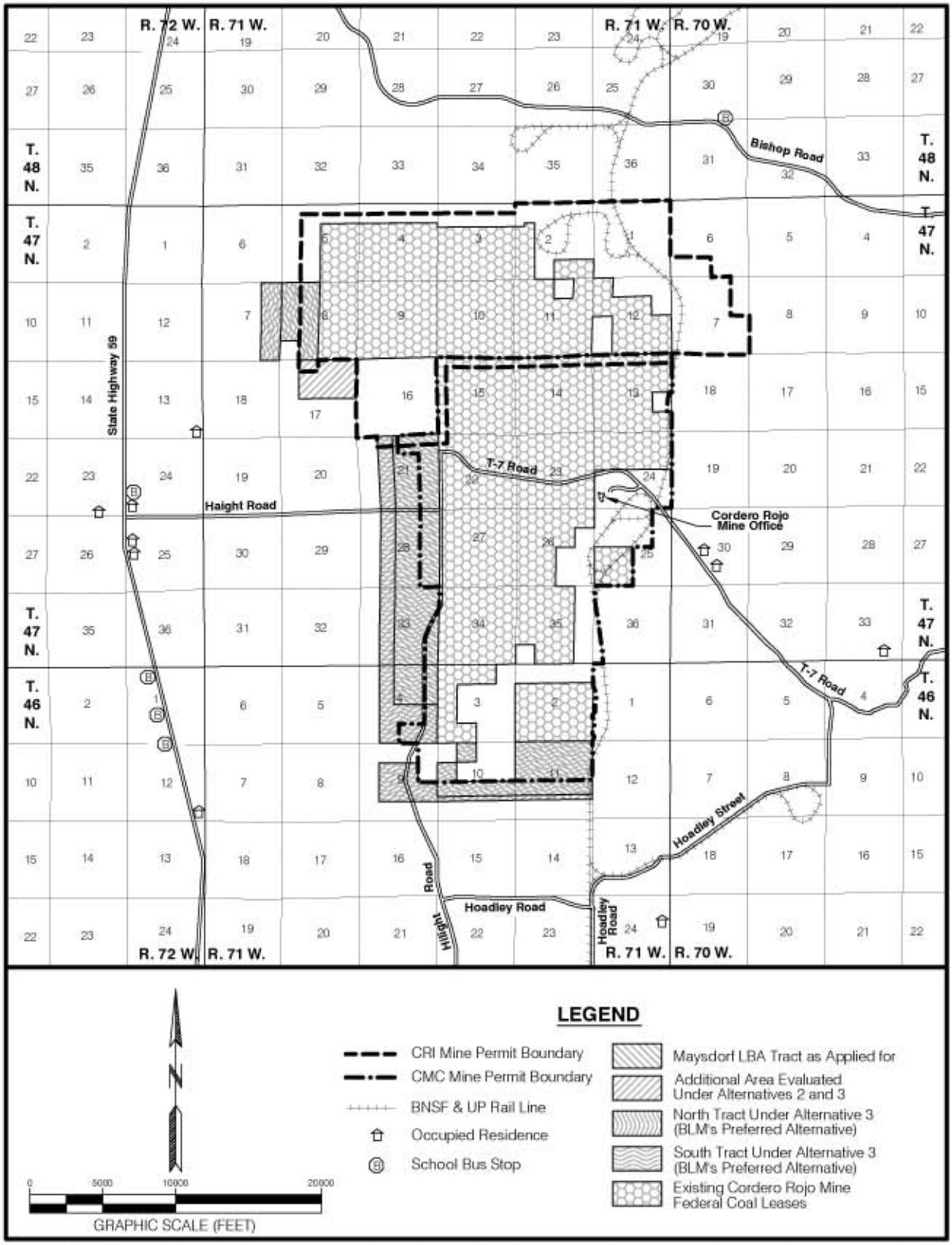


Figure 3-8. Residences, School Bus Stops, Public Roads, and other Publicly Accessible Facilities Within and Adjacent to the Maysdorf LBA Tract.

Mine would continue on the existing mine area as permitted, but mining operations would not be extended onto those portions of the LBA tract that will not be affected under the current mining and reclamation plan.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.4.2.3 Regulatory Compliance, Mitigation, and Monitoring for Particulate Emissions

Control of particulate emissions at all PRB coal mines is accomplished with a variety of measures. The WDEQ/AQD permits for all of the surface coal mines in the PRB require the following dust control measures, which are considered to be BACT measures:

- No mines are allowed to have out-or-pit open coal stockpiles. All coal removed from the mine pits must be stored in totally enclosed coal silos or barns.
- Unless specifically exempted, all coal mine main access roads are paved.
- As use and condition warrant, the minor access roads at coal mines that are unpaved must be watered or treated with dust suppressants.
- All coal conveyor transfer points are shrouded or otherwise enclose to direct coal fines from one belt to the next.
- The transfer point and crushers within coal processing plants are equipped with control devices and measures specified in individual permits. These control devices and measures may include, but are not limited to, the use of dust collection baghouses, cyclones, scrubbers, fog systems, and controlled flow transfer chutes.
- All out-of-pit conveyors are hooded or contained in a conveyor gallery.
- All out-of-pit coal dump hoppers are fitted with a dust control stilling shed, water sprays, or a baghouse dust collector.
- Active longer-term coal haul roads are treated with dust control chemicals and/or water.
- Active short-term mine haul roads that are continuously being relocated are maintained and watered while in use.
- All haul roads are regularly maintained to reduce the amount of dust re-entrained by haulage equipment (WDEQ/AQD 2006).

Additional site-specific requirements related to mine-specific layout and mining practices may be included in individual mine permits. In 2000, when the Cordero Rojo Mine's MD-

457A air quality permit was issued, the BACT on emissions from the mine's point sources included stilling sheds, covered conveyors, telescoping loadout chutes, enclosed storage devices (silos), and dust collectors (baghouses) at all coal transfer points. As discussed above, WDEQ/AQD issued air quality permit MD-1058 to modify operations at the Cordero Rojo Mine with the addition of atomizer/fogger dust control systems that replaced existing conventional baghouses in 2004.

Fugitive emissions are also controlled with a variety of other measures that the WDEQ/AQD considers BACT. Haul truck speed limits are imposed to further help to reduce fugitive emissions from roads. Material drop heights for shovels and draglines (bucket to truck bed or backfill) are limited to the minimum necessary to conduct the mining operations. Timely permanent and temporary revegetation of disturbed areas is utilized to minimize wind erosion. All of these control measures are employed at the Cordero Rojo Mine.

The Natural Events Action Plan discussed in Section 3.4.2.1.1 identifies two other categories of control measures designed to prevent exceedances during high wind events, in addition to the BACT measures discussed above (WDEQ/AQD 2006). One of these, BACM, is an additional list of control measures that the mines can implement continuously so that they are in place before a high wind event occurs. These measures are not current requirements in all of the mines' air quality permits. They primarily address the principal mine-controlled sources of fugitive dust, which are large contiguous disturbed areas. These measures include:

- Stabilizing topsoiled area as soon as practicable following topsoil replacement.
- Ripping, windrowing, mulching, temporarily seeding or chemically treating areas greater than 300 contiguous acres in size that have been stripped of topsoil but will not be mined in the near future.
- Ripping, windrowing, temporarily seeding or chemically treating graded backfill areas greater than 300 contiguous acres in size.
- Ripping, mulching, temporarily seeding or chemically treating long-term out-of-pit overburden and topsoil stockpiles that have been graded.
- Applying non-vegetative barriers such as gravel or other large-diameter particles to erodible surfaces to reduce surface erosion where appropriate.
- Cleaning, treating, and maintaining pads in front of truck dumps to prevent accumulations of spilled materials from getting pulverized.
- Scheduling topsoil removal, backfill grading and topsoil replacements concurrently to

minimize open areas when possible.

- Requiring contractors to apply water and/or chemical dust suppressants in their haulage areas.

The third category of control measures discussed in the Natural Events Action Plan includes measures that are not currently required by all individual air quality permits but are actions that can be taken during a high wind event, depending on site specific conditions (WDEQ/AQD 2006). These include:

- The mine operator will consider relevant information, including NWS forecasts and local meteorological information, to confirm that a high wind event is occurring.

- The mine operator will visually determine areas of mining activity that are generating excessive visible dust and direct water trucks to those areas.

- The mine operator should direct overburden operations to the shortest haul distance available during a high wind event.

- The mine operator will evaluate the practicality of dumping the overburden as low as possible.

- Mine employees will inspect for and extinguish coal fires.

- The mine operator will evaluate shutting down scoria crushing operations that appear to be generating excess dust.

- The mine operator will evaluate shutting down road maintenance activities that are generating dust.

- The mine operator will evaluate ordering contractors to increase water, reduce operating equipment or shut down haulage.

- The mine operator will evaluate the need to shut down and/or reduce earthmoving activities as the mine schedule and conditions will allow.

WDEQ/AQD may require implementation of these control steps and continual evaluation of activity plans when exceedances are monitored at surface coal mines. Some of these measures have been formally implemented at the Black Thunder, North Rochelle, and Jacobs Ranch Mines through the establishment of a formal, site-specific mitigative response plan at each of those mines. A mitigative response plan will be developed by any mine that records an exceedance or violation of the NAAQS downwind of its mining operations.

Other operational control measures that WDEQ/AQD may require at specific mines when exceedances occur include, but are not limited to, relocation of overburden truck-dumping operations and deferring blasting. The mines are

experimenting with dust control treatments, including magnesium chloride, surfactants, and petroleum-based products. In addition, WDEQ/AQD may require additional monitoring, action levels based on continuous monitoring, expedited reporting of monitored exceedances, detailed reporting of contributing factors (e.g., meteorological conditions), and continual evaluation of activity plans when exceedances are monitored at surface coal mines.

The WDEQ/AQD is continually reviewing the data and considering regulatory options, such as increasing the frequency of monitoring. Where elevated emissions have occurred, continuous PM_{10} monitors, or TEOMs, are installed, which allows monitoring of emissions on a real-time basis (WDEQ/AQD 2006). Other regulatory options may include enforcement actions such as Notices of Violation resulting in a consent decree and/or modified permit conditions. WDEQ/AQD is also coordinating with EPA to develop additional monitoring requirements in CBNG development areas, high PM_{10} mitigation action plans in permits, and additional mitigation measures under the State Implementation Plan.

The eastern side of the PRB has one of the most extensive networks of monitoring sites for PM_{10} in the nation (Figure 3-3). The monitors include six TSP monitors, four $PM_{2.5}$ monitors and 30 PM_{10} monitors, including TEOMs. This count does not include collocated monitors installed for quality assurance purposes in this area. Most of these monitoring sites are funded and operated by the coal mines. WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the PRB mines. Each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. All PM_{10} monitors located at the active mines are now required by WDEQ/AQD to sample air quality for a 24-hour period every three days beginning in 2002.

There are also monitors in Sheridan, Gillette, Arvada, and Wright, Wyoming. WDEQ/AQD uses monitoring stations located throughout the state to anticipate issues related to air quality. These monitoring stations are located to measure ambient air quality; they are not located to measure impacts from specific sources. Monitors located to measure impacts from specific sources may also be used for trends. The extensive air quality monitoring network currently in use enables the WDEQ to manage the air resource using monitoring data rather than modeled predictions. WDEQ uses the monitoring data to pro-actively arrest or reverse trends towards air quality problems. When WDEQ became aware that particulate readings in the PRB were increasing due to increased CBNG activity and exacerbated by prolonged drought, the WDEQ approached the counties, coal mines, and CBNG industry. A coalition involving the Campbell County Commission, coal companies (including the Cordero Rojo Mine), and regional CBNG and oil producing operators have made significant efforts towards minimizing dust from

graded roads. Measures taken have ranged from the implementation of speed limits to paving of heavily traveled roads. The coalition has utilized chemical treatments to control dust as well as closing roads where appropriate or necessary and rebuilding existing roads to higher specifications. The coalition is requesting money from the Wyoming State Legislature to fund acquisition of Rotomill (ground up asphalt) which would be mixed with gravel and used to treat some of the roads in the PRB. The Rotomill/gravel mixture has been demonstrated to be effective in reducing dust and the life of the mixture on treated roads is from five to six years (WDEQ/AQD 2007).

Monitoring is also used to measure compliance. When monitoring shows that any standard has been violated, the WDEQ can take a range of enforcement actions to remedy the situation. Where a standard is exceeded specific to an operation, the enforcement action is specific to the facility. For many facilities, neither the cause nor the solution is simple. The agency normally uses a negotiated settlement in those instances.

3.4.3 Emissions of Nitrogen Oxides (NO_x)

3.4.3.1 Affected Environment for NO_x Emissions

Gases that contain nitrogen and oxygen in varying amounts are referred to as nitrogen oxides, or NO_x. One type of NO_x is nitrogen dioxide (NO_2), a reddish brown gas that is heavier than air and has a pungent odor. Gaseous NO_2 is highly reactive and combines with water to form nitric acid and nitric oxide. According to the EPA (EPA 2001a):

- NO_x gas may cause significant toxicity because of its ability to form nitric acid with water in the eye, lung, mucous membranes, and skin.
- Acute exposure may cause death by damaging the pulmonary system.
- Chronic or repeated exposure to lower concentrations of NO_2 may exacerbate pre-existing respiratory conditions, or increase the incidence of respiratory infections.

The primary direct source of emissions of nitrogen oxides during coal mining operations is tailpipe emissions from large mining equipment and other vehicle traffic inside the mine permit area. Blasting that is done to remove the material overlying the coal (the overburden) can result in emissions of several products, including NO_2, as a result of the incomplete combustion of explosives used in the blasting process. When this occurs, gaseous, orange-colored clouds may be formed and they can drift or be blown off mine permit areas.

3.4.3.1.1 Regional NO_x Emissions

Annual mean NO_2 concentrations have been periodically measured in the PRB since 1975, as discussed in Section 3.4.3.3. The annual mean NO_2 concentrations recorded by those

monitoring efforts have all been well below the 100 µg/m^3 standard. The highest annual mean concentration recorded to date was 22 µg/m^3 at two separate sites between March 1996 and April 1997.

NO_2 is a product of incomplete combustion at sources such as gasoline- and diesel-burning engines or from mine blasting activities. Incomplete combustion during blasting may be caused by wet conditions, incompetent or fractured geological formations, deformation of bore holes, and other factors. Generally, blasting-related NO_x emissions are more prevalent at operations that use the blasting technique referred to as cast blasting (Chancellor 2003). Cast blasting refers to a type of direct blasting in which the blast is designed to cast the overburden from on top of the coal into the previously mined area.

In the mid-to late-1990s, OSM received complaints from several citizens about blasting clouds from several mines in the PRB. EPA expressed concerns that NO_2 levels in some of those blasting clouds may have been sufficiently high at times to cause human health effects. In response to those concerns, several studies have been conducted, the mines have modified their blasting techniques, and the WDEQ has imposed blasting restrictions on several mines. More information about these studies and restrictions is presented in the following discussion.

3.4.3.1.2 Site Specific NO_x Emissions

Sources of NO_x emissions at the Cordero Rojo Mine include the tailpipe emissions from the mining equipment and the emissions from the trains used to haul the coal from the mine. There are no NO_x point sources at the mine.

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Cordero Rojo Mine. The WDEQ has not required the mine to implement any specific measures to control or limit public exposure to NO_2 from blasting.

3.4.3.2 Environmental Consequences Related to NO_x Emissions

Although there is no NAAQS that regulates short-term NO_2 levels, there is concern about the potential health risk associated with short-term exposure to NO_2 from blasting emissions. According to EPA, NO_x may cause a wide variety of health and environmental impacts because of various compounds and derivatives in the family of nitrogen oxides, including NO_2, nitric acid, nitrous oxide, nitrates, and nitric oxide. Potential health risks associated with short term exposure to NO_2 include changes in airway responsiveness and lung function in individuals with pre-existing respiratory illnesses and increases in respiratory illnesses in children. Long-term exposure to NO_2 may lead to increases susceptibility to respiratory infection and may cause irreversible alterations in lung structure (EPA 2006a and 2006b).

NIOSH, OSHA, and EPA have identified the following short-term exposure criteria for NO_2:

- NIOSH's recommended Immediately Dangerous to Life and Health level is 20.0 ppm (37,600 µg/m^3);
- EPA's Significant Harm Level, a one-hour average, is 2.0 ppm (3,760 µg/m^3);
- OSHA's Short-Term Exposure Limit, a 15-minute time-weighted average, which was developed for workers, is 5.0 ppm (9,400 µg/m^3), which must not be exceeded during any part of the workday, as measured instantaneously);
- NIOSH's recommendation for workers is a limit of 1.0 ppm (1,880 µg/m^3) based on a 15-minute exposure that should not be exceeded at any time during the workday; and
- EPA recommends that concentrations not exceed 0.5 ppm (940 µg/m^3) for a 10-minute exposure to protect sensitive members of the public (EPA 2003).

A study conducted by Dr. Edward Faeder for the Black Thunder Mine (Figure 1-1) recommended a limit of 5.0 ppm (9,400 µg/m^3) for a 10-minute exposure.

According to EPA "...the exact concentrations at which NO_2 will cause various health effects cannot be predicted with complete accuracy because the effects are a function of air concentration and time of exposure, and precise measurements have not been made in association with human toxicity. The information that is available from human exposures also suggests that there is some variation in individual response" (EPA 2001a).

he WMA conducted a study beginning in August 1999 and completed in April 2000, with participation from the WDEQ/LQD and WDEQ/AQD, because of the concern with the health risk that could be potentially associated with short-term exposure to NO_x. The study involved collection of 15-minute average NO_2 concentrations in areas that are near PRB coal mining operations and that would be accessible to the public. It was designed to help evaluate potential exposure of the public to NO_2 emissions resulting from blasting activity at surface coal mines. Six monitor locations were selected "...based on their proximity to mining activity and accessibility to the public. Roads adjacent to mining activity were felt to be areas where the public exposure would most likely occur. Locations were also chosen based on dominant wind direction, and to represent areas having the greatest chance of being impacted by several mining operations..." (WMA 2000).

A brief summary of the findings follows:

- Approximately 95 percent of the valid data points were readings of 0 ppm (0 µg/m^3) NO_2.

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

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

The Black Thunder Mine also conducted a study designed to provide information on safe setback distances for blasting activities at that mine (TBCC 2002). Monitors for that report were located close to blasts in order to collect data for a modeling project; they were located within the mine permit boundary in areas that are not and would not be accessible to the public during mining operations and these areas are also cleared of employees during blasting activities. The measured NO_x levels ranged from non-detectable to 21.4 ppm. The highest value was measured 361 ft from the blast.

There are no state or federal rules that require the public or employees to stay back a certain distance from mine blasting operations in order to limit their exposure to NO_2. An administrative ruling by the Wyoming EQC in 2003 approved a 2,500-ft setback of blasting operations from the southern boundary of the Eagle Butte Coal Mine when prevailing winds are blowing toward the mine's downwind neighbors (Wyoming EQC Docket No. 00-4802, filed June 26, 2003). The Eagle Butte Mine is located just north of Gillette (Figure 1-1).

3.4.3.2.1 Proposed Action and Alternatives 2 and 3

The Maysdorf LBA Tract would be mined as an integral part of the Cordero Rojo Mine. The average annual coal production is anticipated to remain at the projected post-2005 rate of 40 million tons, with or without the Maysdorf LBA Tract. Coal production is anticipated to increase to a maximum rate of 46 mmtpy, then taper off during the mine's later years, with or without the Maysdorf LBA Tract. Cordero Rojo Mine's currently approved air quality permit from the WDEQ/AQD allows up to 65 million tons of coal to be mined per year. If the mine acquires the additional coal in the LBA tract, they would continue to produce at an average rate of 40 mmtpy for a longer period of time (six to nine years). Potential NO_x emissions related to mining operations at the existing Cordero Rojo Mine are described below.

The WDEQ/AQD has determined that an assessment of annual NO_x impacts must be included as part of an air quality permitting analysis for new surface coal mines and existing mine plans revisions. As discussed in Section 3.4.2.2, WDEQ/AQD issued air quality permit MD-457A for the Cordero Rojo Mine on May 2, 2000, and the mine was required to conduct NO_2 dispersion modeling in their permit. Emission rates were determined for the same worst-case years used in the PM_{10} modeling. The

amount of NO_x emissions from blasting is related to the amount of ANFO utilized. NO_x emission rates for 2005 and 2007 are expected to be 569.7 tpy and 610.0 tpy, respectively. NO_x modeling closely followed many of the same procedures used in the PM_{10} analysis. Emissions were apportioned in a similar manner and the same meteorological data set was used. Only the Cordero Rojo Mine was modeled, regional activity was not considered. No NO_x point sources exist at the mine and the regional background NO_x annual concentration used was 20 µg/m^3. Additional area sources and line sources were added to describe the railroad tracks/loops on the Cordero Rojo Mine site. Long-term modeling indicated the currently projected mine activities will be in compliance with the annual NO_x AAQS for the life of the Cordero Rojo Mine. For year 2005, the maximum annual NO_x concentration was 50.3 µg/m^3 and for year 2007, the maximum annual NO_x concentration was 49.6 µg/m^3 (CMC 1999). Coal production in both years was assumed to be the maximum permitted production level of 65 million tons. The locations of the maximum-modeled NO_x concentrations for 2005 and 2007 are shown on Figures 3-6 and 3-7, respectively. The potential NO_x impacts from mining the Maysdorf LBA Tract have been inferred to be similar to the currently permitted impacts of mining the existing coal leases at the Cordero Rojo Mine because of the similarities in mining rates and mining operations.

The average overburden thickness is greater in the LBA tract than within the current leases, but the thickness of the coal is about the same as in the existing mine area (Table 3-2). If the Cordero Rojo Mine acquires and mines the Maysdorf LBA Tract, there are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tract. However, if the average annual rate of production is maintained, there would potentially be an increase in the frequency of blasting in order to remove the additional volume of overburden overlying the coal.

There have been no reported events of public exposure to NO_2 from blasting activities at the Cordero Rojo Mine through 2005. The mine has, however, employed measures to control/limit public exposure to intermittent, short-term (blasting) releases as discussed in Section 3.4.3.3. Public exposure to emissions caused by surface mining operations is most likely to occur along publicly accessible roads and highways that pass through the area of the mining operations. Occupants of dwellings in the area could also be affected. There are occupied dwellings located approximately one to 3.5 miles west, two miles south-southeast, and 3.5 miles east of the LBA tract, and a school bus stop is located on Highway 59 approximately 2.5 miles west of the LBA tract (Figure 3-8).

If Cordero Rojo Mine acquires the Maysdorf LBA Tract, current mining techniques (i.e., blasting, excavating, hauling, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permit. Modeling for the current Cordero Rojo Mine

permit projected no exceedances of the annual NO_x NAAQS at a 65-mmtpy production rate. Therefore, air quality impacts that result from mining the Maysdorf LBA Tract by the applicant at an estimated average rate of 40 mmtpy should also be within annual NAAQS limits.

3.4.3.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the Cordero Rojo Mine would continue to operate as currently permitted for about nine more years. A discussion of the currently permitted mining operations and potential impacts related to NO_x emissions is included in Section 3.4.3.2.1, above. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and impacts related to mining operations would not be extended onto those portions of the LBA tract that will not be affected under the current mine plan.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.4.3.3 Regulatory Compliance, Mitigation, and Monitoring for NO_x Emissions

Several of the surface coal mines in the PRB have undertaken voluntary blasting restrictions to avoid NO_x impact to the public. WDEQ has required several mines, including Antelope, North Antelope/Rochelle, Black Thunder, Belle Ayr, Eagle Butte, and Wyodak (Figure 1-1), to stop traffic on public roads during blasting due to concerns with fly rock and the "startle factor".

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Cordero Rojo Mine. The WDEQ has not required the mine to implement any specific measures to control or limit public exposure to NO_2 from blasting, although the mine has voluntarily committed to control blasting emissions. Public access to some of the roads in the area, including the Haight, Hilight, and T-7 Roads, are currently blocked and will continue to be blocked during blasting operations when wind directions or proximity to the road warrant such closure. The Cordero Rojo Mine strictly adheres to a self-implemented Environmental Management System, which includes a detailed blasting procedures plan.

Voluntary measures that have been instituted, particularly when large blasts are planned include:

- telephone notification of neighbors (both private parties and other mining operations) in the general area of the mine prior to large blasts;
- monitoring of weather and atmospheric conditions prior to the decision to detonate a large blast;
- minimizing blast size to the extent possible;

- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;

- closing public roads that enter the general mine area, depending on wind conditions and blast location with respect to the road; and

- providing post-blast notification to neighbors of potential exposure to the blasting cloud.

Two mines in the Wyoming PRB, Black Thunder and Eagle Butte, currently have blasting restrictions in their permits to address NO_x. After WDEQ received reports of public exposure to NO_2 from blasting operations at some of the PRB mines prior to 2001, measures to prevent future such incidences were instituted at those mines when large overburden blasts are planned. Measures that have been instituted as mine permit requirements include:

- notification of neighbors and workers in the general area of the mine prior to the blast;

- blast detonation between 12:00 p.m. and 3:00 p.m. whenever possible to avoid temperature inversions and minimize inconvenience to neighbors;

- monitoring of weather and atmospheric conditions prior to the decision to detonate a blast;

- posting of signs on major public roads that enter the general mine area and on all locked gates accessing the active mine area;

- closing public roads when appropriate to protect the public; and

- as mentioned above, the Wyoming EQC approved a 2,500 ft setback of blasting operations from the southern boundary of the Eagle Butte Mine when prevailing winds are blowing toward the mine's downwind neighbors.

Mine operators in the eastern PRB have also been working with blasting agent manufacturers to reduce NO_x emissions. Efforts to eliminate NO_x production have included use of different blasting agents, different blends of blasting agents, different additives, different initiation systems and sequencing, borehole liners, and smaller cast blasts. Operators have tried adding substances like microspheres and rice hulls, using different blends of ANFO and slurries and gels, using electronic detonation systems that can vary shot timing, different shot hole patterns, and using plastic liners within the shot holes. No one single procedure or variation has proven consistently successful due to the numerous factors that are believed to contribute to the production of NO_2. The most successful control measure has been reducing the size of the cast blasting shots (Doug Emme 2003, Rick Chancellor 2003). The Eagle Butte Mine has almost eliminated NO_x production, while the North Antelope/Rochelle Mine has had

success in eliminating NO_x in over 75 percent of their cast blasting through the use of borehole liners and changing their blasting agent blends (Chancellor 2003). Both mines are shown in Figure 1-1.

NO_2 was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. Table 3-6 summarizes the results of that monitoring.

Due to public concerns about emissions of nitrogen dioxides as a result of blasting and a general concern of the WDEQ about levels of nitrogen dioxides due to development of all types in the eastern PRB, the coal mining industry instituted a monitoring network in cooperation with WDEQ/AQD to gather data on NO_2 beginning in 2001. Industry funded and operated the network for approximately three years. The 2001 through 2004 data from this regional network are summarized in Table 3-7.

The WDEQ now funds and operates the NO_2 monitoring network along the east side of the basin. Ownership of the monitoring equipment was transferred to WDEQ by the mines and the mines have given ongoing access to the monitoring sites and provide electrical power for the instrumentation.

As represented by Table 3-7, NO_2 monitoring data are available from five currently active sites in the PRB. With respect to the Maysdorf LBA Tract, the Thunder Basin National Grassland Site is approximately 50 miles north-northeast; the Campbell County Site is approximately 15 miles west-northwest; the Tracy Ranch Site

Table 3-6. Annual Ambient NO_2 Concentration Data.

Site	**Gillette, WY**	**Black Thunder Mine**	**Belle Ayr Mine**	**Bill, WY**
Year	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**	**Percent of Standard[1]**
1975	6*			
1976	4*			1*
1977	4*			5*
1978	11*			
1979	11			
1980	12			
1981	14			
1982	11			
1983[2]	17			
1996[3]	16	16	22	22

[1] Based on arithmetic averaging of data.
[2] Monitoring discontinued December 1983, reactivated March 1996 to April 1997.
[3] Arithmetic average – actual sampling ran from March 1996 to April 1997.
* Inadequate number of samples for a valid annual average.
Source: (McVehil-Monnett 1997)

Table 3-7. 2001 Through 2004 Annual Mean NO_2 Concentration Data.

Site Address	2001 (µg/m³)	2002 (µg/m³)	2003 (µg/m³)	2004 (µg/m³)
Thunder Basin National Grassland	6*	5	6	4
Campbell County	--	--	13	8
Tracy Ranch	--	--	--	8
Black Thunder Mine	5**	6	--	--
Belle Ayr Mine, Site Ba-4	14	14	13	13
Antelope Mine, Site 3	7	6	8	8

* Data for May through December 2001. Monitor was not operational until May 2, 2001.

** Data for the third quarter is questionable and therefore is not used in the determination of the annual mean for the site.

is approximately 24 miles south-southeast; the Belle Ayr Mine Site is approximately four miles northeast; and the Antelope Mine Site is approximately 33 miles south. These monitoring stations are maintained by WDEQ/AQD and respective mines. The WDEQ/AQD is relying on the on-going monitoring data and emission inventories in air quality permit applications to demonstrate compliance with the annual NO_2 ambient air standard (Table 3-3).

3.4.4 Visibility

Visibility refers to the clarity with which scenic vistas and landscape features are perceived at great distances. Visibility can be defined as the distance one can see and the ability to perceive color, contrast, and detail. Fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Visual range, one of several ways to express visibility, is the furthest distance a person can see a landscape feature. Without the effects of human-caused air pollution, a natural visual range is estimated to be about 140 miles in the western U.S. and 90 miles in the eastern U.S. (EPA 2001b).

Visibility impairment is expressed in terms of deciview (dv). The dv index was developed as a linear perceived visual change (Pitchford and Malm 1994), and is the unit of measure used in the EPA's Regional Haze Rule to achieve the National Visibility Goal. The National Visibility Goal was established as part of the CAA in order to prevent any future, and remedy any existing, impairment of visibility in mandatory Federal Class I areas that result from manmade air pollution. The deciview index is a scale related to visual perception that has a value near zero for a pristine atmosphere. A change in visibility of 1.0 dv represents a "just noticeable change" by an average person under most circumstances. Increasing dv values represent proportionately larger perceived visibility impairment.

3.4.4.1 Affected Environment for Visibility

AQRVs, including the potential air pollutant effects on visibility, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets an LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Table 3-4 shows the distances from 31 PSD Class I and Class II areas in the vicinity of the PRB to the Maysdorf LBA Tract general analysis area.

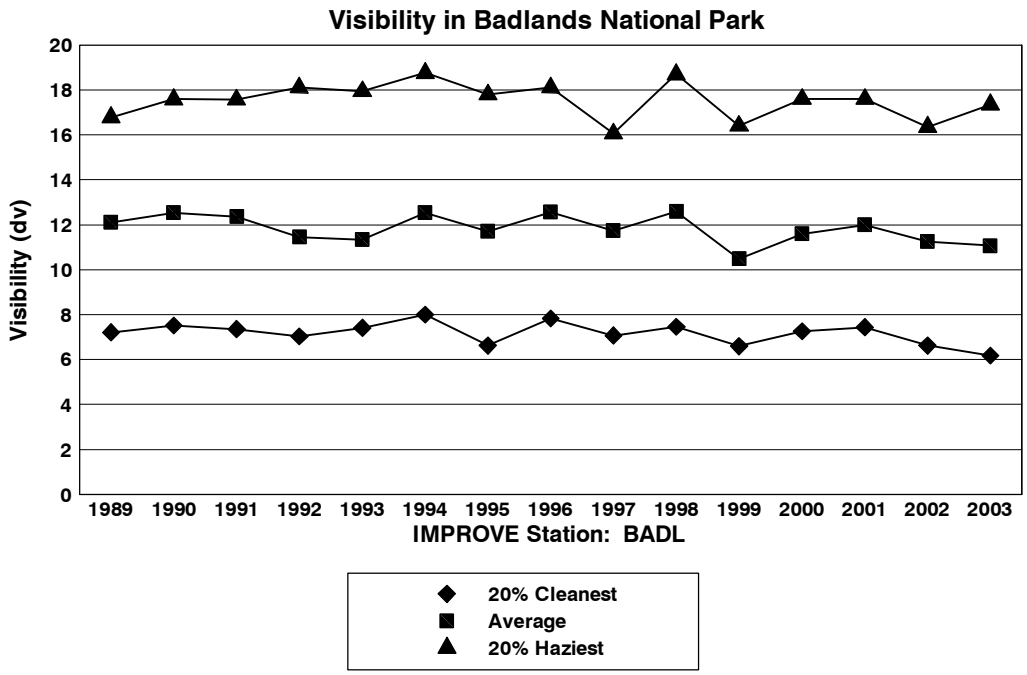
The Regional Haze Rule calls for improved visibility on the most-impaired days and no additional impairment on the least-impaired days. EPA participates in the IMPROVE visibility monitoring program as part of its visibility protection program. The IMPROVE monitoring sites were established to be representative of all Class I areas. Figure 3-9 shows annual averages for the 20 percent best, average, and worst visibility days at Badlands and Bridger Wilderness Areas from 1989 through 2003. To date, Badlands National Park has statistically shown improved visibility on the least impaired days and no change in visibility on the average and most-impaired days. Bridger Wilderness has shown no statistically significant change in visibility on the least, average, or most impaired days (IMPROVE 2005).

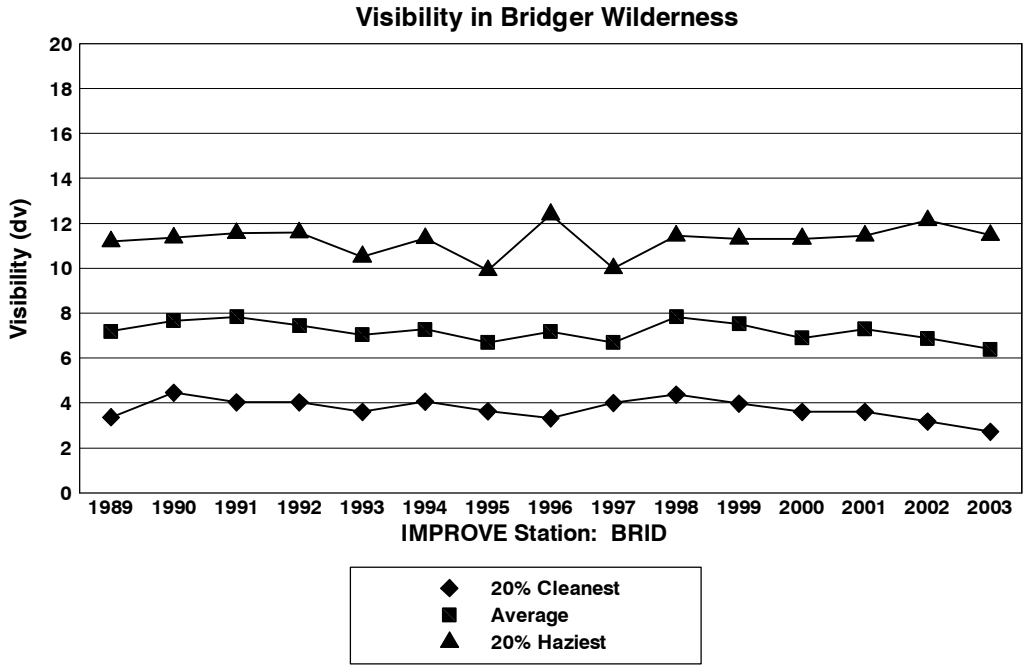
The *Wyoming State Implementation Plan for Class I Visibility Protection* states: "Wyoming's long term strategy will focus on the prevention of any future visibility impairment in Class I areas that can be attributed to a source or small group of sources as the Federal Land Managers have not identified any current impairment in the State's Class I areas due to such sources" (WDEQ/AQD 2005d). WDEQ/AQD prepared the *2003 Review Report on Wyoming's Long Term Strategy for Visibility Protection in Class I Areas*, as required by WAQSR, which calls for AQD to review and revise, if appropriate, the Long Term Strategy every three years. The 2003 Review Report is available on the WDEQ/AQD website at <http://deq.state.wy.us/aqd/visibility.asp>.

3.4.4.2 Environmental Consequences for Visibility

3.4.4.2.1 Proposed Action and Alternatives 2 and 3

The impacts to visibility from mining the Maysdorf LBA Tract have been inferred from the currently permitted impacts of mining the existing coal leases at the Cordero Rojo Mine. The Maysdorf LBA Tract would be mined as an integral part of the Cordero Rojo Mine. The average annual coal production is anticipated to remain at the projected post-2005 rate of 40 million tons, with or without the Maysdorf LBA Tract. Coal production is anticipated to increase to a maximum rate of 46 mmtpy, then taper off during the mine's later years, with or without the Maysdorf LBA Tract. Cordero Rojo Mine's currently approved air quality permit from the WDEQ/AQD allows up to 65 million tons of coal to be mined per year. If the mine acquires the





Source: IMPROVE(2005)

Figure 3-9. Visibility in the Badlands and Bridger Wilderness Area.

additional coal in the LBA tract, they would continue to produce at an average rate of 40 mmtpy for a longer period of time (six to nine years). Therefore, impacts to visibility under the Proposed Action and Alternatives 2 and 3 would be similar to the impacts under the No Action Alternative, but they would be extended by six to nine years.

Current mining techniques (i.e., haulage, blasting, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permit. Material movement would continue to utilize shovels and trucks in overburden and coal. Facilities shown in the current air quality permit would not change as a result of proposed mining of the LBA tract. There are no plans to change blasting procedures or blast sizes associated with the mining of the LBA tract; however, the blasting processes and required mitigation measures would be reviewed when the mining permit is amended to include the new lease area. At that time, the blasting plan would be reviewed and modified to incorporate the BACT protection measures that are in effect at that time.

Surface coal mines are not considered to be major emitting facilities in accordance with Chapter 6, Section 4 of WDEQ/AQD Rules and Regulations. Therefore, the State of Wyoming does not require mines to evaluate their impacts on Class I areas; however, BLM considers such issues during leasing.

3.4.4.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the Cordero Rojo Mine would continue to operate as currently permitted for about nine more years. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract. Impacts to visibility related to mining operations on the existing leases would continue as approved under the current mining and reclamation plan.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.4.4.3 Regulatory Compliance, Mitigation and Monitoring for Visibility Impacts

As discussed above, fine particulate matter ($PM_{2.5}$) is the main cause of visibility impairment. Mitigation measures being used to limit emissions of particulate matter are discussed in Section 3.4.2.3.

Visibility monitoring within the State of Wyoming consists of both the WDEQ/AQD sponsored Wyoming Visibility Monitoring Network and the IMPROVE program. WDEQ has sited two visibility monitoring stations in the PRB. One of these sites (the Thunder Basin National Grasslands site) is 32 miles north of Gillette and includes a nephelometer, a transmissometer, an IMPROVE

aerosol sampler, instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), a digital camera, instruments to measure ozone and instruments to measure oxides of nitrogen (NO, NO_2, NO_x). The second visibility monitoring station (the Cloud Peak Wilderness Area site) is located 14 miles west of Buffalo and includes a nephelometer, a transmissometer, an IMPROVE aerosol sampler, instruments to measure meteorological parameters, and a digital camera.

These sites are being utilized to characterize the extent, frequency of occurrence, and magnitude of visual air quality impacts. The IMPROVE Steering Committee approved the incorporation of the Thunder Basin and Cloud Peak sites into the IMPROVE network in June 2002. Although these stations are not located in areas classified as Class I areas, the collected data will be comparable to monitoring data available from the state's Class I areas. This information can help scientists determine the types and concentrations of air pollutants and their direction of travel in order to project visibility impacts to Class I areas. The Wyoming Visibility Monitoring Network was recently supplemented with the development of a website at <http://www.wyvisnet.com/all.html> to allow public access to real-time monitored visibility and air quality conditions (WDEQ/AQD 2005a).

3.4.5 Acidification of Lakes

The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). According to EPA, sulfur dioxide and NO_x, primarily derived from the burning of fossil fuels, are the primary causes of acid rain. Most lakes and streams have a pH between 6 and 8, although some lakes are naturally acidic even without the effects of acid rain. Acid rain primarily affects sensitive bodies of water, which are located in watersheds whose soils have a limited ability to neutralize acidic compounds (called "buffering capacity"). Lakes and streams become acidic (pH value goes down) when the water itself and its surrounding soil cannot buffer the acid rain enough to neutralize it. In areas where buffering capacity is low, acid rain also releases aluminum, which is highly toxic to many species of aquatic organisms, from soils into lakes and streams.

Several regions in the U.S. were identified in a national surface water survey as containing many of the surface waters sensitive to acidification. They include the Adirondacks and Catskill Mountains in New York State, the mid-Appalachian highlands along the east coast, the upper Midwest, and mountainous areas of the western U.S.

Scientists predict that the decrease in SO_2 emissions required by the Acid Rain Program will significantly reduce acidification due to atmospheric sulfur. Without the reductions in SO_2 emissions, the proportions of acidic aquatic ecosystems would remain

high or dramatically worsen (EPA 2005c). The USDA-FS has been monitoring air quality in the Wind River Mountain Range in Wyoming since 1984 and is seeing a general trend of decreasing sulfates. Nitrates, on the other hand, have been increasing globally.

3.4.5.1 Affected Environment

AQRVs, including the potential air pollutant effects on the acidification of lakes and streams, are applied to PSD Class I and Class II areas. The land management agency responsible for the Class I area sets an LAC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards.

Lake acidification is expressed as the change in ANC measured in microequivalents per liter (μeq/L), the lake's capacity to resist acidification from acid rain. Table 3-8 shows the existing ANC monitored in some mountain lakes and their distance from the Maysdorf LBA Tract general analysis area.

3.4.5.2 Environmental Consequences

3.4.5.2.1 Proposed Action and Alternatives 2 and 3

The Maysdorf LBA Tract would be mined as an integral part of the Cordero Rojo Mine; therefore, the impacts to air quality from mining the Maysdorf LBA Tract have been inferred from the impacts at the currently permitted mining operation. Cordero Rojo Mine anticipates that coal production would remain unchanged from projected post-2005 levels if the Maysdorf LBA Tract is acquired. Impacts to air quality related to lake acidification under the Proposed Action and Alternatives 2 and 3 would be similar to the impacts under the No Action Alternative, but they would be extended from six to nine years. Therefore, current mining techniques (i.e., haulage, blasting, etc.) would be expected to continue for a longer period of time than is shown in the currently approved air quality permit.

3.4.5.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the Cordero Rojo Mine would continue to operate as currently permitted for about nine more years. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract. Impacts to visibility related to mining operations on the existing leases would continue as approved under the current mining and reclamation plan.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.4.5.3 Regulatory Compliance, Mitigation, and Monitoring

Mitigation and monitoring for coal mine emissions, including the emissions that contribute to the acidification of lakes, are discussed in

Table 3-8. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	Lake	Background ANC (μeq/L)	Distance from General Analysis Area (miles)
Bridger	Black Joe	69.0	240
	Deep	61.0	230
	Hobbs	68.0	245
	Upper Frozen	5.8[1]	250
Cloud Peak	Emerald	55.3	105
	Florence	32.7	95
Fitzpatrick	Ross	61.4	240
Popo Agie	Lower Saddlebag	55.5	230

[1] The background ANC is based on only six samples taken between 1997 and 2001.
Source: Argonne (2002)

Sections 3.4.2.3 and 3.4.3.3. Other air quality monitoring programs that are in place in the PRB include WARMS monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, and NADP monitoring of precipitation chemistry in Newcastle.

3.4.6 Residual Impacts to Air Quality

No residual impacts to air quality would occur following mining and reclamation.

3.5 Water Resources

3.5.1 Groundwater

3.5.1.1 Affected Environment

The Maysdorf LBA Tract overlies three geologic water-bearing strata that have been directly affected by previous surface coal mining operations in the PRB and would be directly affected by mining the LBA tract. In descending order, these units are the recent alluvium, the Wasatch Formation overburden, and the mineable coal seam in the Tongue River Member of the Fort Union Formation, which is referred to as the Wyodak or Wyodak-Anderson by the Cordero Rojo Mine. The underlying, subcoal Fort Union Formation and the Fox Hills Sandstone are utilized for industrial water supply at the Cordero Rojo Mine and other nearby coal mines, but these units are not physically disturbed by mining activities. Both regional and site-specific baseline hydrogeologic environments within and around the Cordero Rojo Mine are extensively characterized in the WDEQ/LQD mining and reclamation permits (CMC 2004a and CRI 2002), which also provide groundwater monitoring data. Figure 3-2 presents the hydrostratigraphic units underlying the general analysis area.

3.5.1.1.1 Recent Alluvium

Within the Maysdorf LBA Tract, alluvial (unconsolidated, stream laid) deposits are primarily located in the Belle Fourche River valley and the lower portions of tributary draws where they join the river. The Belle Fourche River alluvium consists of recent stream channel deposits and

terrace deposits. The thickness of alluvial deposits varies from absent where bedrock is exposed in the stream channel to more than 40 ft. Lesser quantities of alluvium occur in tributaries to the Belle Fourche. The alluvial, colluvial, and playa deposits associated with these dry tributary draws and other minor surface drainages within the LBA tract are generally thin and not laterally extensive enough to be considered aquifers. Saturated alluvium along the Belle Fourche varies from absent (dry from land surface to the top of the underlying overburden) to more than 10 ft thick, and is greatest near the stream channel.

Aquifer testing in the field and laboratory indicate that the Belle Fourche River alluvium has a very low hydraulic conductivity within the current Cordero Rojo Mine permit area, ranging from nearly zero to 2.83 ft/day.

Belle Fourche alluvial monitor well water level data indicate that alluvial groundwater flows down-valley, and exhibits a hydraulic gradient similar to that of the valley profile. Recharge to the alluvium is from direct precipitation, streamflow infiltration, and adjacent upland overburden areas. Channel bed materials are clayey and heavy-textured, which restricts recharge from or seepage to alluvial materials. Groundwater elevations and flow directions in the undisturbed portion of the Belle Fourche River alluvium within the southern portion of the Maysdorf LBA Tract have not been impacted by surface coal mining activities (i.e., Belle Fourche River diversion constructed in 1995) to date. The heavy-textured nature of the alluvial aquifer material severely limits groundwater flow down gradient.

In general, the groundwater in the saturated Belle Fourche River alluvium within the LBA tract is not suitable for domestic consumption or irrigation, and it is considered to be marginal for wildlife and livestock use. The alluvial water type is characterized as a sodium/calcium-sulfate with a TDS concentration averaging around 3,900 mg/L. The median TDS concentration for alluvial groundwater in the area of the Cordero Rojo Mine and the adjacent mines (Figure 1-1) is 3,314 mg/l, as calculated from 1,005 samples (Ogle et al. 2005). These numbers are similar but are not directly comparable; the average value is more likely to be influenced by a few high values. The Belle Fourche River alluvial groundwater quality characteristics are due partly to solute concentration by evapotranspiration, and partly to the relatively poor water quality that recharges the aquifer. The alluvial groundwater quality is similar to that of the Wasatch Formation. The low hydraulic conductivities and limited areal extent of saturation indicate that the alluvium does not exhibit aquifer characteristics adequate for agricultural or domestic use. There is currently no known use of alluvial groundwater in or near the Maysdorf LBA Tract general analysis area.

3.5.1.1.2 Wasatch Formation

Within the PRB, the Wasatch Formation (the strata lying above the

coal seams or the overburden) generally consists of interbedded sands, silts, and clays with occasional discontinuous deposits of coal and carbonaceous material. This description basically holds true for the Maysdorf LBA Tract. The Wasatch strata range in cohesion from unconsolidated (i.e., loose sands and siltstones) to lithified (sandstones, siltstones, shales, and coal stringers). Any of the deposits may be water bearing, although the sands and sandstones possess a greater, but laterally limited, potential for groundwater yield. These sands and sandstones are generally discontinuous and separated laterally and vertically by the finer-grained siltstone and shale deposits. The discontinuous nature of the deposits produces considerable variability in groundwater elevations both laterally and vertically. The hydraulic connection between sandstone lenses is tenuous due to intervening shale aquitards; thus, groundwater movement through the Wasatch Formation overburden is limited. Because the water-bearing units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer.

Another geologic unit that may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of sediments that were baked, fused, and melted in place when the underlying coal burned spontaneously. These burned sediments collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. The occurrence of scoria is site specific, typically occurring in areas where coal seams crop out at the surface. The hydrologic function of scoria is to provide infiltration of precipitation and recharge to laterally contiguous overburden and Wyodak coal beds. Scoria outcrop areas occur along the Cordero Rojo Mine's eastern permit boundary. No scoria deposits are present within the Maysdorf LBA Tract.

Recharge to the Wasatch Formation is from the infiltration of precipitation and lateral movement of water from adjacent scoria bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, by drainage into mine excavations, and by seepage into the alluvium along stream courses. Overburden in the vicinity of the LBA tract is recharged naturally by precipitation infiltration and infiltration of surface water runoff stored in playa areas. Additional, artificial recharge occurs where reservoirs have been constructed for ranching operations, and where CBNG groundwater is discharged to the surface.

For the Wasatch Formation as a whole in the PRB, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Field aquifer tests within and adjacent to the Cordero Rojo Mine indicate that the water-bearing Wasatch strata typically have a low hydraulic conductivity, with a range of roughly two orders of magnitude (0.03 to 3.3 ft/day); with locally

higher values being associated with higher sand fractions relative to the low-permeability silts and clays that make up the majority of the overburden. Aquifer testing has also verified that the overburden sands are typically isolated hydraulically from on another (CMC 2004a).

Premine saturated thicknesses in the overburden ranged from near zero in the eastern part of the Cordero Rojo Mine permit area to more than 200 ft in the western portions of the Maysdorf LBA Tract as applied for. Due to the discontinuous nature of the deposits, premine overburden groundwater movement generally followed the topography. Groundwater flow has since been affected in the mine area by the removal of overburden, and west and south of the mine by dewatering operations. Monitor well data indicate that overburden groundwater in the Maysdorf LBA Tract general analysis area now flows toward the mine; however, water levels in overburden monitoring wells located more than 500 ft from the pit have shown no significant decline and any changes have generally been only in response to seasonal fluctuations. Currently, overburden groundwater levels in the Cordero Rojo Mine area vary from approximately six to over 160 ft below land surface.

The quality of groundwater in the Wasatch Formation near the Maysdorf LBA Tract is extremely variable. TDS concentrations range from approximately 525 mg/L to 9,600 mg/L and the water type is characterized as a calcium/ magnesium-sulfate. The median TDS for the Wasatch Formation for the group of mines located between Gillette and Wright, as calculated by WDEQ/LQD based on 1,109 samples, is 2,996 mg/L (Ogle et al. 2005). The water is considered unsuitable for domestic consumption and irrigation, but suitable for livestock and wildlife use.

3.5.1.1.3 Wyodak Coal

The Tongue River Member of the Fort Union Formation contains the Wyodak coal seam, which is often divided by partings that separate it into two or more units. The separate units are given local names that vary from mine to mine (e.g., Upper and Lower Wyodak or Anderson and Canyon seams). At the Cordero Rojo Mine, it is referred to as either the Wyodak or the Wyodak-Anderson. Only local, discontinuous carbonaceous shale partings, typically less than one ft thick, occur in the Maysdorf LBA Tract general analysis area; therefore, the Wyodak coal seam is considered a single aquifer. A general description of the coal seam aquifer is presented as follows.

Due to its continuity, the Wyodak coal seam is considered a regional aquifer because it is water bearing and is laterally continuous throughout large areas in the PRB. Hydraulic conductivity within the Wyodak coal seam is highly variable and reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. Field tests indicate that the coal has a low to moderate transmissivity with a range of roughly

three orders of magnitude, with localized zones of moderately high transmissivity due to increased fracturing. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. The highest permeability is imparted to the coal by tectonic fractures. Due to their pronounced surface expression, these tectonic fractures are often referred to as "lineaments". Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only. Such increased aquifer transmissivity occurs west of the Cordero Rojo Mine area, and is attributed to structural development that has produced additional fracturing. Hydraulic conductivity values reported for the Wyodak coal seam within the Cordero Rojo Mine permit boundary range from 0.03 to 19.0 ft/day, with a mean of approximately 4.0 ft/day (CMC 2004a and CRI 2002).

Recharge to the coal in the LBA tract occurs principally by infiltration of precipitation in the clinker outcrop areas along the Cordero Rojo Mine's eastern permit boundary. Secondary vertical recharge from the overburden also occurs. Prior to mining, the direction of groundwater flow within the coal aquifer was generally from recharge areas westward into the basin, following the dip of the coal. Groundwater conditions varied from unconfined to confined depending on the coal elevation and proximity to outcrop, and the coal was unsaturated in some portions of the Cordero Rojo Mine permit area.

Site-specific water-level data collected from monitoring wells by CMC and other Gillette area coal mining companies and presented in the GAGMO 20-year report (Hydro-Engineering 2001) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater level declines observed near active mining areas prior to 1997 were due predominantly to mine dewatering alone and the direction of groundwater flow was toward the mine excavations. By year 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater drawdown in the coal caused by CBNG development (Hydro-Engineering 2001).

Coal groundwater commonly exceeds many suitability criteria for domestic uses and has a high salinity and sodium hazard, which makes it unsuitable for agricultural uses. Therefore, coal groundwater is typically only suitable for livestock and wildlife watering purposes. Within the general analysis area, Wyodak coal groundwater generally exhibits lower TDS concentrations than alluvial or overburden groundwater. The composition of groundwater in the coal is generally

characterized as a calcium/ magnesium-sulfate type near the scoria outcrop recharge areas and transitions to a sodium-bicarbonate type as the groundwater moves downgradient. In the general analysis area, TDS concentrations range from around 600 mg/L to 4,400 mg/L, and average approximately 1,700 mg/L. WDEQ/LQD calculated a median TDS concentration of 920 mg/L for the coal aquifer in the area of the Cordero Rojo Mine and the adjacent mines (Figure 1-1), based on 1,200 samples (Ogle et al. 2005). The average and the mean values are calculated differently and are not directly comparable, with the average value more likely to be influenced by a few high values; however, these data suggest that the coal in the general analysis area has a higher TDS value than the coal in the surrounding area.

3.5.1.1.4 Subcoal Fort Union Formation

As discussed in Section 3.3.1.1, the Fort Union Formation is divided into three members: the Tongue River Member, the Lebo Member, and the Tullock Member. The mineable coal zones occur within the Tongue River Member. The subcoal Fort Union Formation consists primarily of lithified sands and shales, and is divided into three hydrogeologic units: the upper Tongue River aquifer, the Lebo confining layer, and the Tullock aquifer (Law 1976). Of the three units, the Tullock is the most prolific in terms of groundwater yield.

Mining does not directly disturb the hydrogeologic units below the mineable coal, but many PRB mines use them for industrial water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBNG development (BLM 2001b).

Transmissivities are generally higher in the deeper Tullock aquifer than in the shallower Tongue River aquifer. Many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988), which is also utilized for municipal, industrial, and domestic water supply by the city of Gillette, residential subdivisions, and other nearby coal mines. The average transmissivity for the Tullock, as reported by OSM (1984), is 290 ft^2/day.

The water quality of the subcoal Fort Union Formation is generally suitable for domestic use and may be suitable for irrigation, depending upon TDS concentrations and site-specific SAR values. TDS concentrations measured in various subcoal Fort Union Formation water supply wells in the eastern PRB range from 230 mg/L to 520 mg/L.

According to SEO records, excluding wells for industrial and mining use, and based on depth of completion, there are 18 wells within three miles of the Maysdorf LBA Tract that are completed in the sub-coal Fort Union Formation: five for domestic and stock use and 13 for livestock-only use. CMC uses four wells completed in this formation (Rojo No. 1, Rojo No. 2A, PW-24-1-P, and PW-24-2-P) to supply water for human consumption

and mining operations (Figure 3-10). The depths of these industrial water supply wells range from 988 to 2,034 ft.

3.5.1.1.5 Lance Formation-Fox Hills Sandstone

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. The Lance Formation is comprised of an upper confining layer and a lower aquifer. In Wyoming, the lower Lance Formation is also called the Fox Hills Sandstone. The Fox Hills Sandstone is described as a well-developed, fine- to medium-grained, marine sandstone that contains thin beds of sandy shale and averages around 670 ft thick.

Cordero Rojo Mine's industrial water supply well PW-23-1 (Figure 3-10) is completed in the Fox Hills Sandstone. This well is 4,130 ft deep and permitted to pump 375 gpm. According to chemical analyses, water from this well is potable, although it is used for dust suppression and other miscellaneous uses. If there is a need for additional potable water, it could be incorporated into the mine's potable water system.

3.5.1.2 Environmental Consequences

3.5.1.2.1 Proposed Action and Alternatives 2 and 3

Surface coal mining impacts the quantity of the groundwater resource in two ways: 1) the coal aquifer and any aquifers present in the overburden are removed from the mined areas during mining and replaced with unconsolidated backfill after the coal is removed, and 2) water levels in the coal and overburden aquifers adjacent to the mine pits are depressed as a result of seepage into and dewatering from the open excavations in the area of coal and overburden removal. If the Maysdorf LBA Tract is leased, the area of coal removal and reclamation would increase, which would result in an increase in the area of mining-related impacts to groundwater quantity. While there would be variations in hydrologic properties, the time the pits are open, the distance from mining and dewatering that has occurred as a result of previous mining and CBNG development, the area subject to lower water levels would be increased roughly in proportion to the increase in area affected by mining.

Currently approved mining will remove the existing Wasatch Formation overburden, Fort Union interburden (if present), and coal on the existing Cordero Rojo leases and replace these stratified units with backfill material composed of an unlayered mixture of the shale, siltstone, and sand that makes up the existing Wasatch Formation overburden and Fort Union Formation interburden (if present). The existing leases currently include approximately 13,269 acres. Mining the LBA tract as a maintenance lease would extend these impacts onto an additional area ranging from about 2,558 acres (Proposed Action) to about 4,025 acres (Alternatives 2 and 3).

If the Maysdorf LBA Tract is leased and mined under the Proposed Action

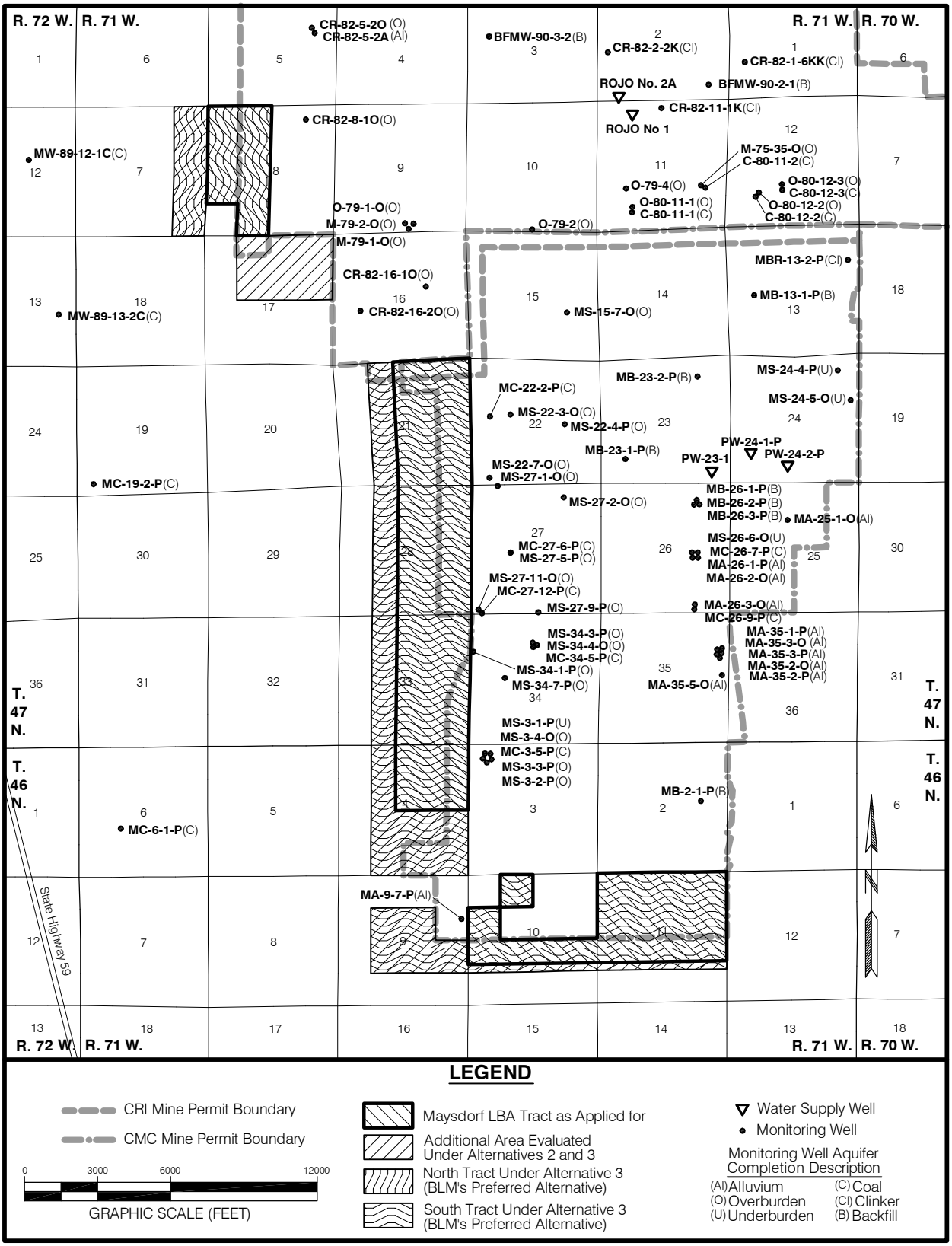


Figure 3-10. Locations of Currently Active Groundwater Monitoring and Water Supply Wells at the Cordero Rojo Mine.

or Alternatives 2 or 3, the coal and overburden aquifers within the tract would be completely dewatered and removed and the area of drawdown caused by coal and overburden removal would be extended further to the west and south of the active mine area. The extent that drawdowns would propagate away from the mine pits would be a function of the water-bearing properties of the aquifer materials. In materials with high transmissivity and low storativity, drawdowns would extend further from the pit face than in materials with lower transmissivity and higher storage capacity.

In general, due to the geologic makeup of the Wasatch Formation overburden (discontinuous sandstone lenses in a matrix of siltstone and shale), drawdowns in the overburden do not extend great distances from the active mine pits. Due to the varied nature of the water-bearing units within the Wasatch Formation overburden, the extent of water level drawdowns are variable as well. Water levels in overburden monitoring wells located more than 500 ft from the Cordero Rojo Mine pits have shown no significant decline and, in fact, the water levels at nearly half of the mine's overburden monitoring wells are higher in elevation at present than in 1980. The maximum drawdown observed is approximately 90 ft at a single well located about 500 ft from an active pit. Drawdown at all of the other currently monitored overburden wells has been 22 ft or less (Hydro-Engineering 2004, CMC 2004b, and CRI 2004).

Water level drawdowns propagate much farther and in a more consistent manner in the Wyodak coal seam than in the overburden because of the regional continuity and higher transmissivity within the coal aquifer. Drawdowns in the coal seam are primarily a function of distance from the pit, although geologic and hydrologic barriers and boundaries such as crop lines, fracture zones, and recharge sources can also influence drawdowns. Drawdowns within the coal from 1980 to 1995 were generally in excess of five ft within 12 miles west and three miles south of the active pits at the Cordero Rojo Mine (Hydro-Engineering 1996). Prior to 1994, water level declines in most of the mine's coal monitoring wells were fairly gradual and mainly due to mine dewatering. However, in 1994, as a result of CBNG development, larger water level declines began to be observed in coal wells located roughly three miles or more west of the active pits than were observed in coal wells located within three miles of the active pits. Since 1995, coal monitoring wells located more than one mile west of the mine pits have recorded an increased rate of drawdown as a result of dewatering associated with CBNG production. By year 2000, the extent of drawdown to the west of the Cordero Rojo Mine caused by mine dewatering could not be defined due to the much larger drawdown caused by CBNG development (Hydro-Engineering 2001). In 2000, monitoring wells located within one mile west of the mine pits had recorded less than 100 ft of historical drawdown. However, monitoring wells located three or

more miles west of the mine pits had recorded total drawdowns of 150 ft or more. Near State Highway 59, which was four to five miles west of the mine pits in 2000, approximately 180 ft of drawdown had occurred (Hydro-Engineering 2001). As of 2003, minimal additional drawdown had occurred immediately west of the advancing pits, although an additional 60 to 80 ft of drawdown had occurred in the vicinity of Highway 59 (Hydro-Engineering 2004). As of May 2005, dewatering by mining and CBNG development had lowered the Wyodak coal aquifer's groundwater level to around 40 ft above the base of the seam within the Maysdorf LBA Tract. The direction of groundwater flow within the LBA tract is now predominantly to the west rather than toward the Cordero Rojo Mine's open pits to the east. Groundwater level monitoring data are included in the annual progress report that the Cordero Rojo Mine submits to the WDEQ/LQD, as well as the GAGMO Annual Reports.

In 1992, CMC used the numerical groundwater flow model MODFLOW to predict the extent of cumulative water level drawdown in the Wyodak coal seam aquifer attributable to mining the existing leases at the Caballo, Belle Ayr, Caballo Rojo, Cordero, and Coal Creek Mines (WWC 1992). The results of the groundwater modeling are reported in Section 2.6, Addendum 2.6-10 of the Cordero Mine 237-T7 permit document (CMC 2004a). Overall, groundwater level monitoring data approximated the modeled impacts relatively well through the mid-1990s. However, both the rate and extent of the actual drawdown in the coal became much greater than the modeled drawdown in the late 1990s, effectively rendering the MODFLOW prediction obsolete. This has occurred as drawdown caused by extensive CBNG development west of the Cordero Rojo Mine permit area and the Maysdorf LBA Tract has overlapped with drawdown caused by mining operations.

The predicted extent of coal-mining related drawdown (five ft contour) in the Wyodak coal seam over the life of the Cordero Rojo Mine if the Maysdorf LBA Tract is mined is shown on Figure 3-11. The life-of-mine drawdown shown in this figure extends the predicted 1992 life-of-mine five ft drawdown contour westward by the dimensions of the Maysdorf LBA Tract. This extrapolation serves as a general approximation of the potential impacts, based on previous experience, but it does not take variations in hydrologic properties, the time the pits are open, the distance from mining and dewatering that has occurred as a result of previous mining and CBNG development into account. More precise predictions of the extent of drawdowns would be required in order to amend the Maysdorf LBA Tract into the WDEQ/LQD permit area, if the Cordero Rojo Mine acquires the Maysdorf LBA Tract.

A "no-coal" zone that exists in the southwest corner of the LBA tract, in Section 4, T.46N., R.71W., appears to be a paleochannel that is comprised of non-indurated sand (Section 3.3). This sand body will not be

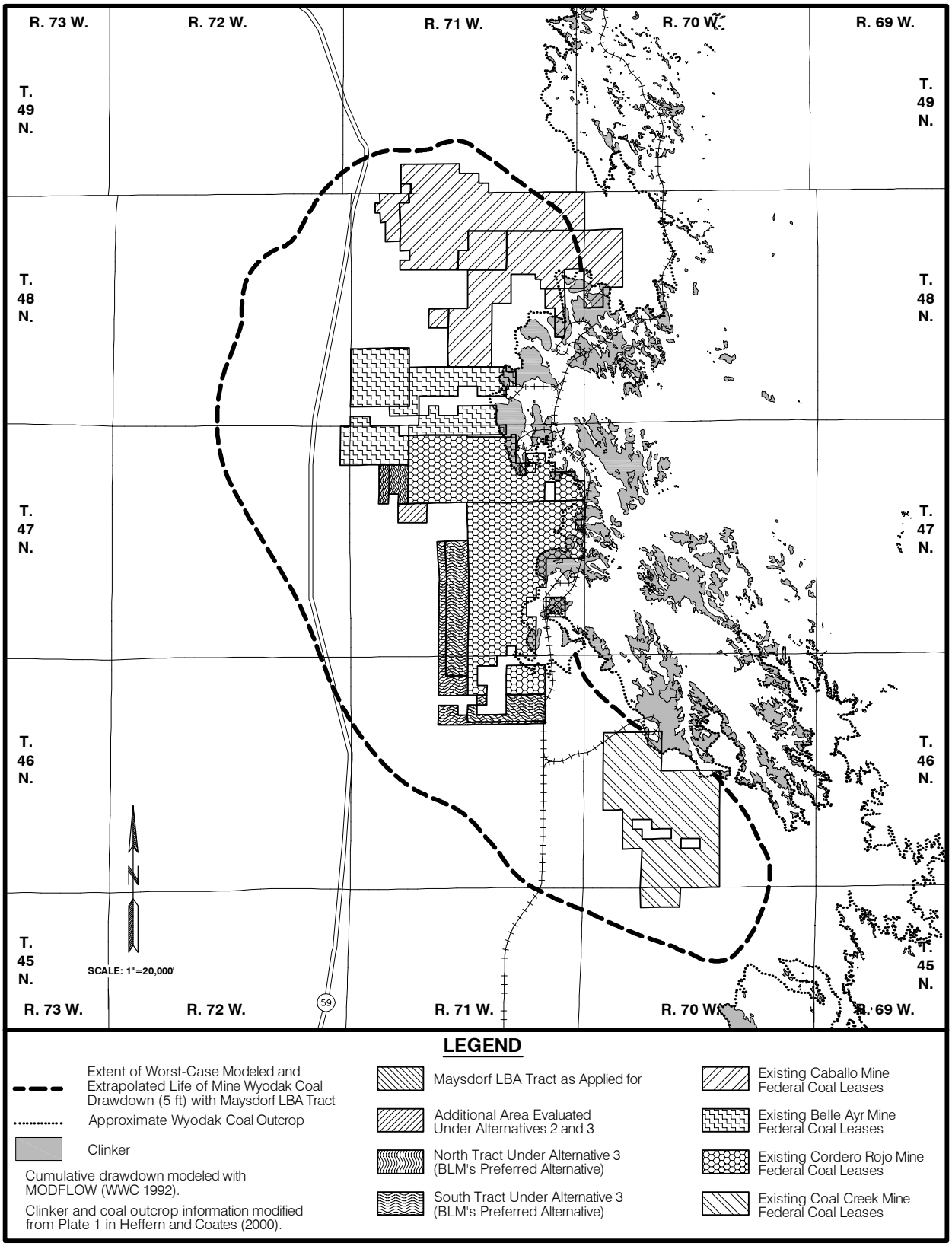


Figure 3-11. Life of Mine Drawdown Map, Resulting from Currently Approved Mining With Addition of the Maysdorf LBA Tract.

significantly disturbed by mining operations; therefore, the hydrogeologic functions of this potential aquifer will not be disrupted if the Cordero Rojo Mine acquires the Maysdorf LBA Tract.

The subcoal aquifers (i.e., Tullock Member of the Fort Union Formation and Lance Formation-Fox Hills Sandstone) are not removed or disturbed by mining, so they are not directly impacted by coal mining activity. CMC has five water supply wells completed in aquifers below the Wyodak coal. If the LBA tract is leased by the applicant, water would be produced from these wells for a longer period of time, but CMC would not require additional sub-coal wells to mine the LBA tract.

As noted above, the existing layers of sediment and rock in the area of coal removal would be replaced by generally homogeneous, unconsolidated backfill material, which would recover as a single hydrostratigraphic unit. The backfill unit created in the Maysdorf tract area would be in hydraulic communication with the undisturbed coal, overburden, and adjacent mine backfill aquifer system. Premining recharge areas, described in Section 3.5.1.1, would not be disturbed by mining. Surface infiltration recharge rates for the backfill materials should be equivalent to or somewhat greater than infiltration recharge through undisturbed overburden, due primarily to the generally flatter topography resulting in less surface runoff.

The hydraulic properties of the backfill aquifer based on the results of aquifer testing at mines in the PRB are quite variable, although generally equal to or greater than the undisturbed overburden and coal aquifers (Van Voast et al. 1978 and Rahn 1976). It is early in the process of full reclamation and to date, the backfilled materials have not reached an adequate saturated thickness to be aquifer tested at the Cordero Rojo Mine. Therefore, no site-specific data are available for the hydraulic properties of the applicant mine's backfill. The composition of backfill material at the adjacent Belle Ayr Mine is quite similar to that of the Cordero Rojo Mine, and the hydraulic properties of the backfill at both mines, as well as the Maysdorf LBA Tract, are also expected to be quite similar. Permeability values measured in existing monitoring wells completed in the saturated backfill at the Belle Ayr Mine range from 0.002 to 0.8 ft/day (Foundation Coal West, Inc. 2003), which is comparable but slightly lower than the reported hydraulic conductivity values for the overburden and Wyodak coal seam within the Cordero Rojo Mine area. These data therefore provide an indication that the Cordero Rojo Mine backfill would readily resaturate as postmining potentiometric elevations recover in the surrounding undisturbed aquifers, and that wells completed in the backfill (including in the Maysdorf LBA Tract) would be capable of supplying sufficient yields to wells constructed for livestock watering uses.

Mining and reclamation also impacts groundwater quality; the TDS

concentration in the water resaturating the backfill is generally higher than the TDS concentration in groundwater from the coal seam aquifer prior to mining. This is due to the exposure of fresh mineral surfaces to groundwater that moves through the backfill. Using data compiled from 10 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. Van Voast and Reiten (1988) reached similar conclusions after analyzing data from the Decker and Colstrip Mine areas in the northern PRB. Their research indicates that upon initial saturation, mine backfill is generally high in TDS concentration and contains soluble salts of calcium, magnesium and sodium sulfates. As the backfill is resaturated, the soluble salts are leached by groundwater inflow and TDS concentrations tend to decrease with time, indicating that the long term groundwater quality in mined and off-site lands would not be compromised (Van Voast and Reiten 1988). Clark (1995) conducted a study to determine if the decreases predicted by laboratory studies actually occur onsite. In the area of the West Decker Mine near Decker, Montana, his study found that dissolved solids concentrations increased when water from an upgradient coal aquifer flowed into a backfill aquifer, and apparently decreased along an inferred path from a backfill aquifer to a downgradient coal aquifer.

Groundwater quality within the backfill aquifer at the Maysdorf LBA Tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Cordero Rojo Mine. To date, nine wells have been installed to monitor water levels and water quality in the backfill at Cordero Rojo Mine. In October and November 2003, TDS concentrations in four of the backfill monitoring wells (five wells cannot be sampled due to a lack of saturation) ranged from 1,670 to 5,910 mg/L (Hydro-Engineering 2004) with a geometric mean of 4,210 mg/L. WDEQ/LQD calculated a median TDS concentration of 3,293 mg/L for the backfill aquifer in the east-central area of the PRB, which includes the Cordero Rojo Mine and adjacent mines (Figure 1-1), based on 1,384 samples (Ogle et al. 2005). The average and the mean values are calculated differently and are not directly comparable.

TDS concentrations observed in the Cordero Rojo Mine backfill monitoring wells to date are generally higher than those found in the undisturbed Wasatch Formation overburden or Wyodak coal aquifers. Postmining groundwater quality is expected to improve after one pore volume of water moves through the backfill. In general, the mine backfill groundwater TDS can be expected to range from 3,000 to 6,000 mg/L, similar to the premining Wasatch Formation aquifer, and meet Wyoming Class III standards for use as stock water.

Changes to the premining hydraulic characteristics of the alluvial aquifer and the quality of alluvial groundwater are expected to be minor

after final reclamation, because Cordero Rojo Mine is required to maintain the essential hydrologic functions of the Belle Fourche River and its alluvial groundwater system. See additional discussion in Section 3.5.1.3.

As discussed in Chapter 2, the Proposed Action and Alternatives 2 and 3 assume that this LBA tract would be leased as a maintenance tract to an existing mine. As discussed above, there have been drawdowns in the coal and overlying aquifers as a result of the existing approved mining and the existing CBNG development in the vicinity of the LBA tract. In the Maysdorf LBA Tract, the level of groundwater in the Wyodak coal has already been lowered to around 40 ft above the base of the coal as a result of dewatering by existing mining and CBNG development activities in the area as of May 2005. The potential overlapping impacts of the existing mining activities with other proposed activities are discussed in Chapter 4.

3.5.1.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the Maysdorf LBA Tract. Impacts to groundwater resources related to existing approve mining and CBNG development, described above, would continue as permitted on the existing Cordero Rojo Mine leases. The surface and potentially some shallow aquifers in portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.5.1.3 Regulatory Compliance, Mitigation and Monitoring

In order to obtain a mining and reclamation permit, the Cordero Rojo Mine was required to evaluate regional and site-specific baseline hydrogeologic environments within and around the mine and use a groundwater flow model to predict the extent of cumulative water level drawdown in the Wyodak coal seam aquifer that would occur as a result of mining the existing leases at the Caballo, Belle Ayr, Caballo Rojo/Cordero, and Coal Creek Mines. Results of these studies are included in the WDEQ/LQD mine permits (CMC 2004a and CRI 2002). If the Maysdorf LBA Tract is leased and mined, the permit for the Cordero Rojo Mine will have to be amended to include the tract, and these studies will be revised accordingly.

As discussed in Section 3.5.3.3, SMCRA and Wyoming regulations, require mine operators 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.

The surface coal mines are also required to monitor water levels and water quality in the overburden, coal, interburden, underburden, and

backfill. Groundwater monitoring wells installed by CMC within and around the current permit area have been used to evaluate groundwater conditions since 1974. Most monitor wells were installed between 1975 and 1982, and have since been used for long-term monitoring purposes until removed by mining operations or discontinued. Wells for which monitoring has been discontinued are still in place and may be reincorporated into the monitoring network in the future. Additional wells have been installed as mining has progressed, yielding a total of 221 wells that have historically been used for monitoring. Currently, 74 wells in and surrounding the mine permit area are monitored by CMC: 12 in the alluvium, 30 in the overburden, 15 in the coal, four in the clinker, four in the underburden, and nine in the mine backfill. The locations of these monitoring wells are shown on Figure 3-10.

Cordero Rojo Mine is required to maintain the essential hydrologic functions of the Belle Fourche River and its alluvial groundwater system that were identified prior to mining. In order to meet this requirement, the stream-laid alluvial materials would be salvaged and stockpiled during mining and would be replaced upon final reclamation (Section 3.5.1.3).

3.5.2 Surface Water

3.5.2.1 Affected Environment

The Belle Fourche River and its tributaries drain the existing Cordero Rojo Mine permit area and Maysdorf general analysis area. The Maysdorf LBA Tract and the existing mining operations and associated permit area are located primarily north of the Belle Fourche River. In this area, the narrow, shallow channel of the river meanders through a looping, one-half mile wide floodplain. A unique geomorphic feature of the Belle Fourche River in the general analysis area is a series of deep pools separated by shallow runs. Surface water features in the Maysdorf LBA Tract and the surrounding areas prior to all mining disturbance are displayed in Figure 3-12.

The Maysdorf LBA Tract consists predominantly of gently rolling topography, although the southern portion is dissected by the Belle Fourche River bottomlands and breaks. The Belle Fourche River flows roughly east-northeast through the southernmost portion of the tract and is currently diverted from its natural channel in this area to facilitate mining within the existing Cordero Rojo Mine permit area. The diversion channel was constructed in 1995. The diversion begins within the LBA tract area, near and parallel to the northern edge of Section 11, T.46N., R.71W., then extends to the north-northeast into the mine's existing permit area, across most of Section 2, T.46N., R.71W., where it rejoins the natural channel. Another channel diversion was constructed in 1977 in Sections 25 and 26, T.47N., R.71W as part of the mine's railroad spur and loop construction. Both of these diversions are shown in Figure 3-12.

Caballo and Coal Creeks, which are located north and southeast of the

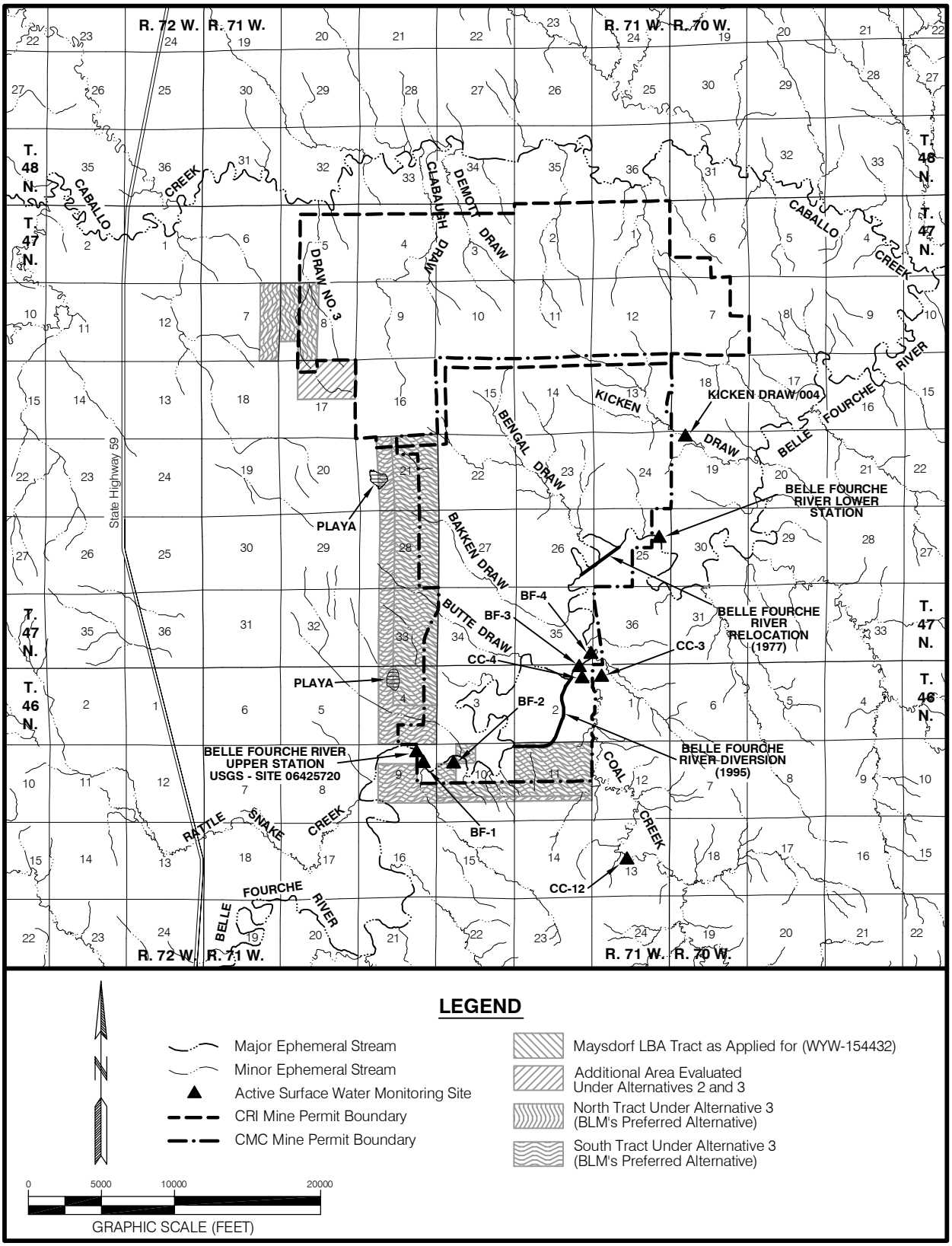


Figure 3-12. Surface Water Features Within and Adjacent to the Maysdorf LBA Tract.

tract, respectively, both discharge to the Belle Fourche River (Figure 3-12). Caballo Creek is located outside of the Cordero Rojo Mine permit area and the Maysdorf LBA Tract general analysis area. Coal Creek is located along the southeastern boundary of the mine permit area and a portion of it lies within the general analysis area (Figure 3-1). Caballo Creek flows easterly toward the Belle Fourche River about 1.5 miles north of the tract, and is currently diverted by the Belle Ayr Mine operation. Caballo Creek flows into the Belle Fourche River in Section 3, T.47N., R.70W. Coal Creek flows northwesterly toward the southern portion of the LBA tract and joins the Belle Fourche River near the end of the diversion channel in Section 2, T.46N., R.71W. The eastern edge of Section 11, T.46N., R.71W., in the southern portion of the LBA tract, coincides with the Coal Creek channel for about 1,000 ft. (Figure 3-12).

All streams, including the Belle Fourche River, within and adjacent to the tract are typical for the region in that flow events are ephemeral. Limited portions of the Belle Fourche River do receive recharge from bank storage (groundwater stored in the alluvium along the stream channel) making the stream locally intermittent.

The central and southern portions of the tract are drained by several shallow, first order tributaries of the Belle Fourche River, while the northern portion of the tract is drained by a few first order tributaries that flow north to Caballo Creek. Two areas on the tract do not drain toward any stream: a roughly 30-acre playa formed by a natural topographic depression exists in the northern portion of Section 4, T.46N., R.71W., and roughly a 40-acre playa formed by a natural topographic depression exists in the west-central portion of Section 21, T.47N., R.71W. (Figure 3-12).

Long-term streamflow records collected by the USGS on the Belle Fourche River near Moorcroft, Wyoming indicate an average discharge of about 16,700 ac-ft per year, ranging from 825 ac-ft in 1961 to about 98,300 ac-ft in 1978. Streamflow at USGS Station 06425720 (located in the NE¼NE¼ of Section 9, T.46N., R.71W., and depicted on Figure 3-12) was monitored continuously from 1975 to 1983, and then discontinued until 2001 when monitoring was reestablished. According to streamflow records from 1975 to 1983, the river at this gaging station did not flow throughout most of the year except in direct response to snow melt and precipitation runoff events. The annual mean streamflow during that period ranged from 0.19 to 9.82 cfs.

More recent streamflow records, from 2001 to the present, indicate that the mean annual streamflow of the Belle Fourche River at this location is normally less than five cfs, with greater, episodic flows occurring during heavy precipitation and snow-melt events. Streamflow occurrence is currently more persistent as a result of surface discharge of groundwater associated with CBNG production upstream of this

monitoring station, which is a relatively recent phenomenon. In contrast to the infrequent nature of streamflow events that were recorded at Station 06425720 from 1975 to 1983, the Belle Fourche River at this location is now seldom completely dry. However, the mean annual streamflow rate and annual discharge volume have not significantly increased, indicating that pre-CBNG development conditions still prevail. Discharge volumes for 2002 and 2003 (the most recent period of record with a complete year's-worth of data) were 1,600 and 1,860 ac-ft, respectively.

The Belle Fourche River is listed in the WDEQ/WQD Surface Water Classification List as a Class 2AB stream that is protected for drinking water, aquatic life (classified as a warm water fishery), recreation, wildlife, agriculture, industry and scenic value. Coal Creek is listed as a Class 3B stream (not known to support fish populations or drinking water supplies and where those uses are not attainable). All other ephemeral streams draining the existing permit area and LBA general analysis area are categorized as Class 4 streams (where it has been determined that aquatic life uses are not attainable) (WDEQ/WQD 2005).

Springs are uncommon in the general analysis area and have not been identified in the Belle Fourche River valley. A few springs have been observed in upper terrace areas, but yield negligible flow that does not contribute directly to the Belle Fourche River.

Six reservoirs used for livestock water are located in the tract, all of which are in T.47N., R.71W. Two reservoirs are located on Draw No. 3, which drains north into Caballo Creek: one is in the SE¼SW¼ of Section 8, (0.41 acres), and the other is in the SE¼NW¼ of Section 8 (0.19 acres). One stock reservoir is located on Bengal Draw, which drains south into the Belle Fourche River, in the NW¼NE¼ of Section 21 (0.27 acres). Two stock reservoirs are located on Butte Draw, which drains south into the Belle Fourche River: one is in the NE¼NE¼ of Section 33 (0.25 acres), and the other in the SW¼SE¼ of Section 28 (0.14 acres). None of the existing reservoirs has estimated storage capacities of more than two acre-feet.

Water quality in the Belle Fourche River was measured by the USGS at Station 06425720 between November 1975 and April 1983, and from March 2001 to the present. In compliance with WDEQ/LQD permit monitoring requirements, CMC collects quarterly water quality samples from the Belle Fourche River at both the Upper and Lower Stations (Figure 3-12). Based on these historical water quality analyses, water from the Belle Fourche River is typically a sodium/calcium-sulfate type with TDS concentrations normally ranging around 2,000 to 3,000 mg/L. Surface water quality is usually unsuitable for domestic use, marginal for irrigation, and suitable for livestock and wildlife use. Total iron and manganese concentrations are significantly high in relation to domestic water use, although these

metal concentrations coincide with increases in TSS concentrations.

Surface water quality typically varies with flow and/or season. In general, as streamflow increases, TDS concentration decreases, while TSS concentration increases. Conversely, as streamflow decreases, the TDS concentration increases, while the TSS concentration decreases. Due to the sparse vegetative cover and the infrequent occurrence of surface runoff in this semi-arid environment, high TSS concentrations can be expected, especially from floods caused by thunderstorms.

3.5.2.2 Environmental Consequences

3.5.2.2.1 Proposed Action and Alternatives 2 and 3

Changes in surface runoff characteristics and sediment discharges would occur during mining of the LBA tract as a result of the destruction and reconstruction of drainage channels as mining progresses and the use of sediment control structures to manage discharges of surface water from the mine permit area. Erosion rates could be high on the disturbed areas because of vegetation removal. However, both state and federal regulations require treatment of surface runoff from mined lands to meet effluent standards. Generally, the surface runoff sediment is deposited in ponds or other sediment control devices inside the permit area before the surface runoff water is allowed to leave the permit area.

Since the LBA tract would be mined as an extension of the existing mine under the Action Alternatives, there would not be a large increase in the size of the area that is disturbed and not reclaimed at any given time as a result of leasing the tract. The presence of disturbed areas creates a potential that sediment produced by large storms (i.e., greater than the 10-year, 24-hour storm) could potentially adversely impact areas downstream of the mining operation. This potential for adverse downstream impacts would be extended if the LBA tract were leased.

Following reclamation, the loss of soil structure would act to increase runoff rates on the LBA tract. However, the general decrease in average slope in reclaimed areas, as discussed in Section 3.2.2, would tend to counteract the potential for an increase in runoff. Soil structure would gradually reform over time, and vegetation (after successful reclamation) would provide erosion protection from raindrop impact, retard surface flows, and control runoff at approximately premining levels.

The Maysdorf LBA Tract may encounter significant runoff in the Belle Fourche River. A section of the river is currently diverted around active pits at the northern edge of the tract in Section 11, T.46N., R.71W. and within the existing Cordero Rojo Mine permit area. During mining of the LBA tract, hydrologic control would likely consist of building another diversion channel for the river around the open pit area. Due to its location in the headwaters area

of ephemeral Belle Fourche River and Caballo Creek tributaries, runoff within the tract would not be expected to be substantial. In addition to diverting the Belle Fourche River, hydrologic control during mining would most likely consist of allowing runoff to accrue to the mine pit where it would be treated and discharged according to the standards of the WDEQ/WQD. Large flood control reservoirs are not anticipated for the LBA tract.

The impacts described above would be similar for both the Proposed Action and Alternatives 2 and 3, and they are similar to the expected impacts for the currently permitted mining operation.

3.5.2.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected; coal removal and the associated disturbance to the Belle Fourche River and its tributaries would not occur on the Maysdorf LBA Tract. The impacts to surface water resources described above would continue on the existing mine permit area as a result of currently approved mining and CBNG development. The surface in portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.5.2.3 Regulatory Compliance, Mitigation and Monitoring

In accordance with SMCRA and Wyoming State Statutes, the Belle Fourche River channel would be restored after surface mining operations are completed on the Maysdorf LBA Tract. Surface water flow, quality, and sediment discharge would approximate premining conditions. The drainages that intersect the permit area would be reclaimed to exhibit channel geometry characteristics similar to the premining characteristics. The Belle Fourche River would be restored in approximately the same location as the natural channel and its hydrologic functions, including the alluvial groundwater-surface water interaction and the premining pools and runs features would be restored.

Other WDEQ/LQD permit requirements for the existing Cordero Rojo Mine include constructing sediment control structures to manage discharges of surface water from the mine permit area; treatment of all surface runoff from mined lands as necessary to meet effluent standards; and restoration of stock ponds and playas disturbed during mining. These requirements would be extended to include the Maysdorf LBA Tract when the mine permit is amended to include the tract.

Monitoring requirements for the existing Cordero Rojo Mine include a monitoring program to assure that ponds would always have adequate space reserved for sediment accumulation and collection of water quality samples from the Belle

Fourche River at both the Upper and Lower Stations (Figure 3-12) on a quarterly basis. These requirements would be extended to include the Maysdorf LBA Tract when the mine permit is amended to include the tract.

3.5.3 Water Rights

3.5.3.1 Affected Environment

The Wyoming SEO administers water rights in Wyoming. Water rights are granted for both groundwater and surface water appropriations. Prior to development of water resources associated with energy development, water appropriations (either groundwater or surface water) in the PRB were typically for livestock use. Currently, mining companies and CBNG development companies hold the majority of the water rights in the general analysis area.

Records of the SEO have been searched for groundwater rights within a three-mile radius of the Maysdorf LBA Tract as applied for under the Proposed Action and Alternatives 2 and 3. This information is required for WDEQ permitting. The result of the most recent search is provided below. A more detailed listing of the non-coal mine related groundwater rights within a three-mile radius of the LBA tract is presented in the Draft EIS for the Maysdorf Coal Lease Application, which is available on request.

For the Maysdorf LBA Tract, SEO data indicate that, as of March 8, 2005, there are 2,702 permitted water wells within three miles of the tract, of which, 2,034 are owned by coal mining companies. The other 668 non-coal mine related, permitted water wells, which include 488 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 278 CBNG only
- 122 livestock and CBNG
- 66 livestock only
- 36 miscellaneous and CBNG
- 29 domestic and livestock
- 21 industrial
- 21 miscellaneous
- 20 livestock, miscellaneous, and CBNG
- 16 domestic
- 16 miscellaneous, dewatering, and CBNG
- 15 miscellaneous, livestock, and CBNG
- 13 monitoring
- 3 industrial and miscellaneous
- 2 miscellaneous and livestock
- 2 livestock and miscellaneous
- 1 CBNG and livestock
- 1 dewatering, reservoir, and industrial
- 1 miscellaneous and domestic
- 1 livestock and industrial
- 1 livestock and irrigation
- 1 livestock, irrigation, and domestic
- 1 livestock, miscellaneous, and domestic
- 1 temporary, industrial, and drilling

SEO records have been searched for surface water rights within a three-mile radius of the Maysdorf LBA Tract as applied for and Alternatives 2 and 3. Like the groundwater rights, this information is also required for WDEQ permitting. The result of the

most recent search is provided below. A listing of the non-coal mine related surface water rights is presented in the Draft EIS for the Maysdorf Coal Lease Application, which is available on request.

For the Maysdorf LBA Tract, SEO records indicate that as of March 8, 2005, there are 201 non-coal mine related, permitted surface water rights within the search area. These surface water rights are permitted for the following uses:

- 76 livestock
- 63 temporary industrial
- 22 irrigation
- 15 temporary industrial drilling
- 9 livestock and fisheries
- 8 temporary oil production and drilling
- 4 irrigation and domestic
- 3 temporary industrial miscellaneous
- 1 temporary oil production/drilling and miscellaneous

3.5.3.2 Environmental Consequences

3.5.3.2.1 Proposed Action and Alternatives 2 and 3

In March 2005, Wyoming SEO records indicate that there are a total of 2,702 permitted water wells presently located within three miles of the LBA tract. As discussed above, most of these wells are owned by coal mining companies and are used for groundwater monitoring and water supply. Of the non-coal mine related wells within the search area, approximately 32 percent are permitted for stock watering, 14 percent are permitted for miscellaneous use, 42 percent are permitted for CBNG development, four percent are permitted for industrial uses, and seven percent are permitted for domestic uses. Other uses amounted to approximately two percent. Most of these wells have been permitted for multiple uses.

Some of these privately permitted water wells will likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining operations occurring at the Cordero Rojo and adjacent mines and additional water wells would be likely to be affected if the LBA tract is leased and mined. Three of the permitted water wells listed in Section 3.5.3.1 are located within the expanded five-ft drawdown contour with completion depths that indicate they produce water from the Wyodak coal seam (this excludes wells constructed for monitoring, mine dewatering, or CBNG production). These wells are shown on Table 3-9.

3.5.3.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the Maysdorf LBA Tract. The impacts to water rights associated with existing approved mining and CBNG development would continue to occur.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not

Table 3-9. Water Supply Wells Possibly Subject to Drawdown if the Maysdorf LBA Tract is Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P84138W	Austin Powder Co.	Miscellaneous	10	400	160
P45634W	Milo Haight	Stock	20	430	80
P73316W	Edna L. Carter	Domestic,	20	612	280

Note: Wells in this table are believed from their completion depths to be completed in the Wyodak coal seam and are within the additional area of five ft or more drawdown caused by mining the Maysdorf tract. Wells impacted by the No Action Alternative are already addressed in the Cordero Rojo Mine's WDEQ/LQD mine permit document.

preclude an application to lease the tract in the future.

3.5.3.3 Regulatory Compliance, Mitigation and Monitoring

SMCRA and Wyoming regulations require mine operators 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 required mitigation is considered to be part of the Action Alternatives. The most probable source of replacement water would be one of the aquifers underlying the coal. For example, the subcoal Fort Union Formation aquifers are not removed or disturbed by coal mining, and would therefore be a potential source of replacement water.

If the Maysdorf LBA Tract is leased, the mine operator would be required to update the list of potentially impacted private water supply wells and predict impacts to those wells within the five-ft drawdown contour as part of the permitting process. The operator would be required to commit to replacing those water supplies that are determined to be affected by mining with water of equivalent quality and quantity.

3.5.4 Residual Impacts

The area of coal and overburden removal and replacement of overburden and associated groundwater drawdowns would be increased under the Action Alternatives compared with the area of coal and overburden removal and overburden replacement and associated groundwater drawdowns for the existing Cordero Rojo Mine. The postmining backfill may take in excess of 100 years to reach equilibrium water levels and water quality. Less time would be required near the mining boundaries. Monitoring data from wells completed in existing backfilled areas in the PRB suggest that there would be an adequate quantity of water in the backfill to replace current use, which is for livestock. Water quality in the backfill would generally be expected to meet the Wyoming Class III standards for use as stock water.

3.6 Alluvial Valley Floors

3.6.1 Affected Environment

Prior to leasing and mining, AVFs must be identified because, under SMCRA, mining on AVFs is prohibited unless the affected AVF is undeveloped rangeland that is not significant to farming or if the affected AVF is of such small acreage that it would have a negligible impact on a farm's agricultural production. These restrictions also apply to AVFs that are downstream of the area of disturbance but might be affected by disruptions in streamflow. AVFs that are determined not to be significant to agriculture can be disturbed during mining but must be restored as part of the reclamation process.

WDEQ regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Guidelines established by OSM and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These studies are used to identify the following conditions: 1) the presence of unconsolidated stream laid deposits, 2) the possibility for artificial flood irrigation, 3) past and/or present flood irrigation, and 4) apparent subirrigated areas and the possibility for natural flood irrigation. Areas that are identified as AVFs following these studies are evaluated for their significance to farming by WDEQ/LQD.

Portions of the Belle Fourche River and its associated ephemeral tributaries within the existing Cordero Rojo Mine permit boundary (including a portion of the Maysdorf LBA Tract) and portions of Caballo Creek within the existing Belle Ayr Mine permit boundary (north of the Maysdorf LBA Tract) have been investigated for the presence of AVF's (Foundation Coal West, Inc. 2003, CMC 2004a, and CRI 2002).

Three separate areas along Caballo Creek, located within and upstream of the existing Belle Ayr Mine permit boundary and north of the Maysdorf LBA Tract, have been determined by WDEQ/LQD to be AVFs. One of these was determined to be an AVF with possible significance to agriculture, while the other two were determined not to be significant to farming.

The reach of Belle Fourche River and its associated ephemeral tributaries within and adjacent to the existing Cordero Rojo Mine permit boundary have also been investigated for the presence of AVFs (CMC 2004a). WDEQ/LQD determined that the valleys of Kicken and Bengal Draws, Coal Creek, and Belle Fourche River in the vicinity of the Cordero Rojo Mine are not AVFs because they are not capable of supporting subirrigation or flood irrigation agricultural activities (WDEQ/LQD 2004a). The Belle Fourche River is considered an impractical water source for artificial flood irrigation practices due to poor water quality and infrequent water availability. Historic flood irrigation attempts have not been identified along the Belle Fourche or ephemeral drainages within the general analysis area.

CMC's baseline studies also determined that there is a small amount of groundwater in storage in the unconsolidated deposits of the Belle Fourche River, with subirrigation confined to a narrow area immediately adjacent to the channel (CMC 2004a).

The Maysdorf LBA Tract has not yet been formally evaluated for the presence of AVFs; however, CMC is currently conducting preliminary investigations along the Belle Fourche River and within its associated ephemeral draws to determine if AVFs are present within the southern portion of the LBA Tract. These studies include mapping of stream laid deposits, evaluations of groundwater availability and quality, assessment of subirrigated land, and evaluations of natural and flood irrigation.

A detailed AVF study would be part of the mine permitting process if the Maysdorf LBA Tract is leased. Formal declarations of the presence or absence of an AVF, its significance to agriculture, and the appropriate perimeter (areal extent) would be made by the WDEQ/LQD as part of the mine permitting process if the LBA tract is leased and proposed for mining.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action and Alternatives 2 and 3

AVF investigations conducted within and adjacent to the general analysis area have identified three small AVF areas that occur along Caballo Creek downstream of the northern portion of the Maysdorf LBA Tract. No AVFs have been identified along the Belle Fourche River and its associated ephemeral draws within and adjacent to the existing Cordero Rojo Mine permit boundary. As indicated above, the Maysdorf LBA Tract has not yet been formally evaluated for the presence of AVFs, but the general absence of flood irrigation activity in this area indicates it is unlikely that mining activity would be precluded by the presence of an AVF.

Streamflows in drainages within the Maysdorf 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 would be necessary to evacuate them following major runoff events to provide storage volume for the next flood. Consequently, disruptions to streamflows that might supply downstream AVFs are expected to be negligible. Groundwater intercepted by the mine pits would be routed through settling ponds to meet state and federal quality criteria, and the pond discharges would likely increase the frequency and amount of flow in these streams, thereby increasing surface water supplies to downstream AVFs.

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

3.6.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal and associated impacts to any existing AVFs would not occur as a result of mining operations on the Maysdorf LBA Tract. The impacts to AVFs associated with mining operations at the Cordero Rojo and Belle Ayr Mines and CBNG development would continue to occur as approved under the current mining and reclamation permits.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.6.3 Regulatory Compliance, Mitigation and Monitoring

As discussed above, AVFs must be identified because SMCRA restricts mining activities that would affect AVFs that are determined to be significant to agriculture. Impacts are generally not permitted to AVFs that are determined to be significant to agriculture. AVFs that are determined not to be significant to agriculture or that were permitted to be disturbed prior to the effective date of SMCRA can be disturbed during mining but must be restored as part of the reclamation process. The determination of significance to agriculture is made by WDEQ/LQD, and it is based on specific calculations related to the production of crops or forage on the AVF and the size of the existing agricultural operations on the land of which the AVF is a part. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the valley will be protected. Downstream AVFs must also be protected during mining.

3.6.4 Residual Impacts

No residual impacts to AVFs would occur following mining.

3.7 Wetlands

3.7.1 Affected Environment

Waters of the U.S. is a collective term for all areas subject to regulation by the COE under Section 404 of the Clean Water Act. Waters of the U.S. include *special aquatic sites*, wetlands, and jurisdictional wetlands. Special aquatic sites are large or small geographic areas that possess special ecological characteristics of productivity, habitat, wildlife protection or other important and easily disrupted ecological values (40 CFR 230.3). Wetlands are a type of special aquatic site that includes "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" [33 CFR 328.3(a)(7)(b)].

There are effectively three categories of wetlands:

- Jurisdictional wetlands, which are defined as those wetlands which are within the extent of COE regulatory review. They must contain three components: hydric soils, a dominance of hydrophytic plants, and wetland hydrology.

- Non-jurisdictional wetlands, which are non-navigable, isolated intrastate wetlands (e.g., playas) and other Waters of the U.S. These wetlands are not considered to be jurisdictional as a result of a Supreme Court ruling (Solid Waste Agency of Northern Cook County *v.* United States Army Corps of Engineers, January 9, 2001). Navigable, non-isolated wetlands and other Waters of the U.S. are still considered jurisdictional by the COE.

- Functional wetlands, which are areas that contain only one of the three criteria listed under jurisdictional wetlands. The USFWS used this categorization in producing the NWI maps. These maps were produced using aerial photo interpretation, with limited field verification.

Several types of wetland systems are present within the general analysis area. These wetland systems are limited in size; however, the vegetation in these environments is highly productive and diverse, and provides habitat for many wildlife species. Further, the systems as a whole play important roles in controlling flood waters, recharging groundwater, and filtering pollutants (Niering 1985).

Wetlands occur in a variety of forms within the general analysis area. Palustrine wetlands, defined by their close association with emergent herbaceous marshes, swales, and wet meadows, support a variety of lush plant life and occur sporadically along drainages and closed depressions. These areas are supported by the saturated soils along the banks of the Belle Fourche River, discharged CBNG waters, and upland drainages that are adequately supplied with surface runoff.

Wetland inventories, based on USFWS NWI mapping and vegetation mapping in the field, were completed in 2005 by CMC on lands contained within a wetland analysis area. The area investigated is located within, west, and south of the current Cordero Rojo Mine permit area and includes the Maysdorf LBA Tract as applied for, the lands added under Alternatives 2 and 3, and a ¼-mile disturbance buffer. Wetland areas previously mapped by the USFWS NWI project have been recently altered somewhat due to CBNG-related water production within and upstream of the general analysis area. Within the entire wetland analysis area (5,590.65 acres, of which 1,245.96 acres are within the current Cordero Rojo Mine permit area), a total of 154.2 acres of Waters of the U.S. have been identified. A total of 33.2 acres of jurisdictional Waters of the U.S. have been identified, of which approximately 30.0 acres are jurisdictional wetlands. Identified jurisdictional

wetlands occur immediately along the banks of the Belle Fourche River channel and at intermittent locations in upland swale drainages adjacent to the river. The additional 3.2 acres of jurisdictional other Waters of the U.S., which did not qualify as jurisdictional wetlands, consist primarily as the open water of the Belle Fourche River. There are an additional 121.0 acres of non-jurisdictional Waters of the U.S. also contained in the wetland analysis area that include a large flooded playa, stockponds, depressions, and several ephemeral riverine systems that are isolated. Non-jurisdictional wetlands (78.4 acres) are associated with stockponds, depressions, and ephemeral riverine drainages that are isolated. The non-jurisdictional other Waters of the U.S. (42.6 acres) occur as an area of open water in Section 21, T.47N., R.71W., where water produced from nearby CBNG development wells is regularly discharged, resulting in year-round ponding in a depression/playa area.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action and Alternatives 2 and 3

Based on USFWS NWI mapping and vegetation mapping completed in 2005, a maximum of approximately 30 acres of jurisdictional and 78.4 acres of non-jurisdictional wetlands would be disturbed if the LBA tract is leased and subsequently mined under the largest tract configuration (Alternatives 2 and 3).

A formal wetland delineation has been confirmed by COE for some of the wetlands included in the proposed LBA tract (1,245.96 acres of the Cordero Rojo Mine's current permit area lie within the wetland analysis area), but wetland inventories covering portions of the LBA tract have not yet been submitted to COE for verification. This wetland inventory would be submitted to COE for verification as part of the mining and reclamation permit process. In Wyoming, once the delineation is verified by COE, it would be made a part of the mine permit document. The reclamation plan would then be revised to incorporate restoration of at least equal types and number of jurisdictional wetlands.

Non-jurisdictional wetlands would be restored as required by the federal surface managing agency, the WDEQ/LQD, or the private surface owner. These include stockponds, depressions, and ephemeral riverine drainages. The current WDEQ/LQD mine permit for the existing Cordero Rojo Mine requires restoration of stock ponds and playas disturbed during mining. Although playas may no longer be identified as jurisdictional Waters of the U.S. under Section 404 of the Clean Water Act as a result of court directives, the Cordero Rojo Mine plans to continue establishing playa/depression features within the reclaimed topography if the LBA tract is mined as an extension of existing operations.

During the period of time after mining and before replacement of wetlands, all wetland functions would be lost. The replaced wetlands may not

duplicate the exact function and landscape features of the premine wetlands, but replacement plans would be evaluated by COE and replacement would be in accordance with the requirements of Section 404 of the Clean Water Act as determined by COE.

3.7.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the Maysdorf LBA Tract. The impacts to wetlands on the existing Cordero Rojo Mine leases would occur as currently permitted. The surface of portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine, and any wetlands located on those lands, would be disturbed as currently permitted to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.7.3 Regulatory Compliance, Mitigation and Monitoring

The presence of jurisdictional wetlands on a mine property does not preclude mining. A wetland delineation must be completed according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands present. There are special required permitting procedures to assure that after mining there will be no net loss of wetlands. COE requires replacement of all impacted jurisdictional wetlands in accordance with Section 404 of the Clean Water Act.

Section 404 of the Clean Water Act does not cover non-jurisdictional or functional wetlands; however, Executive Order 11990 requires that all federal agencies protect all wetlands. Replacement of non-jurisdictional and functional wetlands may be required by the surface land owner and/or WDEQ/LQD. WDEQ/LQD allows and sometimes requires mitigation of non-jurisdictional wetlands affected by mining, depending on the values associated with the wetland features. WDEQ/LQD also requires replacement of playas with hydrologic significance.

Reclaimed wetlands are monitored using the same procedures used to identify pre-mining jurisdictional wetlands.

3.7.4. Residual Impacts

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

3.8 Soils

3.8.1 Affected Environment

Numerous baseline soil surveys associated with surface mining operations and oil field development have been conducted in the eastern PRB. Soil surveys of Campbell

County, Wyoming, including the Maysdorf LBA Tract soils analysis area, have also recently been conducted by the NRCS (Westerman and Prink 2004). The Maysdorf LBA soils analysis area (5,590.65 total acres) includes the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under Alternatives 2 and 3), as well as the additional area that would be disturbed in order to recover the coal in the study area (assumed to be a ¼-mile buffer surrounding the BLM study area).

Soils vary depending upon where and how they were formed. Major factors involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Four primary soil formation processes causing different soil types were noted in this area: 1) those soils developing predominantly in thin residuum from sandstone or shale on upland ridges, 2) those soils developing predominantly in slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands, 3) those soils developing predominantly in coarse-textured alluvium or sandy eolian deposits on rolling uplands, and 4) drainage soils developing in mixed stream laid alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins.

All soil surveys were completed to an Order 1-2 and 3 resolution in accordance with WDEQ/LQD Guideline No. 1, which outlines required soils information necessary for a coal mining operation. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the analysis area were identified by series, which consist of soils that have similar horizons in their profile. More detailed information about the soils present on the Maysdorf LBA Tract is included in the supplementary information document for the Maysdorf EIS, which is available on request.

The soil depths and types on the Maysdorf LBA Tract soils analysis area are similar to soils currently being salvaged and utilized for reclamation at the adjacent Cordero Rojo Mine and other mines in the eastern PRB. The site-specific soil surveys have located hydric soils and/or inclusions of hydric soils, which are one component used in identifying wetlands. Areas with soils that are not suitable to support plant growth include sites with high alkalinity, salinity, or clay content.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action and Alternatives 2 and 3

Removal and replacement of soils during mining and reclamation would cause changes in the soil resources. In reclaimed areas, soil chemistry and soil nutrient distribution would generally be more uniform and average topsoil quality would be improved because soil material that is not suitable to support plant growth

would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land.

The Maysdorf LBA Tract baseline soils analysis indicates that the amount of suitable topsoil that would be available for redistribution on all disturbed acres within the soils analysis area during reclamation would have an average depth of 1.9 ft. The replaced topsoil would support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

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

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

Potential impacts to soil resources on the LBA tract after final reclamation under the Proposed Action or Alternatives 2 and 3 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 14,694 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Cordero Rojo Mine (Table 3-1). If the Maysdorf LBA Tract is leased, disturbance related to coal mining would directly affect approximately 2,558.2 additional acres of soil resources on and adjacent to the LBA tract under the Proposed Action, or approximately 4,024.7 additional acres under Alternatives 2 and 3 (Table 3-1). Average topsoil thickness would be about 23 inches across the entire reclaimed surface. The types of soils and the quantities of the soil resource included in the Maysdorf LBA Tract under the Action Alternatives considered in this EIS are similar to the soils on the existing leases at the Cordero Rojo Mine. Additional information about the soil types on the LBA tract is included in the supplemental information document, which is available on request.

3.8.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would

be rejected and coal removal and the associated disturbance and impacts to soils would not occur on the 2,558.2 or 4,024.7 additional acres disturbed in the Proposed Action or Alternatives 2 and 3, respectively. Soil removal and replacement would occur on the existing Cordero Rojo Mine leases as currently permitted. Soils on portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.8.3 Regulatory Compliance, Mitigation and Monitoring

Soils suitable to support plant growth would be salvaged for use in reclamation. Soil stockpiles would be protected from disturbance and erosional influences. Soil material that is not suitable to support plant growth would not be salvaged. Soil or overburden materials containing potentially harmful chemical constituents (such as selenium) would be specially handled.

At least four ft of suitable overburden would be selectively placed on the graded backfill surface below the replaced topsoil to meet guidelines for vegetation root zones. After topsoil is replaced on reclaimed surfaces, revegetation would reduce wind erosion. The mine would construct sediment control structures as needed to trap eroded soil.

Regraded overburden would be sampled for compliance with root zone criteria. Vegetation growth would be monitored on reclaimed areas to determine if soil amendments are needed.

3.8.4 Residual Impacts

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.

3.9 Vegetation

3.9.1 Affected Environment

The vegetation analysis area (5,590.65 total acres) includes the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under Alternatives 2 and 3) plus an additional area (assumed to be a ¼-mile buffer) that would be disturbed in order to recover the coal in the study area. The Maysdorf LBA Tract vegetation analysis area is partially located within and west and south of the current Cordero Rojo Mine permit boundary. Consequently, portions of the analysis area were previously mapped and sampled in accordance with the current WDEQ/LQD mine permitting requirements. The balance of the vegetation assessment was completed by ESCO Associates, Inc. of Boulder, Colorado in 2005. The vegetation communities in this area were appraised and mapped to provide a preliminary assessment.

The vegetation within the analysis area consists of species common to

eastern Wyoming and consistent with vegetation that occurs within the adjacent Cordero Rojo Mine permit area. A total of eight vegetation types have been preliminarily identified and mapped within the Maysdorf LBA vegetation analysis area. Water and disturbed areas were also mapped. The vegetation types include sagebrush grassland, sandy grassland, rough breaks, playa, saline grassland, streamside bottomland, crested wheatgrass pasture, and salt pond.

The predominant vegetation types, in terms of total acres of occurrence in the vegetation analysis area are the sagebrush grassland (54.94 percent) and sandy grassland (32.40 percent), which occur primarily on the level uplands (Table 3-10). The sagebrush grassland vegetation type is characterized by Wyoming big sagebrush and upland grasses of the region. The sandy grassland vegetation type is dominated by needleandthread and upland sedges. Manyspine plains pricklypear cactus is frequently a large component of the vegetation cover. The ground-dwelling (but not ground-attached) lichen can make a substantial contribution to ground cover, particularly in dry years. The predominant vegetation types on approximately 12 percent of the vegetation analysis area include the rough breaks, saline grasslands, crested wheatgrass pasture, playa, salt pond, and streamside bottomland. On the rough breaks, the total vegetation cover is sparser than on the upland sagebrush grassland and sandy grassland, but the diversity of vascular plant species is greater. Common species may include most of those found in the more extensive upland types, but in addition, such species as bluebunch wheatgrass and Indian ricegrass are present. The saline grassland resembles sagebrush grassland with a generally sparser shrub presence

Table 3-10. Vegetation Types Identified and Mapped Within the Maysdorf LBA Tract Vegetation Analysis Area.

Vegetation Type	Acres	Percent of Area
Sagebrush Grassland	3,071.63	54.94
Sandy Grassland	1,811.31	32.40
Rough Breaks	282.43	5.05
Saline Grassland	124.52	2.23
Crested Wheatgrass Pasture	121.46	2.17
Playa	43.31	0.77
Water	42.59	0.76
Streamside Bottomland	36.64	0.66
Disturbed Area	34.35	0.61
Salt Pond	22.41	0.40
Total	**5,590.65**	**100.00**

Source: Nyenhuis 2005

and the common plant species are inland saltgrass, western wheatgrass, and blue gramma, while salt efflorescence is present on the soil surface. Western wheatgrass, bluegrass, foxtail barley, and alkali bluegrass occur near and around the playas. The streamside bottomland exists in the form of narrow bands that range from approximately two to 50 ft in width along the edges of the Belle Fourche River. The predominant plants are usually some combination of threesquare, common spikerush, broadleaf cattail, and bulrush. No trees are located within the general analysis area. Table 3-10 presents the acreage and percent of the analysis area encompassed by each vegetation type. Additional information about the vegetation types on the LBA Tract is included in the supplemental information document, which is available on request.

There are few occurrences of noxious weeds in the mine area; however, there are native areas adjacent to the mine permit area that are infested with noxious weeds, primarily Canada thistle (*Cirsium arvense*) along the Belle Fourche River.

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action and Alternatives 2 and 3

Under the currently approved mining and reclamation plan, approximately 14,694 acres of vegetation will be disturbed in order to mine the coal in the existing leases at the Cordero Rojo Mine. Under the Proposed Action, mining of the Maysdorf LBA Tract would progressively remove the native vegetation on 2,558.2 additional acres on and near the LBA tract. Under Alternatives 2 and 3, mining of the LBA tract would progressively remove the native vegetation on 4,024.7 additional acres on and near the LBA tract. Vegetation removal on the LBA tract under the Proposed Action and Alternatives 2 and 3 is presented as the additional mine disturbance area in Table 3-1.

Short-term impacts associated with the removal of vegetation from the Maysdorf LBA Tract would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-term impacts include loss of habitat or loss of habitat carrying capacity for some wildlife species as a result of reduced plant species diversity or reduced plant density for some species, 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 two to four years. This would be longer for areas occupied by stockpiles, haulroads, sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. No new life-of-mine facilities would be located on

the LBA tract under the Proposed Action or Alternatives 2 and 3 because the LBA tract would be mined as an extension of an existing mine.

Grazing restrictions prior to mining and during reclamation would remove up to 100 percent of the LBA area from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region, and long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. Use of the area by wildlife would not be substantially restricted throughout the operations.

In an effort to approximate premining conditions, the applicant would plan to reestablish vegetation types that are similar to the premine types during the reclamation operation. Reestablished vegetation would be dominated by species mandated in the reclamation seed mixtures (to be approved by WDEQ). The majority of the approved species are native to the LBA tract. Initially, the reclaimed lands would be primarily a mixture of prairie grasslands with graminoid/forb-dominated areas. An overall reduction in species diversity, especially for the shrub component, would occur. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Estimates for the time it would take to restore shrubs, including sagebrush, to premining density levels range from 20 to 100 years. As indicated previously, the predominant vegetation type on approximately 55 percent of the vegetation analysis area is sagebrush grassland and the reclamation standards call for restoration of sagebrush to at least 20 percent of the reclaimed area. Following completion of reclamation (seeding with the final seed mixture) and before release of the reclamation bond (a minimum of 10 years), a diverse, productive, and permanent vegetative cover would be established on the LBA tract. The decrease in plant diversity would not seriously affect the potential productivity of the reclaimed areas, regardless of the alternative selected. The proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity. Native vegetation from surrounding areas would gradually invade and become established on the reclaimed land.

Following reclamation bond release, management of the privately owned surface areas would revert back to the private surface owners, who would have the right to manipulate the reclaimed vegetation.

A reduction in sagebrush would result in a long term reduction of habitat for some wildlife species and may delay use of the reclaimed area by shrub-dependent species, such as the sage grouse. An indirect impact of this vegetative change could be decreased big game habitat carrying capacity.

On average, roughly 400 to 500 acres of surface would be disturbed per year of mining if the proposed lease

area is mined, regardless of which alternative is selected. By the time mining ceases, over 75 percent of these disturbed lands would have been reseeded. The remaining 25 percent would be reseeded during the following two to three years as the life-of-mine facilities area is reclaimed.

The reclamation plan for the existing Cordero Rojo Mine includes steps to control invasion by weedy (invasive nonnative) plant species because WDEQ/LQD rules and regulations require surface coal mine operators to control and minimize the introduction of noxious weeds in accordance with Federal and State requirements until bond release (SOSWY 2007). As a result, there are few occurrences of noxious weeds in the mine area. The reclamation plan for the Maysdorf LBA Tract would also include steps to control invasion from such species.

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, 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 on the LBA tract as a result of mining and reclamation would affect the reestablishment of vegetation patterns on the reclaimed areas to some extent. The postmining maximum overland slope would be 20 percent, in accordance with WDEQ policy. The average reclaimed overland slope on the LBA tract would not be known until WDEQ's technical review of the permit revision application is complete. No major changes in the average overland slope are predicted.

There would be no net loss of jurisdictional wetlands. They would be restored under the jurisdiction of the COE (Section 3.7). Functional wetlands would be restored in accordance with the requirements of the federal surface managing agency, WDEQ/LQD, or the private surface owner.

3.9.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal and the associated disturbance and impacts to vegetation would not occur on the 2,558.2 or 4,024.7 additional acres disturbed in the Proposed Action or Alternatives 2 and 3, respectively. Coal removal and the associated removal and replacement of vegetation would occur on the existing Cordero Rojo Mine leases as currently permitted. Vegetation on portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease

application at this time would not preclude an application to lease the tract in the future.

3.9.3 Threatened, Endangered, Proposed, and Candidate Plant Species, and BLM Sensitive Species

Refer to Appendices E and F.

3.9.4 Regulatory Compliance, Mitigation and Monitoring

Reclaimed areas would be revegetated as specified in the approved mine plan using reclamation seed mixtures which would be approved by WDEQ. The majority of the species would be native to the LBA tract. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter as required by current regulations. Shrubs would be selectively planted in riparian areas.

The Cordero Rojo Mine mining and reclamation permit includes a requirement to control weeds in reclaimed areas by means of agriculturally accepted techniques. Occurrences of noxious weeds are identified by CMC staff, ranchers grazing cattle on the reclaimed areas, contractors who conduct vegetation monitoring, and contractors who conduct weed spraying in the mine permit area. Weed control measures include limited grazing, mowing, burning, chemical control, and other management practices, when approved by WDEQ/LQD. A contractor is hired annually to spray noxious weeds that are identified in reclaimed areas; adjacent native areas that are infested with noxious weeds are also sprayed. In order to reduce the likelihood of occurrence of noxious weeds, CMC buys “blue tag certified” seed mixes for reclamation areas. Similar steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan, if the Maysdorf LBA Tract is leased.

Detailed wetland mitigation plans would be developed and approved by COE during the permitting stage to ensure no net loss of jurisdictional wetlands occurs within the total disturbance area (Section 3.7). Non-jurisdictional and functional wetlands would be restored in accordance with the requirements of the surface managing agency, surface landowner, or as required by WDEQ/LQD.

Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for post-mining land uses.

3.9.5 Residual Impacts

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

3.10 Wildlife

3.10.1 General Setting

This section discusses the affected environment and environmental consequences to wildlife in general. The subsequent sections address the potential impacts to specific groups of wildlife species.

3.10.1.1 Affected Environment

Background information on wildlife in the vicinity of the Maysdorf LBA Tract was drawn from several sources, including the South Powder River Basin Coal FEIS (BLM 2003a), WGFD and USFWS records, and personal contacts with WGFD and USFWS biologists. Site-specific data for the Maysdorf LBA Tract general analysis area were obtained from several sources, including WDEQ/LQD mine permit applications and annual wildlife monitoring reports for the applicant and nearby coal mines. CMC initiated baseline investigations in 2005 expressly for the Maysdorf LBA Tract, and the proposed lease area has received comprehensive coverage during baseline and annual wildlife monitoring surveys for the adjacent Cordero Rojo Mine since the mid-1970s. Baseline and annual wildlife surveys cover a large perimeter around mine permit areas; consequently, a majority of the proposed lease area has been surveyed as part of the required monitoring surveys for both the Cordero Rojo and Belle Ayr Mines. Site-specific surveys for the entire leased area and appropriate perimeter would be part of the mine permitting process if the tract is leased.

The topography within the general analysis area is mainly gently rolling and of moderate relief, influenced by the Belle Fourche River. Elevation ranges from approximately 4,510 to 4,770 ft above sea level. Rough breaks and streamside bottomland areas occur near the Belle Fourche River, which flows through the southern portion of the tract (Figure 3-12).

In an undisturbed condition, the major vegetation types in the general analysis area (discussed in Section 3.9) provide high quality habitats for many species. Vegetation types tend to occur in a mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Wildlife habitat types include sagebrush grassland, sandy grassland, seeded grassland, bottomland grassland, and rough breaks. Various, relatively small parcels of crested wheatgrass pasture occur throughout the area. As a result of oil and gas development in this area, there are networks of road and well-pad disturbance areas overlaying much of the sagebrush-grassland and sandy-grassland areas, as well as tank batteries and miles of pipeline disturbance with varying degrees of recovering vegetative cover. No designated critical, crucial, or unique habitats are present.

The predominant habitat is sagebrush grassland and sandy grassland is the next largest habitat type (Table 3-10). Seeded grassland is dominated by crested wheatgrass, but older seedings have a mixture of less dominant native plant species and, with the passage of time, these

seedings begin to resemble sagebrush grassland again. Bottomland grassland or streamside bottomland habitat is limited to a narrow band along the edges of the Belle Fourche River in the southern portion of the general analysis area. No trees are present along the river or any of its tributaries in the general analysis area. Rough breaks habitat is distinguished by the irregularity of vegetation, slopes, and soils. Vegetation on the rough breaks is typically sparse, although the diversity of vascular plant species is greater than in the sagebrush grassland and sandy grassland communities.

Under natural conditions, all streams, including the Belle Fourche River, within and adjacent to the LBA tract are ephemeral. In response to surface discharge of groundwater associated with CBNG production upstream of the LBA tract, which is a relatively recent phenomenon, streamflow occurrence is now more persistent. The Belle Fourche River and the distinctive shallow pools that are present along its natural course in the general analysis area are now seldom completely dry, resulting in an increase in habitat for waterfowl, shorebirds, and aquatic species. Six small stock reservoirs and two playa areas exist in the general analysis area (Section 3.5.2.1). One of the playas has been turned into a temporary shallow pond as the result of a CBNG well discharging within its drainage area.

Cordero Rojo Mine's approved WDEQ/LQD mine permit allows disturbance of the Belle Fourche River channel. Approximately six miles of the natural channel has been diverted to-date within the Cordero Rojo Mine's current permit area. CMC would propose another diversion of the Belle Fourche River if they acquire a lease for the Maysdorf LBA Tract.

3.10.1.2 Environmental Consequences

3.10.1.2.1 Proposed Action and Alternatives 2 and 3

If the Maysdorf LBA Tract were leased under the Proposed Action or Alternatives 2 and 3, coal removal and associated mining disturbance would extend onto the LBA tract. Mining would be extended by up to nine years at the Cordero Rojo Mine. Impacts to wildlife that would be caused by mining the LBA tract would be addressed by the WGFD and the WDEQ/LQD when the mining and reclamation permit is amended to include the LBA tract.

Mining directly and indirectly impacts local wildlife populations. 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. If the Maysdorf LBA Tract is leased and mined, the direct impacts related to mine traffic and mine operations would be extended within the general analysis area by up to nine years.

The indirect impacts are longer term. After the LBA tract is leased, mined, and reclaimed, alterations in the topography and vegetative cover, particularly the reduction in sagebrush density, would cause a decrease in carrying capacity for some species and a decrease in vegetative diversity. Sagebrush would gradually become reestablished on the reclaimed land, but the topographic changes would be permanent. Microhabitats may be reduced on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density.

3.10.1.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the impacts to wildlife and wildlife habitat associated with coal removal described above would not occur on the Maysdorf LBA Tract, but would continue to occur on the existing Cordero Rojo Mine coal leases as currently permitted. Coal removal would not affect wildlife habitat on from 2,558.2 or 4,024.7 additional acres (under the Proposed Action or Alternatives 2 and 3, respectively); however, wildlife habitat on portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.10.2 Big Game

3.10.2.1 Affected Environment

The two big game species that are common in suitable habitat throughout the general analysis area are pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*). White-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) are transients east of the Maysdorf LBA Tract. No crucial big game habitat or migration corridors are recognized by the WGFD in this area.

Pronghorn are by far the most common big game species in this area. This species is most abundant in the sagebrush grassland or mixed-grass prairie habitats. Reclaimed grassland constitutes only a small portion of the available habitat around the PRB mines, although pronghorn are observed during all seasonal surveys in these areas. Home range for pronghorn can vary between 400 acres to 5,600 acres, according to several factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movement does not exceed six miles.

Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). The WGFD has classified the general analysis area as primarily winter/yearlong pronghorn range, which means that a population or a portion of a population of animals makes general use of this habitat on a year-round basis and that there is a significant influx of additional animals onto this habitat from other seasonal ranges in the winter. The entire general analysis area is within the WGFD Hilight Herd Unit. In post-season 2004, the WGFD estimated the Hilight Herd Unit to be 11,416 animals, with an objective of 11,000 (WGFD 2004).

Mule deer use nearly all habitats, but prefer sagebrush grassland, rough breaks, and riparian bottomland. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). Mule deer are frequently observed on Cordero Rojo Mine reclaimed lands. In certain areas of the state this species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. However, monitoring has indicated that mule deer are not very migratory in the vicinity of the Maysdorf LBA Tract. The WGFD has classified a majority of the general analysis area as being out of normal mule deer use range and a small portion as being yearlong mule deer use range, which means that a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion. The entire area is located within the WGFD Thunder Basin Mule Deer Herd Unit. No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the Maysdorf LBA Tract or in the general analysis area. Crucial range is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. The WGFD estimated the 2004 post-season mule deer for the herd unit at 19,299, which is near the current objective of 20,000 (WGFD 2004).

White-tailed deer are generally managed separately by the WGFD in the Central Herd Unit. White-tailed deer prefer riparian habitats and are therefore seldom observed in the general analysis area due to the lack of that particular habitat. The WGFD classifies the entire general analysis area as out of the normal white-tailed deer use range. A narrow corridor along the Belle Fourche River east of the Maysdorf LBA Tract and east of the Cordero Rojo Mine area is classified as yearlong range. White-tailed deer are occasionally recorded along the Belle Fourche River and Pine Hills to the east but have rarely been recorded in the general analysis area.

Elk reside in the Rochelle Hills south of the general analysis area. Elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands within the general analysis area. None of the general analysis area is classified by the WGFD as within normal elk use range. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately five square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Odekoven 1994). The Jacobs Ranch Mine is located about 15 miles south of the Cordero Rojo Mine (Figure 1-1). No elk have been observed recently within the Maysdorf LBA Tract but they are occasionally recorded in the Pine Hills east of the Cordero Rojo Mine.

3.10.2.2 Environmental Consequences

3.10.2.2.1 Proposed Action and Alternatives 2 and 3

Under the Proposed Action and Alternatives 2 and 3, big game would be displaced from portions of the Maysdorf LBA Tract to adjacent ranges during mining. Pronghorn would be most affected; however, no areas classified as crucial pronghorn habitat occur on or within two miles of the LBA tract. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. White-tailed deer are not usually found in the area but are occasionally observed to the east. None of the land within the general analysis area is considered by WGFD to be an elk use area and no elk have been observed within the vicinity of the Maysdorf LBA Tract in recent years. Big game displacement would be incremental, occurring over several years and allowing for gradual changes in distribution patterns. Big game residing in the adjacent areas could be impacted by increased competition with displaced animals. Noise, dust, and associated human presence would cause some localized avoidance of foraging areas adjacent to mining activities. On the existing coal leases, however, big game have continued to occupy areas adjacent to and within active mining operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can move to undisturbed areas. There would be more restrictions on big game movement on or through the tract, however, due to the construction of 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.

Following reclamation, topographic moderation and changes in vegetation may result in a long-term reduction in big game carrying capacity.

3.10.2.2.2 No Action Alternative

The impacts to big game under the No Action Alternative would be similar to

the impacts described in Section 3.10.1.2.2 and above for the existing Cordero Rojo Mine area.

3.10.3 Other Mammals

3.10.3.1 Affected Environment

A variety of small and medium-sized mammal species occur in the vicinity of the general analysis area, although not all have been observed on the LBA Tract itself. These include predators and furbearers, such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents (such as mice, rats, voles, gophers, ground squirrels, chipmunks, muskrats, and black-tailed prairie dogs) and lagomorphs (jackrabbits and cottontails). These prey species are cyclically common and widespread throughout the region. Porcupines (*Erethizon dorsatum*) and bats (such as hoary [*Lasiurus cinereus*] and big brown [*Eptesicus fuscus*]) also have habitat in the vicinity, primarily east of the Cordero Rojo Mine area. The prey species are important for raptors and other predators.

The black-tailed prairie dog was added to the list of candidate species for federal listing on February 4, 2000 (USFWS 2000a). The USFWS has since removed the black-tailed prairie dog from the list of candidate species (USFWS 2002a), but continues to encourage the protection of prairie dog colonies for their value to the prairie ecosystem and the myriad of species that rely on them (USFWS 2004).

The black-tailed prairie dog is a highly social, diurnally active, burrowing mammal. Aggregations of individual burrows, known as colonies, form the basic unit of prairie dog populations. Found throughout the Great Plains in shortgrass and mixed-grass prairie areas (Fitzgerald et al. 1994), the black-tailed prairie dog has declined in population numbers and extent of colonies in recent years. The three major impacts that have influenced black-tailed prairie dog populations are the initial conversion of prairie grasslands to cropland in the eastern portion of its range from approximately the 1880s-1920s; large-scale control efforts conducted from approximately 1918 through 1972, when an Executive Order was issued banning the use of compound 1080; and the introduction of sylvatic plague into North American ecosystems in 1908 (USFWS 2000b). In Wyoming, this species is primarily currently found in isolated populations in the eastern half of the state (Clark and Stromberg 1987). USFWS recently estimated that about 125,000 acres of black-tailed prairie dog occupied habitat exists in Wyoming (USFWS 2000b). Many other wildlife species, such as the black-footed ferret, swift fox, mountain plover, ferruginous hawk, and burrowing owl may be dependent on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000b).

The species is considered a common resident in eastern Wyoming, utilizing shortgrass and mid-grass habitats (Luce et al. 1999). According to USDA-FS observations on the Thunder Basin National Grassland, the largest concentrations of prairie dog colonies in the vicinity of the eastern PRB surface coal mines are found east of the coal burnline, which is outside and east of the area of surface coal mining (Tim Byer, personal communication 9/11/2003). The large prairie dog complexes in this area east of the coal burnline have been drastically impacted by outbreaks of plague. The prairie dog colonies west of the burnline, including the areas near the Maysdorf LBA Tract, are generally smaller and less densely concentrated. These colonies have not been affected by plague.

Qualified wildlife biologists with Intermountain Resources have mapped the current acreage of prairie dog colonies in the vicinity of the Cordero Rojo Mine by walking the perimeters of colonies and delineating them on topographic maps. No colonies are currently present on or within two miles of the Maysdorf LBA Tract under the Proposed Action or Alternatives 2 or 3. One black-tailed prairie dog colony exists within one mile east of the Cordero Rojo Mine's current permit area while another town is located more than three miles west of the current mine permit area and the Maysdorf LBA Tract (Figure 3-13). The town located east of the CMC mine permit area is currently smaller than that depicted. The boundaries shown on Figure 3-13 are historical town boundaries and, although black-tailed prairie dogs still exist in the area, their numbers and distribution are currently much smaller than previously recorded.

3.10.3.2 Environmental Consequences

3.10.3.2.1 Proposed Action and Alternatives 2 and 3

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

Black-tailed prairie dogs would not be affected by leasing and mining the Maysdorf LBA Tract because no colonies are currently present on or within two miles of the tract as

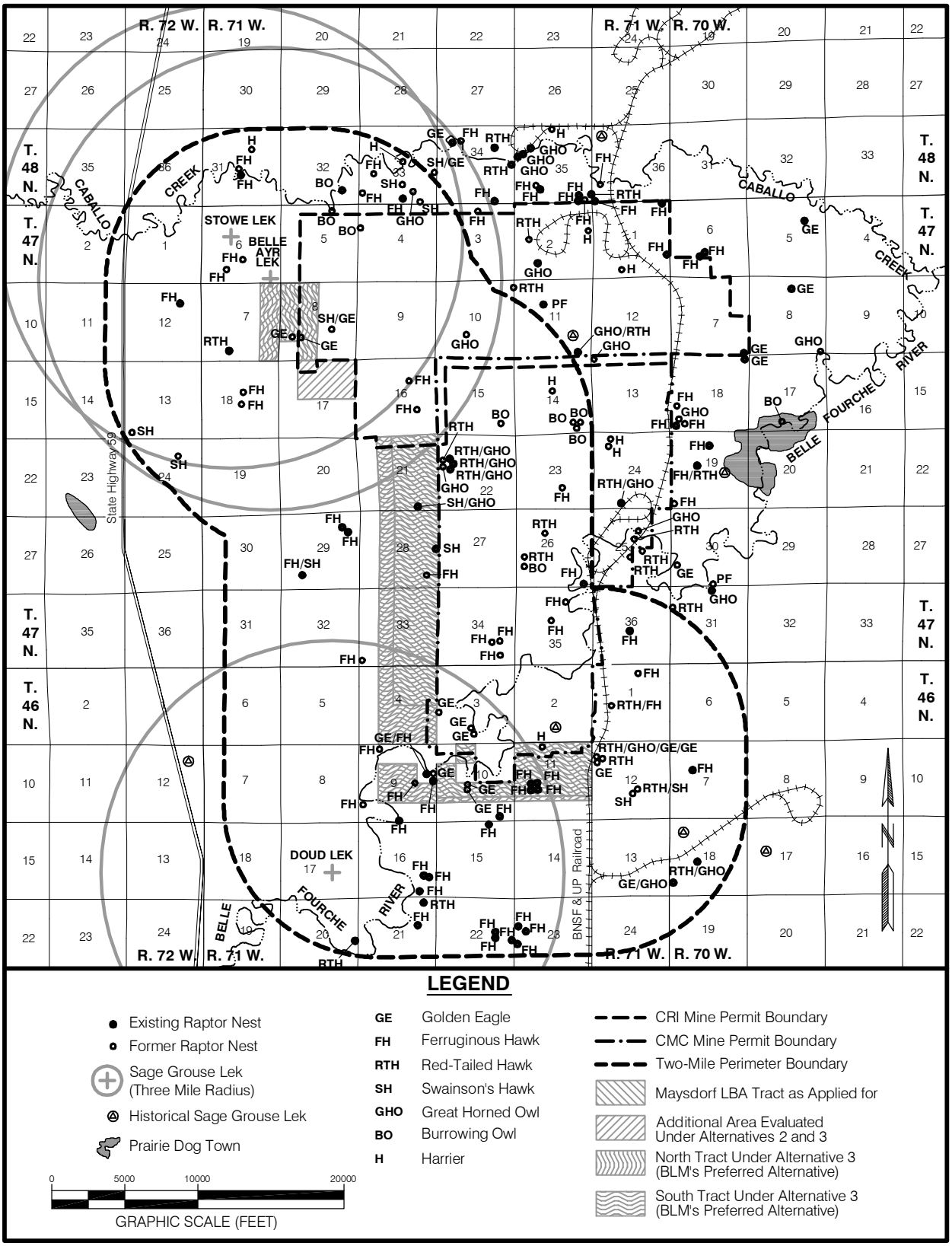


Figure 3-13. Raptor Nest Sites, Sage Grouse Leks, and Prairie Dog Towns Within and Adjacent to the Maysdorf LBA Alternative Tract Configurations.

applied for and the area added by Alternatives 2 and 3.

3.10.3.2.2 No Action Alternative

The impacts to small mammals under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Cordero Rojo Mine area.

3.10.4 Raptors

3.10.4.1 Affected Environment

The raptor species expected to occur in suitable habitats in the general analysis area include golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl (*Athene cunicularia*), and short-eared owl (*Asio flammeus*). The bald eagle (*Haliaeetus leucocephalus*) is a migrant and winter resident as discussed in the Biological Assessment (Appendix E) of this EIS. Those species that commonly nest in the general analysis area are the ferruginous hawk, golden eagle, red-tailed hawk, Swainson's hawk, northern harrier, and great horned owl. The burrowing owl and short-eared owl occasionally nest in the area. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species have adapted to nesting on the ground, creek banks, buttes, or rock outcrops.

Figure 3-13 shows the locations of raptor nests identified since monitoring began for Cordero Rojo Mine in an area that includes the Maysdorf LBA Tract under the Proposed Action and Alternatives 2 and 3. Over time, natural forces have destroyed many nests, while others have been relocated for mitigation or removed by mining activities. In some cases, nests have been created to mitigate other nest sites impacted by mining operations at this mine.

During surveys that were completed in 2005 by Intermountain Resources, a total of five raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, and great horned owl) were found to be currently nesting within the survey area. The raptor survey area includes the Maysdorf LBA Tract as applied for, lands added by Alternatives 2 and 3, and a two-mile radius. In the past, the prairie falcon, northern harrier, and burrowing owl have also been identified nesting within or adjacent to the survey area. The 2005 survey identified 26 intact raptor nests in the survey area, 10 of these nests were active. Existing, intact nests occupied in 2005 on the Maysdorf LBA Tract as applied for include one ferruginous hawk nest and two Swainson's hawk nests. No occupied nests were observed in 2005 on the area added under Alternatives 2 and 3. Three additional, intact, unoccupied, alternate ferruginous hawk nests were present on the LBA tract area as applied for under the Proposed Action and no other intact raptor nests were present on the lands added under Alternatives 2 and 3.

3.10.4.2 Environmental Consequences

3.10.4.2.1 Proposed Action and Alternatives 2 and 3

Mining the LBA tract would not impact regional raptor populations; however, individual birds or pairs may be impacted. Mining activity could cause raptors to abandon nests proximate to disturbance. There were two intact occupied Swainson's hawk nests and one intact occupied ferruginous hawk nest in 2005 on the Maysdorf LBA Tract under the Proposed Action and Alternatives 2 and 3. USFWS recommends a one-mile buffer around all ferruginous hawk nests.

USFWS and WDEQ/LQD approval would be required before mining would occur within buffer zones for active raptor nests. The Cordero Rojo Mine annually monitors territorial occupancy and nest productivity on and around their existing leases. Raptor nesting activity has previously occurred in active mining and construction areas and the applicant mine has successfully executed state-of-the-art mitigation techniques to protect nest productivity.

Mining near raptor territories would minimally impact availability of raptor forage species. At the applicant mine, lack of nesting habitat for many raptor species that nest in trees or on cliffs, not a lack of forage area, has been determined to be the most important limiting factor. During mining, nesting habitat is created by the excavation process (highwalls), as well as through enhancement efforts (nest platforms, nest boxes, and tree plantings).

3.10.4.2.2 No Action Alternative

The impacts to raptor species under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Cordero Rojo Mine area.

3.10.5 Upland Game Birds

3.10.5.1 Affected Environment

Three upland game bird species are known to occur in suitable habitats in the general analysis area. These species are sage grouse (*Centrocercus urophasianus*), mourning doves (*Zenaida macroura*), and gray partridge (*Perdix perdix*).

Sage grouse are a large upland game bird considered a "landscape species", annually using widespread areas of sagebrush habitats. This grouse is referred to as both sage grouse and greater sage grouse, and the terms are interchangeable. Sage grouse are found in sagebrush shrub-land habitat, and sagebrush is essential for sage grouse during all seasons of the year. During winter, sage grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. Sage grouse tend to select wintering sites where sagebrush is 10-14 inches above the snow. Population and habitat analyses suggest that wintering habitat can be as limiting as mating and breeding habitats. Breeding occurs on strutting grounds (leks) during late March and April. Leks are generally

situated on sites with low vegetation and little or no sagebrush, broad ridge tops, grassy openings, and disturbed sites such as burns, abandoned well locations, airstrips or roads. However, often there are areas of denser sagebrush near the lek that are used for foraging, loafing, and hiding cover (WGFD 2003). Approximately two-thirds of hens nest within three miles of the lek where they were bred. The rest of the hens usually nest within 15 miles of the lek. Sage grouse typically nest under tall sagebrush, but may use other large shrubs. Sagebrush stands used for nesting range in height from eight to 18 inches, with individual plants reaching up to 32 inches tall. Both new spring herbaceous growth and residual cover are important in the understory for nesting sage grouse (WGFD 2003). Hens move their brood immediately upon hatching from the nest site to brood-rearing areas. Sites used during the first 10-14 days after hatching are typically within 1.5 miles of the nest. The vast majority of chick mortality (87 percent of total brood loss in four studies conducted in Wyoming) occurs during this period. After the first 10 days, broods may have dispersed five or more miles from the nest. As summer progresses and food plants mature and dry, sage grouse move to areas still supporting succulent herbaceous vegetation. They continue to rely on adjacent sagebrush for protection from weather and predators, and for roosting and loafing. Sage grouse normally move off late brood-rearing habitat onto transitional fall habitat before moving onto winter range (WGFD 2003).

On and after July 2, 2002, the USFWS received three petitions requesting that the greater sage grouse be listed as endangered across its entire range. Following a 12-month status review of the best available scientific and commercial information on the species, the USFWS found that listing was not warranted at this time. However, the USFWS continues to have concerns regarding sage grouse population status, trends and threats, as well as concerns for other sagebrush obligates (USFWS 2005). USFWS has indicated there is a need for continued efforts to conserve sage grouse and sagebrush habitat on a long-term basis. USFWS encourages continued development and implementation of conservation strategies throughout the grouse's range.

Experimental studies at the USDA National Wildlife Research Center have shown that West Nile virus is usually fatal to sage grouse, resulting in death within six days of infection (USGS 2006). The disease was first detected in sage grouse in the PRB in 2003. That year, the deaths of 11 sage grouse in northeastern Wyoming were confirmed from West Nile virus in August and early September. In 2004 and 2005 combined, five sage grouse in the PRB were found to have died from the disease. Summer temperatures in 2004 and 2005 were cooler than normal, while 2003 was warmer than normal. The lower temperatures in 2004 and 2005 are believed to have contributed to the reduced mortality rate during those years (WGFD 2006). The warmer summer of 2006 was accompanied by

increased sage grouse mortality due to West Nile virus (USGS 2006). Lek, or strutting ground, count data indicate that Wyoming's sage grouse populations increased slightly in 2004 and 2005.

In May 2002, the USFWS office in Cheyenne, Wyoming released a list entitled *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming,* which replaced the previous *Migratory Birds of High Federal Interest List.* The greater sage grouse is included on the new list and, as a result, the presence of sage grouse and sage grouse sign are included in the annual migratory bird surveys that are conducted by the coal mines in both spring and summer.

Cordero Rojo Mine conducts surveys to identify new sage grouse leks and sage grouse lek attendance at previously identified leks in the spring as part of the annual wildlife surveys that are conducted for the mine. These surveys and baseline inventories, which include the mine's permit area and a one-mile perimeter, were initiated in the mid-1970s to early 1980s when the CRI and CMC Mines were initially permitted. As a result, most of the area included in the proposed Maysdorf LBA Tract has been included in previous annual survey areas.

The sage grouse is a yearlong resident and is occasionally encountered in the general analysis area. The most abundant vegetation type on the tract is the Sagebrush Grassland type, which is characterized by the moderate to heavy presence of Wyoming big sagebrush (Section 3-10). However, at the present time sage grouse do not appear to be abundant or common in the area. Three active sage grouse leks have been surveyed within the general analysis area, the Stowe, Belle Ayr, and Doud leks (Figure 3-13). Each lek is generally surveyed three times each breeding season. Seven historical leks (no attendance observed in the past 10 years) are located within or adjacent to the general analysis area. Figure 3-13 shows the location of the three active leks and the seven historical lek sites. The Belle Ayr lek, located immediately north of the proposed lease area, was first documented in 1990. The peak number of males was 12 in 1991, while no males were recorded in surveys conducted in 1992, 1993, or 2004. One male was recorded on the Belle Ayr lek in 2005. Attendance has been relatively low, averaging only about four males over the last 16 years. The Stowe lek, located approximately 0.25 miles west and 0.6 miles north of the proposed lease area, was first identified in 2000. The Stowe lek had a peak of eight males in 2001, but no birds were recorded on this lek in 2003, 2004, or 2005. The Doud lek was first recorded in 1999 and is located over one mile away from the southwest corner of the proposed lease area. A maximum of seven males were recorded at the Doud lek in 2003, but no birds were in attendance in 2004 or 2005. Research has indicated that most (approximately two-thirds) hens will nest within three miles of the lek where they were bred. The remainder of the birds usually nest within 15 miles of the lek (WGFD 2003). The

three-mile radius around the Stowe, Belle Ayr, and Doud leks extends onto the LBA tract as applied for (Figure 3-13).

Mourning doves are a migrant and relatively common in the area during migration, particularly near sites with water sources and trees and in the summer for breeding and nesting. This species is a relatively common breeding bird in Campbell County and may be found in a variety of habitat types. Mourning doves were common on the survey area in 2005.

Gray (or Hungarian) partridge, an introduced species, have been infrequently observed on reclaimed areas, sagebrush shrublands, upland grassland, and cultivated lands. In some years this species is occasionally encountered while in other years partridge appear to be totally absent. The Hungarian partridge has not been observed on the survey area in 2005.

3.10.5.2 Environmental Consequences

3.10.5.2.1 Proposed Action and Alternatives 2 and 3

Overall, the sage grouse population has been steadily declining in Wyoming and across the rest of the west. A study prepared by the Western Association of Fish and Wildlife Agencies (Connelly et al. 2004) estimated that sage grouse populations in western North America declined at an overall rate of 2.0 percent per year from 1965 to 2003. The decline rate was larger from 1965 to 1985, with populations stabilizing and some increasing from 1986 to 2003. For Wyoming, this study estimated that sage grouse populations declined at an average rate of 9.66 percent from 1968 to 1986, and at an average rate of 0.33 percent per year from 1987 to 2003. Population lows were reached in the mid-1990s and there has been some gradual increase in numbers since that time (Connelly et al. 2004).

The Maysdorf LBA Tract is within the Northeast Wyoming Local Sage-Grouse Working Group (NWLWG) Area, which includes portions of the WGFD Sheridan and Casper regions and the Thunder Basin National Grassland, which is located south of the Maysdorf LBA Tract. Sage grouse monitoring has occurred within the NWLWG since 1967. Within this area, sage grouse population trends have exhibited a cyclical pattern, with each successive peak of a cycle being lower than the preceding peak. This suggests a long term population decline since at least 1967 (Figure 3-14).

Population trends within the NWLWG appear to be mirroring statewide trends in Wyoming, although the average number of males per lek in the NWLWG Area, including in the Thunder Basin National Grassland, has typically been lower than those observed state wide (Figure 3-15). Since 1996, sage grouse populations within the state and in northeast Wyoming have fluctuated but exhibited an overall increase, with a recent peak in male lek attendance occurring in 2000 or 2001.

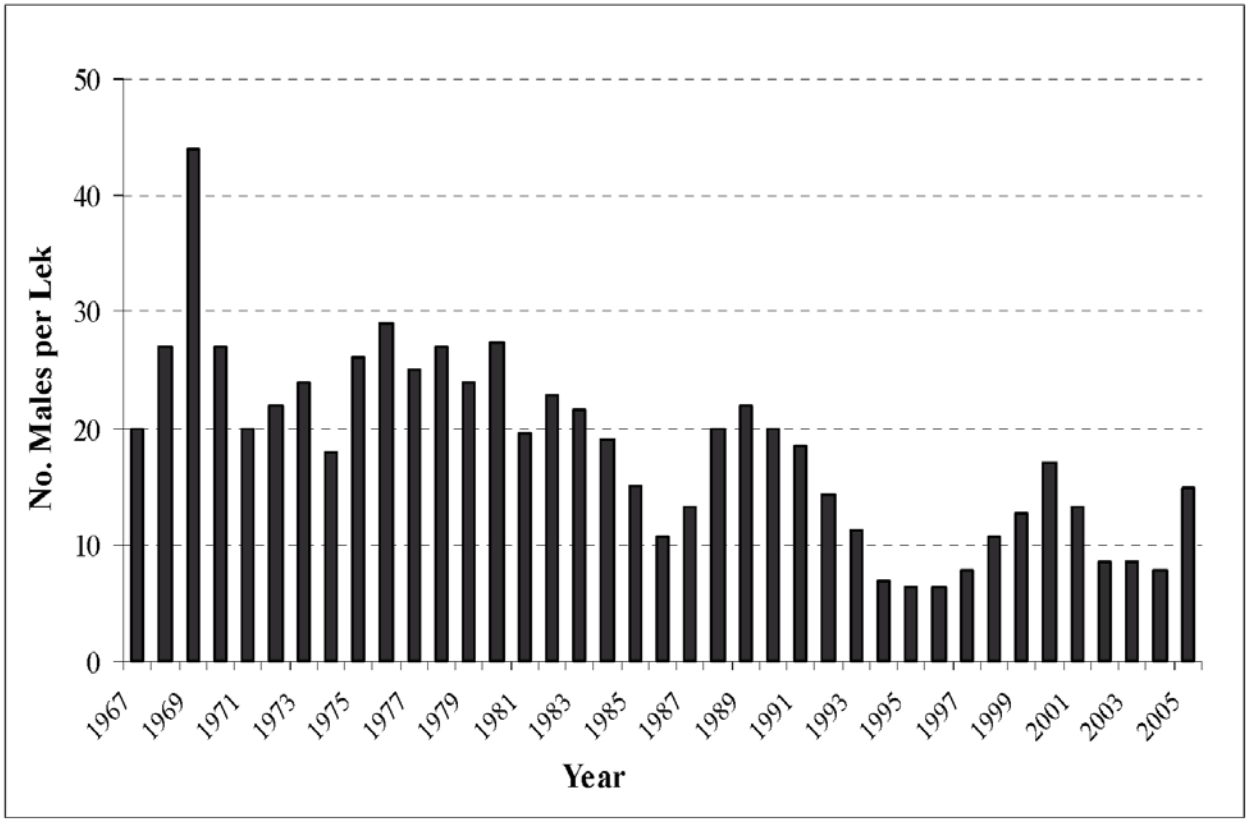


Figure 3-14. Average Male Sage Grouse Lek Attendance Within the Northeast Wyoming Local Working Group Area (1967-2005).

Source: USDA-FS (2006)

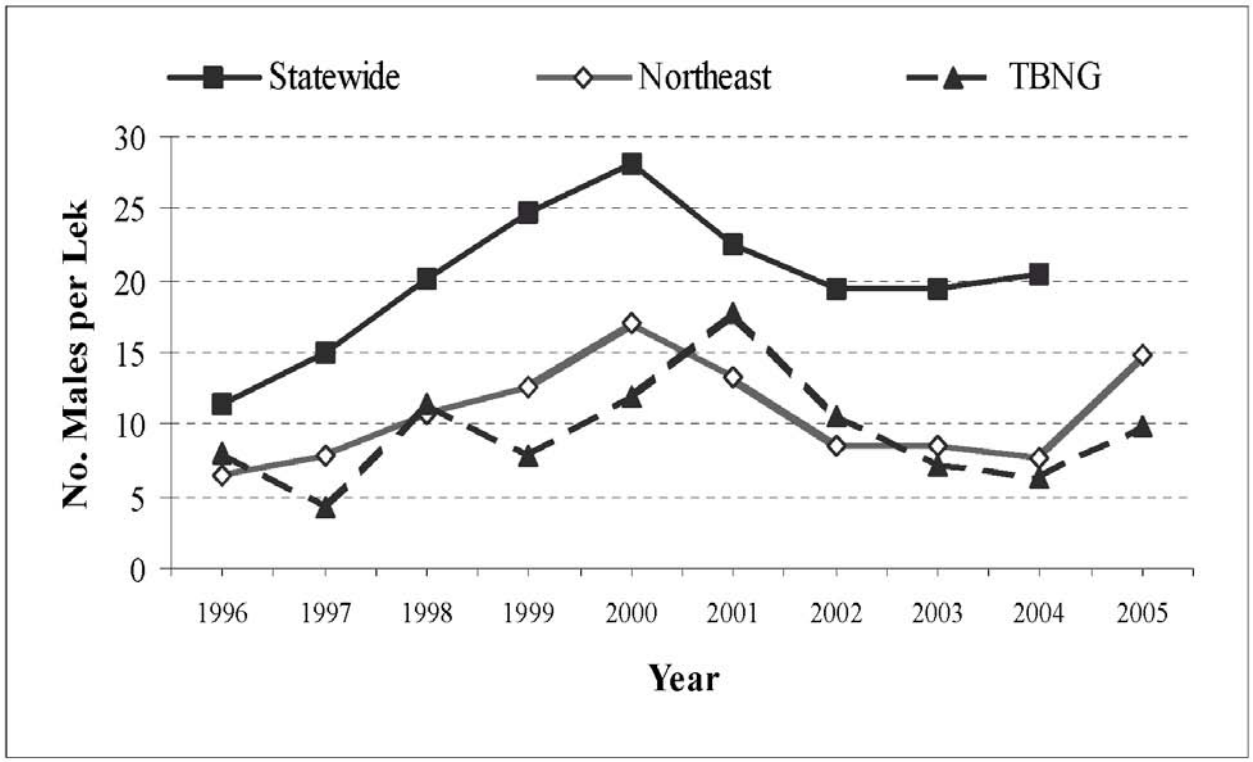


Figure 3-15. Average Male Sage Grouse Lek Attendance Statewide and Within the Northeast Wyoming Local Sage Grouse Working Group Area and the Thunder Basin National Grasslands (1996-2005).

Source: USDA-FS (2006)

The causes of the range-wide decline in sage grouse population levels are not completely understood, but they may be influenced by local conditions. However, habitat loss due to disturbance of leks, nesting and brood-rearing areas as a result of increasing development, drought, and the potential for West Nile virus, as well as loss of population connectivity are key threats to this species (Naugle et al. 2004).

Some potential impacts of mineral development (including coal mining and oil and gas development) on sage grouse include: 1) direct habitat loss and fragmentation from mine, well, road, pipeline, transmission and power line construction, 2) alteration of plant and animal communities, 3) increased human activity which could cause animals to avoid the area, 4) increased noise, which could cause animals to avoid an area or reduce their breeding efficiency, 5) increased motorized access by the public leading to legal and illegal harvest, 6) direct mortality associated with water evaporation ponds and production pits, and 7) reduced water tables resulting in the loss of herbaceous vegetation. Some of these impacts are short-term related to specific periods of activity, and some may result in positive effects such as increased forb production, habitat diversity, and additional water sources. Impacts may be long-term (30 years or more), and rehabilitation of impacted habitats may take many years to complete (WGFD 2003).

Areas of suitable habitat for nesting and strutting grounds are needed to sustain sage grouse populations. One recent study suggests that availability of winter habitat may also affect sage grouse populations (Naugle et al. 2006). During mining, there is a short term loss of potential nesting habitat and potential disturbance to breeding activities, especially when mining operations occur in proximity to sage grouse leks. Following reclamation, there may be a long term loss of nesting and winter habitat, depending on the amount of sagebrush that is restored relative to the amount of sagebrush that is present before mining. Approximately 55 percent of the premining vegetation on the Maysdorf LBA Tract is sagebrush grassland, while reclamation standards call for restoration of sagebrush on at least 20 percent of the reclaimed area. As discussed in Section 3.9.2.1, estimates for the time it would take to restore shrubs, including sagebrush, to premining density levels range from 20 to 100 years. Until sagebrush levels return to their premining density, there would be a reduction in sage grouse nesting and winter habitat on the Maysdorf LBA Tract.

If mining activities disturb a lek, sage grouse would have to use an alternate lek or establish a new lek site for breeding activities. Fidelity to lek sites has been well documented (WGFD 2003), but monitoring of sage grouse activities has indicated that the birds may change lek sites. There are no active or inactive sage grouse leks within the Maysdorf LBA Tract but three recently active leks (Belle Ayr, Stowe, and Doud) are located within three miles of the tract under the Proposed Action and Alternatives

2 and 3. If the tract is leased and mined, nesting habitat for the grouse that have attended these leks would be affected by the mining activity on the tract because, as discussed above, research has indicated that most hens will nest within three miles of the lek where they were bred. The noise associated with mining operations may also disrupt sage grouse breeding and nesting.

There is some evidence that grouse populations do repopulate areas after reclamation for the species, but there is no evidence that populations attain their previous levels and reestablishment in reclaimed areas may take 20 to 30 years, or longer (Braun 1998). Estimates for the time it would take to restore shrubs, including sagebrush, to premine density levels range from 20 to 100 years, which may delay sage grouse repopulation in the reclaimed areas.

Leasing and mining the Maysdorf LBA Tract would also affect potential habitat for mourning doves and gray partridge; however, the tract does not provide unique habitat for these species. Sightings of gray partridge are infrequent in this area.

3.10.5.2.2 No Action Alternative

Impacts to upland game birds under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Cordero Rojo Mine area.

3.10.6 Other Birds

3.10.6.1 Affected Environment

USFWS uses a list entitled *Migratory Bird Species of Management Concern in Wyoming*, specifically the *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, for reviews related to existing and proposed coal mine leased land (USFWS 2002b). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). The *Migratory Bird Species of Management Concern in Wyoming* replaced the *Migratory Birds of High Federal Interest* (MBHFI) list. Cordero Rojo Mine previously conducted annual surveys for the species included on the MBHFI list and now conducts annual surveys for the species included on the coal mine list. The surveys, which are conducted in the winter through summer, include the permit area and a one-half to one mile perimeter.

The Wildlife Section of the supplemental information document to this EIS, which is available on request, includes a tabulation of the regional status and expected occurrence, historical observations, and breeding records for each of the species on the list of *Migratory Bird Species of Management Concern in Wyoming*, based on a compilation of the results of the annual surveys conducted on and near the proposed lease area. Fifteen of the listed species have historically been observed within the general analysis area. The species usually observed nesting in the area include the ferruginous hawk, Swainson's hawk,

greater sage grouse, loggerhead shrike (*Lanius ludovicianus*), Brewer's sparrow (*Spizella breweri*), vesper sparrow (*Pooecetes gramineus*), lark bunting (*Calamospiza melanocorys*), and McCown's longspur (*Calcarius mccownii*). The upland sandpiper (*Bartramia longicauda*), burrowing owl, short-eared owl, chestnut-collared longspur (*Calcarius ornatus*), and the grasshopper sparrow (*Ammodramus savannarum*) may also nest in the area but less frequently because nesting habitat for these species is not abundant. The bald eagle is only observed in the winter or as a migrant and the long-billed curlew (*Numenius americanus*) has only been observed as a migrant.

The mountain plover (*Charadrius montanus)* is included on the list of *Migratory Bird Species of Management Concern in Wyoming*. The mountain plover was designated as a proposed threatened species by the USFWS in October 2001 (USFWS 2001). USFWS subsequently published a withdrawal of the proposed rule to list the mountain plover as threatened on September 9, 2003, (USFWS 2003). The USFWS continues to encourage provisions that would provide protection for this species, as it continues to be protected under the Migratory Bird Treaty Act and as a sensitive species under BLM policy (Bureau Manual 6840.06 E. Sensitive Species).

The mountain plover is a migratory species of the shortgrass prairie and shrub-steppe eco-regions of the arid West. This species utilizes high, dry, shortgrass prairie with vegetation typically shorter than four inches tall. Mountain plovers often use black-tailed prairie dog towns for breeding, nesting, and feeding. Not all prairie dog towns offer suitable habitat for the mountain plover, mostly due to topographic incompatibility. There are also habitats other than prairie dog towns that provide nesting, feeding, and breeding habitat for mountain plovers.

The nest of the mountain plover consists of a small scrape on flat ground in open areas. Mountain plovers arrive on their breeding grounds in late March with egg-laying beginning in late April. Breeding plovers show close site fidelity, often returning to the same territory in subsequent years. Clutches are hatched by late June and chicks fledge by late July. The fall migration begins in late August and most birds are gone from the breeding grounds by late September.

Wildlife surveys conducted at the Cordero Rojo Mine since the 1970s have failed to detect the presence of this species in the area. The survey area, which includes the Cordero Rojo Mine permit area and a half-mile perimeter, is inventoried for suitable mountain plover habitat annually. Qualified wildlife biologists with Intermountain Resources keep watch during all surveys and site visits for all migratory birds of potential concern and habitats that could support them. Data is included in Cordero Rojo Mine's annual wildlife monitoring reports to WDEQ/LQD as required by the "monitoring and mitigation plan for raptors and species of High Federal Interest" approved for Cordero Rojo Mine by

the USFWS. Mountain plover preferred habitat consists of level, open and exceedingly grazed sites (Knopf 1996) that are generally lacking in the Cordero Rojo Mine survey area and the Maysdorf LBA study area. Prairie dog towns can provide habitat for the mountain plover, although no colonies exist within the tract as applied for and the area added by Alternatives 2 and 3. No sightings of mountain plover have ever been recorded in the vicinity of the LBA tract.

The bald eagle is seasonally common and most frequently observed during the winter months. The burrowing owl is uncommon and is observed as an occasional breeder in the general analysis area. Sage grouse, recently added to the Level 1 list, are becoming less common in the general analysis area but are still classified as a common breeder on and in the near vicinity of the Maysdorf LBA Tract (see Section 3.10.5 above). Additional information about the observed occurrence of the bald eagle in the general analysis area can be found in the Biological Assessment (Appendix E).

Suitable nesting habitat is scarce if not absent in the general analysis area for the remainder of the *Migratory Bird Species of Management Concern in Wyoming*; therefore, the other species have rarely or never been recorded.

Under natural conditions, the Maysdorf LBA Tract provides limited waterfowl and shorebird habitat. The natural aquatic habitat, prior to CBNG development within the Belle Fourche River drainage basin, was mainly available during spring migration as ponds (primarily stock reservoirs and playa areas) and ephemeral streams. Many of these water features generally got quite low or dried up during the summer. However, the relatively recent development of CBNG resources upstream and within the general analysis area has supplied the river, its tributaries, ponds, and playas with water nearly continuously, resulting in an increase in habitat for waterfowl and shorebird species. Broods from the American wigeon (*Anas Americana*), blue-winged teal (*Anas discors*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), gadwall (*Anas strepera*), and green-winged teal (*Anas crecca*) were observed during 2005.

3.10.6.2 Environmental Consequences

3.10.6.2.1 Proposed Action and Alternatives 2 and 3

Of the fifteen *Migratory Bird Species of Management Concern in Wyoming* that have historically been observed in the general analysis area, the Level 1 species (those identified as needing conservation action) that have been recorded nesting in the area include the ferruginous hawk, burrowing owl, greater sage grouse, Brewer's sparrow, Swainson's hawk, and McCown's longspur. Level 1 species that do not have abundant nesting habitat available in the general analysis area, but have been documented to nest include the short-eared owl and upland sand

piper. Other Level 1 species observed in the area include the long-billed curlew and bald eagle.

The existing habitat for these species on the Maysdorf LBA Tract would be destroyed during mining. The habitat loss would be short-term for grassland species, but would last longer for shrub-dependent species. There are currently no trees on the LBA tract. Cordero Rojo Mine's current reclamation practices are designed to provide a mosaic of upland grass and sagebrush habitats that would potentially host most of these species. A research project on habitat reclamation on mined lands within the PRB for small mammals and birds concluded that the diversity of song birds on reclaimed areas was less than on adjacent undisturbed areas, although their overall numbers were greater (Shelley 1992).

No impacts to mountain plovers are anticipated because they have not been observed in the vicinity of the LBA tract during wildlife surveys conducted for the Cordero Rojo Mine that began in the 1970s, and the typical suitable habitat for this species is not currently present on the tract.

Potential impacts to the bald eagle, sage grouse and other raptors in general, as well as measures in place to prevent impacts to these species from existing mining operations are included in the preceding discussions or in Appendix E.

Mining the LBA tract would have a negligible effect on migrating and breeding waterfowl and shorebirds. Sedimentation ponds created during mining would provide interim habitat for these fauna. The Belle Fourche River diversion channel would not provide the same habitat as the natural river channel, although natural streamflow and the presence of CBNG discharge water would not be affected. Cordero Rojo Mine's current reclamation plan requires that the portion of the river channel affected by currently permitted mining be reclaimed to restore its premining functions and aquatic habitats. If the LBA tract is leased and mined, these reclamation efforts would be extended onto the portion of the river affected by mining the tract. Replacement of all impacted jurisdictional wetlands would be required in accordance with Section 404 of the Clean Water Act (Section 3.7). If the replaced wetlands on the Maysdorf LBA Tract do not duplicate the exact function and/or landscape features of the premine wetlands, waterfowl and shorebirds could be beneficially or adversely affected as a result.

3.10.6.2.2 No Action Alternative

Impacts to migratory bird species, waterfowl, and shorebirds under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Cordero Rojo Mine area.

3.10.7 Amphibians, Reptiles, and Aquatic Species

3.10.7.1 Affected Environment

Wildlife surveys completed specifically for the applicant and adjacent mines,

as well as biological research projects in the eastern PRB, have documented numerous other wildlife species that inhabit the region, including various amphibians, reptiles, and aquatic species. All these species are generally common inhabitants of the area.

Under natural conditions, aquatic habitat is limited by the ephemeral nature of surface waters in the general analysis area. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. Fish surveys were conducted in the Belle Fourche River during baseline studies for the Cordero Rojo Mine in 1975 and on the Maysdorf LBA Tract in 2005. These surveys were completed in the southern and southeastern portion of the existing Cordero Rojo Mine area in 1975 and throughout the Maysdorf LBA Tract in 2005. Fish species observed during those surveys include the common carp (*Cyprinus carpio*), creek chub (*Semotilus atromaculatus*), flathead chub (*Platygobio gracilis*), sand shiner (*Notropis stramineus*), brassy minnow (*Hybognathus hankinsoni*), fathead minnow (*Pimephales promelas*), white sucker (*Catostomus commersoni*), black bullhead (*Ameiurus melas*), green sunfish (*Lepomis cyanellus*), and yellow perch (*Perca flavescens*). The most abundant fish were the white sucker and various minnow species.

As discussed above, water discharged from CBNG wells has recently supplied the Belle Fourche River and some tributaries, ponds, and playas with water nearly continuously, resulting in an increase in habitat for aquatic species. However, in July of 2005 only 40 percent of the river's channel length through the Maysdorf LBA Tract contained water, while the remaining 60 percent of the channel length was dry. These observations document that this reach of the Belle Fourche River has not become perennial, even with the addition of CBNG discharge water.

In 1997, the Belle Fourche River was sampled at Section 19, T.46N., R.71W., which is several miles upstream from the Maysdorf LBA Tract. The black bullhead, creek chub, carp, fathead minnow, green sunfish, sand shiner, and white sucker were found during those surveys (Patton 1997). WGFD has categorized the black bullhead as a Status 3 species. Status 3 species are widely distributed throughout their native range with stable populations; however, habitat is declining or vulnerable.

Excluding the black bullhead, none of the other aquatic species found during the 1975, 1997, or 2005 surveys are of specific concern to state or federal agencies and the Belle Fourche River channel through the Maysdorf LBA Tract is not considered a viable fishery. The site rating for this stream reach was poor to very poor, based on the 2005 macroinvertebrate samplings and the WDEQ Indices.

Numerous reptile and amphibian species have been recorded during the various surveys on the Cordero Rojo Mine area and adjacent lands,

including the LBA tract. These species include the tiger salamander (*Ambystoma tigrinum*), plains spadefoot (*Scaohiopus bombifrons*), great plains toad (*Bufo cognatus*), boreal chorus frog (*Pseudacris triseriata maculata*), northern leopard frog (*Rana pipiens*), common snapping turtle (*Chelydra serpentina serpentina*), western painted turtle (*Chrysemys picta belli*), eastern short-horned lizard (*Phrynosoma douglassi brevirostre*), northern sagebrush lizard (*Sceloporus graciosus graciosus*), prairie rattlesnake (*Crotalus viridis viridis*), plains hognose snake (*Heterondon nasicus nasicus*), bullsnake (*Pituophis melanoleucas sayi*), western plains garter snake (*Thamnophis radix haydeni*), red-sided garter snake (*Thamnophis sirtalis parietalis*), and eastern yellowbelly racer (*Coluber constrictor flaviventris*). The abundance of these reptiles and amphibians is difficult to determine but these species appear to be common to the area.

3.10.7.2 Environmental Consequences

3.10.7.2.1 Proposed Action and Alternatives 2 and 3

Mining the tracts would remove habitat for aquatic species, amphibians and reptiles in a portion of the Belle Fourche River and sections of the ephemeral tributaries to the Belle Fourche. Although the channel and surface water flow would be restored during reclamation, the river would be diverted and habitat for these species would be lost during mining operations. Under natural conditions, habitat for aquatic species is limited on the Maysdorf LBA Tract, however, as discussed above, a variety of aquatic species and reptiles and amphibians have been observed on and in the vicinity of the tract.

Under jurisdiction of Cordero Rojo Mine's current WDEQ/LQD mine permit, two sections of the Belle Fourche River have been diverted in order to recover coal from the existing coal leases (Section 3.5.2.1). A portion of one of these existing diversion channels that was approved by WDEQ in 1996 (WDEQ/LQD 1996) is within the Maysdorf LBA Tract as applied for.

Reclamation of the river channel and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions would restore fish habitat and aquatic resources of the Belle Fourche River.

3.10.7.2.2 No Action Alternative

Impacts to reptiles, amphibian, and aquatic species under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2 and above for the existing Cordero Rojo Mine.

3.10.8 Threatened, Endangered, Proposed, and Candidate Animal Species, and BLM Sensitive Species

Refer to Appendices E and F.

3.10.9 Regulatory Compliance, Mitigation and Monitoring

Regulatory guidelines and requirements designed to prevent or reduce surface coal mining impacts to wildlife include:

- fencing designed to permit pronghorn passage to the extent possible;
- creation of raptor nests to mitigate other nest sites impacted by mining operations at this mine;
- relocation of active raptor nests that would be impacted by mining in accordance with the approved raptor monitoring and mitigation plan;
- obtaining a permit for removal and mitigation of golden eagle nests;
- buffer zones for protection of raptor nests;
- restriction of mine-related disturbances from encroaching in the near vicinity of any active raptor nest from March until hatching;
- restriction of disturbances near raptor nests containing nestlings to prevent danger to, or abandonment of, the young;
- creation of nesting habitat through enhancement efforts (nest platforms, nest boxes, and tree plantings);
- reestablishment of the ground cover necessary for the return of a suitable raptor prey base after mining;
- restoration of sage grouse habitat after mining including reestablishment of sagebrush and other shrubs on reclaimed lands and grading of reclaimed lands to create swales and depressions;
- development of a *Raptor and Migratory Birds of High Federal Interest (MBHFI) Monitoring and Mitigation Plan* which must be approved by USFWS;
- required use of raptor-safe power lines;
- restoration of diverse landforms, direct topsoil replacement, and the construction of brush piles, snags, and rock piles to enhance habitat for wildlife;
- restoration of habitat provided by jurisdictional wetlands; and
- reclamation of the river channel and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions.

CMC's current mine permit requires reconstruction of bed form features in the Belle Fourche River channel, such as pools and runs, that should help restore the channel's natural function, as well as provide habitat. Restoration will be achieved by

salvaging sufficient material from channel terrace alluvium to reconstruct pool features. Current reclamation, as well as future reclamation of the Belle Fourche River by the Cordero Rojo Mine would incorporate alluvium salvaged from the original channel.

These measures are included in the existing mining and reclamation permit and would be included in the amended mining and reclamation plans, if the LBA tract were leased and proposed for mining.

Baseline wildlife surveys were conducted for the Cordero and Caballo Rojo mines before mining operations began at either mine. Annual wildlife monitoring surveys have been conducted since the mid-1970s. These surveys are required by state and federal regulations. The wildlife monitoring surveys cover the area included in the mine permit area and a perimeter beyond the permit area that varies in size according to the species being surveyed. As a result, a majority of the Maysdorf LBA Tract has been surveyed as part of the required monitoring surveys for both the Cordero Rojo and the Belle Ayr mines.

The annual monitoring program includes:

- winter surveys of raptors and migratory birds wintering or nesting in the area;
- spring surveys for new and/or occupied raptor nests, upland game bird lek locations, T&E species and migratory birds;
- late spring surveys of raptor production for occupied nests, opportunistic observations of all wildlife species, T&E species, and migratory birds;
- annual surveys of raptor territorial occupancy and nest productivity on and around the existing leases; and
- summer surveys for raptors, migratory birds, and lagomorph density.

Monitoring data were collected by all of the surface coal mines in the PRB for big game species until 1999. At that time, the WGFD reviewed monitoring data and requirements for big game species on those mine sites. They concluded that the monitoring had demonstrated a lack of impacts to big game on existing mine sites. No severe mine-caused mortalities had occurred and no long-lasting impacts on big game had been noted on existing mine sites. The WGFD therefore recommended at that time that big game monitoring be discontinued on all existing mine sites. New mines will be required to conduct big game monitoring if located in crucial winter range or in significant migration corridors, neither of which are present within the general analysis area.

There is an approved raptor monitoring and mitigation plan for the Cordero Rojo mine. This monitoring and mitigation plan would be amended to include the Maysdorf LBA Tract if it is leased and proposed for mining. The amended raptor mitigation plan would be subject to

review and approval by USFWS before the amended mining plan is approved.

Thunderbird Wildlife Consulting, Inc. of Gillette, Wyoming is currently conducting an independent research project to investigate how sage grouse use the landscape in the vicinity of active coal mines and how lands can be reclaimed to benefit those populations. This project is being funded by several of the surface coal mines located south of the Cordero Rojo Mine, AML Research Program, and WGFD.

Mitigation plans for Migratory Bird Species of Management Concern have been developed in cooperation with USFWS for the existing Cordero Rojo mining operations, and those plans would be amended to include the LBA tract. If additional species are documented nesting or using the area regularly, a mitigation plan would be developed to protect those birds and their habitat.

3.10.10 Residual Impacts

Although the Maysdorf LBA Tract would be reclaimed in accordance with the requirements of SMCRA and Wyoming statutes, 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. Reclamation standards may limit replacement of habitat for some species, such as mountain plover. Some species, such as sage grouse, may repopulate reclaimed areas but populations may not attain pre-mining levels.

3.11 Land Use and Recreation

3.11.1 Affected Environment

Surface ownership within the Maysdorf LBA Tract as applied for under the Proposed Action and the lands added under Alternatives 2 and 3 consists primarily of private lands with some intermingled federal lands. The federally owned lands included in the tract are administered by the BLM. Surface ownership for the Maysdorf LBA Tract is listed in Table 3-11 and shown in Figure 3-16.

Table 3-11. Distribution of Surface Ownership Within the Maysdorf LBA Tract as Applied for Under the Proposed Action and Area Added Under Alternatives 2 and 3.

	Federal Ownership		Private Ownership	
LBA Tract Configuration	**(Acres)**	**(Percent)[1]**	**(Acres)**	**(Percent)[1]**
Area as Applied for	132.13	3.4	2,098.0	58.5
Area Added Under Alternatives 2 and 3[2]	275.49	8.0	1,082.0	30.1
Total	**407.62**	**11.4**	**3,180.0**	**88.6**

[1] Based on total acres (Proposed Action plus Alternatives 2 and 3).
[2] Includes BLM's preferred tract delineation under Alternatives 2 and 3.

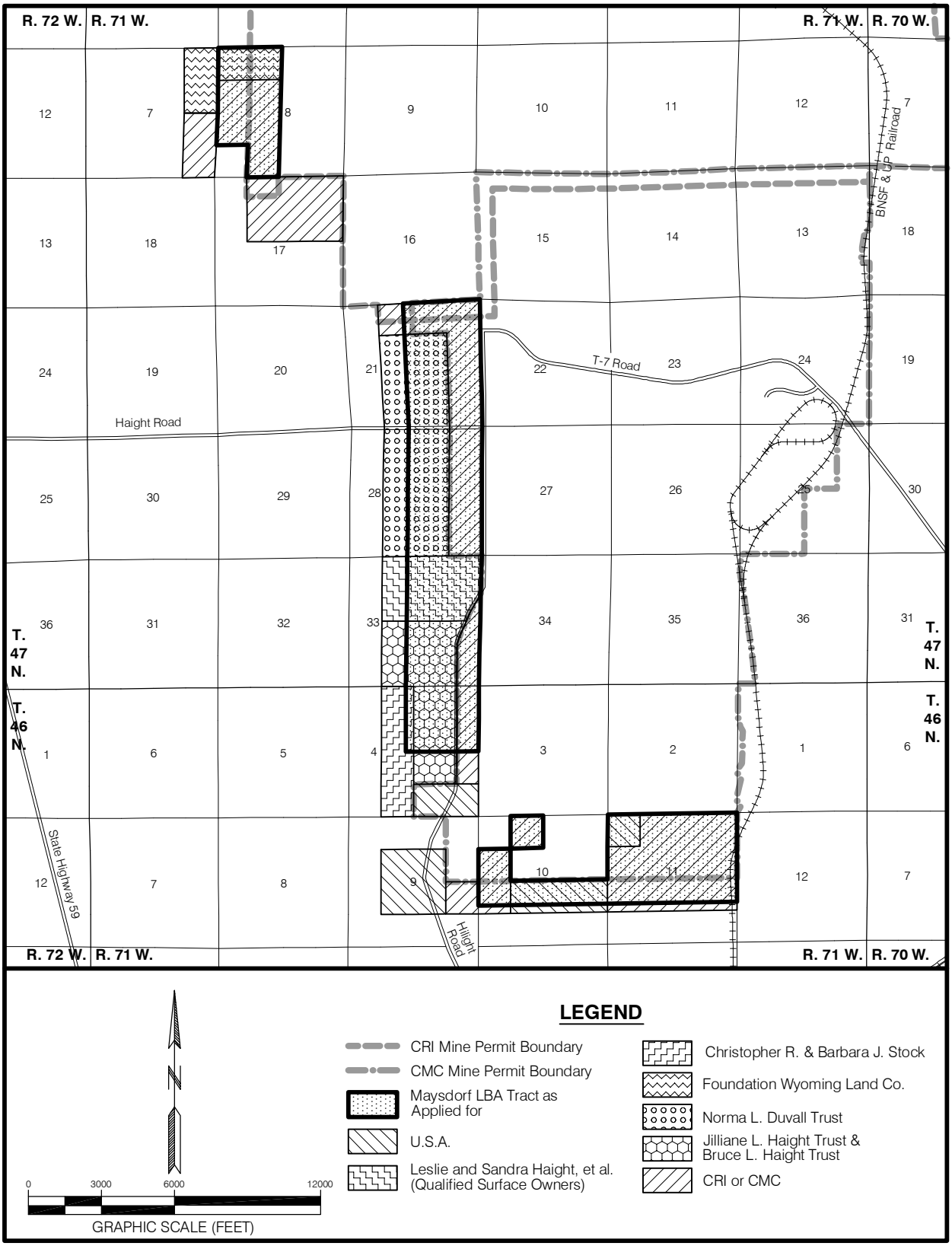


Figure 3-16. Surface Ownership Within the Maysdorf LBA Tract.

The coal underlying the following lands is privately owned:

T.46N., R.71W.
Section 9: N½N½ and SE¼SE¼; Section 10: NE¼, SE¼NW¼, and NW¼NW¼.

T.47N., R.71W.
Section 8: SW¼SW¼.

These lands are not part of the Maysdorf LBA Tract and surface ownership for these lands is not shown on Figure 3-16.

The BLM has determined that one owner of surface lands included in the Maysdorf LBA Tract meets the requirements listed under 43 CFR 3400.0-5gg and is therefore considered to be a qualified surface owner. In the event that surface owner does not consent to leasing their land, which is located in the north half of Section 33, T.47N., R.71W., will be removed from the tract prior to holding a lease sale (Figure 3-16).

Livestock grazing on native rangeland is the primary land use, while oil and as production, wildlife habitat, and recreation are secondary land uses for both public and private lands.

Areas of disturbance within and near the proposed lease area include roads, oil and gas wells and associated production facilities, surface mine-related facilities, and activities associated with ranching. State Highway 59 is several miles west of the LBA tract. Several county roads traverse and provide public and private access within and near the proposed lease area. These include the Haight Road, T-7 Road, Hoadley Road, and the Hilight Road. The BNSF & UP railroad ROW also crosses a small portion of the tract.

The oil and gas estate within the Maysdorf LBA Tract is federally, privately, and state owned, with the majority (approximately 76 percent) being privately owned. All of the federally owned oil and gas estate is leased. The ownership of the oil and gas estate for the LBA tract is shown in Figure 3-17. A list of the current federal oil and gas lessees is given in Table 3-12.

According to the WOGCC records as of July 28, 2005, there were 18 permitted conventional oil and gas wells on lands included in the Maysdorf LBA Tract as proposed and the lands added under Alternatives 2 and 3 (Figure 3-17). Of these, 14 wells are plugged and abandoned, one well is shut in, one well is an active injector, and two wells are still producing. The two producing wells are on a private lease. All of the conventional oil and gas wells within the LBA tract configuration were originally drilled between 1979 and 1996.

The Supreme Court has ruled that the CBNG belongs to the owner of the oil and gas estate (98-830). Therefore, the oil and gas lessees have the right to develop CBNG as well as conventional oil and gas on the LBA tract.

According to the WOGCC records as of July 28, 2005, there were five CBNG wells that were producing, six

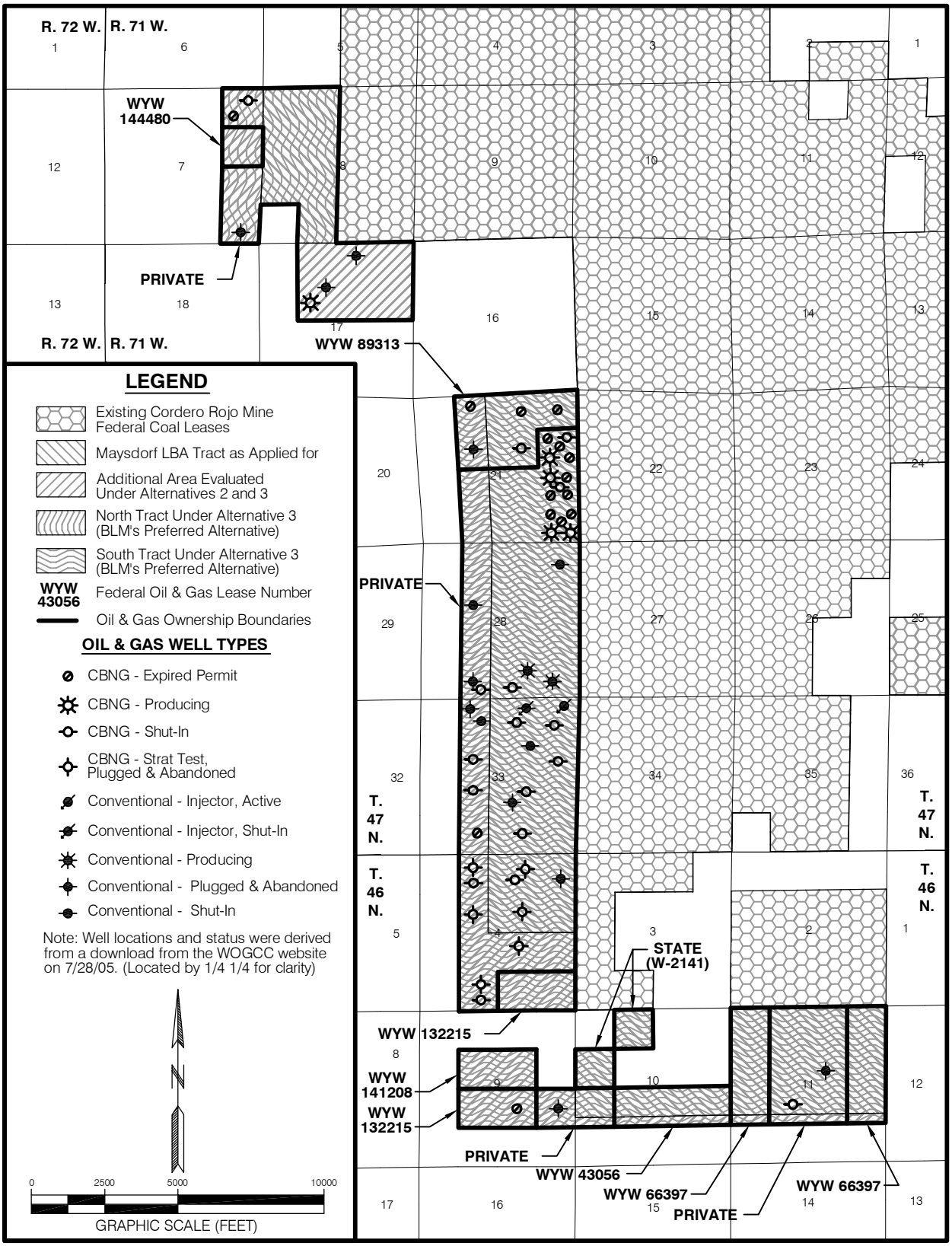


Figure 3-17. Oil and Gas Ownership Within the Maysdorf LBA Tract.

Table 3-12. Maysdorf LBA Tract Federal Oil and Gas Lessees of Record.

For the following locations, both the oil and gas rights (including CBNG) and coal rights are owned by the federal government.

Location	Lease Number	Lessees of Record
T.46N., R.71W.		
Section 4 Lots 19, 20 Section 9 Lots 4, 5	WYW 132215	Maurice W. Brown
Section 9 Lots 1, 2	WYW 141208	Maurice W. Brown
Section 10 Lots 3, 4, 5	WYW 043056	AG Andrikopoulos Res. Chaco Energy Co. Key Production Co. Nance Petroleum Corp.
Section 11 Lots 1, 4, 5, 8, 9, 12	WYW 066397	P&M Petro Management LLC. Key Production Co. Nance Petroleum Corp.
T.47N., R.71W.		
Section 7 Lots 5, 12	WYW 144480	Abo Petroleum Corp. Myco Industries Inc. Yates Drilling Co. Yates Petroleum Corp.
Section 21 Lots 1, 2, 3, 6, 7	WYW 089313	Club Oil & Gas Ltd. Dunway Investment Co. Electra Investment JWD III Inc. Raymond T. Duncan Oil Properties, Ltd. Walter Duncan Oil

Note: For the rest of the LBA tract, the oil and gas rights (including CBNG) are state or privately owned, and the coal rights are federally owned.

plugged and abandoned, and 17 were shut-in within the lands encompassed by the Maysdorf LBA Tract as proposed and the lands added under Alternatives 2 and 3 (Figure 3-17). Extensive CBNG development has occurred west of the tract. CBNG wells capable of production on or in sections adjacent to the Maysdorf LBA Tract are listed in Appendix G.

Additional information on the conventional oil and gas and CBNG development in the Maysdorf LBA Tract and surrounding area is included in Section 3.3.2.

Certain ancillary facilities are needed to support oil and gas production. These support facilities may include well access roads, well pads, production equipment at the wellhead (which may be located on the surface and/or underground), well production casing (which extends from the surface to the zone of production), underground pipelines (which gather the oil, gas, and/or water produced by the individual wells and carry it to a larger transmission pipeline or

collection facility), facilities for treating, discharging, disposing of, containing, or injecting produced water, central metering facilities, electrical power utilities, gas compressor stations, and high-pressure transmission pipelines for delivering the gas to market. Currently, some of these oil and gas production facilities, particularly oil and gas pipelines, exist on the LBA tract, as discussed in Section 3.15 of this EIS. It is unlikely that additional support facilities will be constructed on the LBA tract because most of the conventional oil and gas and CBNG wells that exist on the tract have been either shut in or plugged and abandoned due to exhausted reserves and diminished production.

Coal mining is a dominant land use to the north, east, and southeast of the LBA tract. The Caballo, Belle Ayr, Cordero Rojo, and Coal Creek Mines form a group of contiguous or nearly contiguous surface coal mines located in Campbell County (Figure 1-1). The Coal Creek Mine was inactive between 2000 and 2006, but mining operations resumed in 2006. Coal production from these mines increased by 53 percent between 1994 and 2006 (from approximately 66 million tons in 1994 to 101 million tons in 2006). One lease, the West Rocky Butte lease, has been issued within this group of four mines since decertification of the federal coal region. The Maysdorf LBA Tract being evaluated in this EIS and the currently pending Belle Ayr North, Maysdorf II, and West Coal Creek lease applications are in this group of mines (Tables 1-1 and 1-2).

Campbell County does not have a county-wide land use plan, but has been working on a comprehensive land use plan jointly with the City of Gillette (City of Gillette 1978 and Campbell County 2005). The Gillette area land use plan is an integral part of the overall plan for Campbell County and recommends general types of uses for the area immediately surrounding the City of Gillette (City of Gillette 1978). The proposed lease area does not have a designated zoning classification. The *City of Gillette/Campbell County Comprehensive Planning Program* (City of Gillette 1978) provides general land use goals and policies for state and federal coal leases in the county.

Big game hunting is the principal recreational land use within the general analysis area, and pronghorn, mule deer, and white-tailed deer are present within the area (Section 3.10.2). On private lands, hunting is allowed only with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past two to three decades towards a substantial reduction in private lands that are open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as for sportsmen who desire access to these animals (WGFD 2004).

In general, publicly owned lands (i.e., Forest Service or BLM-administered federal lands and state school sections) are open to hunting if legal access is available. Due to safety concerns, however, public surface lands contained within an active mining area are generally closed to the public, further limiting recreational use. There would be approximately 132 acres of BLM-administered public surface lands included in the Maysdorf LBA Tract as applied for and approximately 408 acres of BLM-administered public surface under Alternatives 2 and 3 (Figure 3-16). A maximum of 164 acres of the public surface are currently accessible to the public under any of the alternatives.

Specific details regarding big game herd management objectives within and near the general analysis area are contained in the *Casper* and *Sheridan Region Annual Big Game Herd Unit Reports* (WGFD 2004). The WGFD classifies the entire general analysis area as winter/yearlong habitat for antelope. No crucial or critical pronghorn habitat is recognized by the WGFD in this area (Note: WGFD definitions of big game ranges are included in Section 3.10.2.1). The proposed lease area is within pronghorn antelope Hunt Area 24, which is contained in the Hilight Herd Unit. In post-season 2003, the population of the Hilight Herd Unit was estimated to be approximately 11,416 animals, which is near the WGFD objective of 11,000 (WFGD 2004).

Historical problems associated with the management of the Hilight Herd Unit include hunter access, over harvest on limited public lands, and quantifying landowner preferences and desires. Prior to 1997, the herd population was fairly stable and near the objective of 11,000 antelope. Losses from severe winters, poor production rates, and disease subsequently decreased the population, but it has recently recovered and begun to stabilize near the objective level. Hunt Area 24 contains mostly privately owned surface lands with poor hunter access to limited publicly owned lands; therefore, the number of antelope is expected to steadily increase. If the population exceeds objective levels, more licenses will be needed and these may be difficult to sell in this mostly private land area. Nearly all landowners charge access fees for hunting and private land access is based on the desires and perceptions of the landowners. Increased harvest may be difficult to achieve because of the increased CBNG development, which is limiting rifle hunting on associated lands. Given the predicted harvest and average winter conditions, the 2004 post-season population was expected to be 12,180 antelope.

The WGFD has classified the majority of the general analysis area as yearlong mule deer use range. Crucial or critical mule deer habitat does not occur on or within several miles of the general analysis area. The proposed lease area is located within mule deer Hunt Area 21, part of the Thunder Basin Mule Deer Herd Unit, which also includes Hunt Areas 7, 8, 9, 10, and 11. The Thunder Basin Herd Unit encompasses 3,642

square miles, of this, 71 percent is privately owned. Access fees are common, resulting in heavy hunting pressure on accessible public lands, particularly in recent years. Between 1983 and 2001, the post-season objective for this mule deer herd was 13,000, but the population was consistently above that objective. The 2000 post-season population was estimated at 21,742, which was 67 percent above the objective. WGFD increased the objective to 20,000 head in December 2001. The 2003 postseason mule deer population was estimated at 19,299, which is near the herd objective. It is likely that insufficient harvest within Hunt Area 21 will result in a population increase in the future.

The Rochelle Hills Elk Herd resides in the Rochelle Hills located south of the general analysis area. A small portion of the general analysis area is within Elk Hunt Area 123 of the Rochelle Hills Herd Unit. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. As more lands are reclaimed from coal mining adjacent to the Rochelle Hills, elk are shifting their winter use to those sites. Such lands typically offer excellent winter grass supplies, especially during more severe winters when other sites are less accessible. Elk have not been recently documented on the Maysdorf LBA Tract, although elk have been observed dispersing from the designated herd boundary. This dispersion is likely due to increasing population density and habitat limitations within the normal herd boundary. Elk may potentially expand into the Maysdorf study area in the future.

White-tailed deer are not managed separately by WGFD, but are included with mule deer as part of the Thunder Basin Herd Unit. White-tailed deer are seldom observed within the general analysis area due to their preference for riparian woodlands and irrigated agricultural lands. WGFD classifies the entire general analysis area, with the exception of a narrow corridor along the Belle Fourche River, as out of normal white-tailed deer use range. The narrow corridor along the Belle Fourche is classified as yearlong range.

Under natural conditions, aquatic habitat is very limited by the ephemeral nature of surface waters in the general analysis area; therefore, public fishing opportunities are very limited. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. However, water discharged from CBNG wells upstream of the general analysis area has supplied the Belle Fourche River with water nearly continuously, resulting in an increase in habitat for aquatic species. The Belle Fourche River currently supports a variety of nongame fish in the general analysis area (Section 3.10.6).

Sage grouse, mourning dove, waterfowl, rabbit, and coyote are hunted in the general vicinity, and some coyote and red fox trapping may occur.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action and Alternatives 2 and 3

The major adverse environmental consequences of leasing and mining the Maysdorf LBA Tract on land use would be the reduction of livestock grazing (cattle and sheep), loss of wildlife habitat (particularly big game), and curtailment of oil and gas development while the coal is being mined and during reclamation. This would include removal of all existing oil and gas surface and downhole production and transportation equipment and facilities. Wildlife and livestock use would be displaced while the tract is being mined and reclaimed. Grazing leases would be suspended on approximately 132 acres of federal lands if the Maysdorf LBA Tract were leased under the Proposed Action. Under Alternatives 2 and 3, access to approximately 408 acres of federal grazing leases would be suspended during mining operations. This federal land is within Grazing Allotment #22027, currently held by Dave Edwards (valid through July 2014) and Grazing Allotment #02349, currently held by Donald Wagensen and Doris Marquis (valid through January 2014). Access for recreational and other (i.e., ranching, oil and gas development) activities would be restricted during mining operations. Estimated disturbance areas for the Maysdorf LBA Tract and the tract configuration for Alternatives 2 and 3 are presented in Table 3-1.

Sections 3.3.2 and 3.11.1 and Appendix G of this document address producing, abandoned, and shut in oil and gas (conventional and CBNG) wells that presently exist on the LBA tract under the Proposed Action and Alternatives 2 and 3. Well location information, federal oil and gas ownership, and federal oil and gas lessee information are presented in Figure 3-17 and Table 3-12. BLM manages federal lands on a multiple use basis, in accordance with the regulations. In response to conflicts between oil and gas and coal lease holders, BLM policy advocates optimizing the recovery of both coal and CBNG resources to ensure that the public receives a reasonable return for these publicly owned resources. Optimal recovery of both coal and oil and gas resources requires negotiation and cooperation between the oil and gas lessees and the coal lessees. In the past, negotiations between some of the applicant mines and some of the existing oil and gas lessees have resulted in agreements that allow development of both resources in this area. Producing conventional oil and gas and CBNG wells are present on the Maysdorf LBA Tract. In the PRB, royalties have been and would be lost to both the state and federal governments if conventional oil and gas wells are abandoned prematurely, if the federal CBNG is not recovered prior to mining, or if federal coal is not recovered due to conflicts. State and federal governments can also lose bonus money when the costs of the agreements between the lessees are factored into the fair market value determinations.

Up to 408 acres of BLM-administered federal surface would be affected

during mining operations if the Maysdorf LBA Tract is leased under the Proposed Action or Alternatives 2 or 3, but only about 164 of those acres are currently accessible by the public. The loss of access to federal lands is long term (during mining and reclamation), but is not permanent. Public access to federal lands would be restored after mining and reclamation are complete.

Hunting on the Maysdorf LBA Tract, including the federal surface discussed above, would be eliminated during mining and reclamation. Pronghorn and mule deer occur on and adjacent to the LBA tract, as do sage grouse, mourning dove, waterfowl, rabbit, and coyote. The federal lands actually represent a relatively small portion of the currently accessible public surface lands for recreational opportunity within the respective animal hunt areas.

Following reclamation, the land would be suitable for grazing and wildlife uses, which are the historic land uses. The reclamation standards required by SMCRA and Wyoming State Law meet the standards and guidelines for healthy rangelands for public lands administered by the BLM in Wyoming. Following reclamation bond release, management of the privately owned surface would revert to the private surface owner and management of the federally owned surface would revert to the federal surface managing agency (BLM).

3.11.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected, coal removal would not occur, and current land uses would continue on the 2,558.2 or 4,024.7 additional acres that would be disturbed under the Proposed Action or Alternatives 2 and 3, respectively. Currently approved mining operations would continue on the existing Cordero Rojo Mine leases. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.11.3. Regulatory Compliance, Mitigation and Monitoring

Mined areas would be reclaimed as specified in the approved mine plan to support the anticipated post-mining land uses of wildlife habitat and rangeland. The reclamation procedures would include stockpiling and replacing topsoil, using reclamation seed mixtures, which would be approved by WDEQ, and replacing stock reservoirs.

Steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan. (See discussion in Section 3.9.)

Revegetation growth and diversity would be monitored until the final reclamation bond is released (a minimum of 10 years following seeding with the final seed mixture). Erosion would be monitored to determine if there is a need for corrective action during establishment of vegetation. Controlled grazing would be used during revegetation to determine the suitability of the reclaimed land for anticipated post-mining land uses.

See Section 3.3.2.3 for discussion of regulatory requirements, mitigation and monitoring related to oil and gas development.

3.11.4 Residual Impacts

No residual impacts to land use and recreation are expected.

3.12 Cultural Resources

3.12.1 Affected Environment

Cultural resources, which are protected under the National Historic Preservation Act of 1966, are nonrenewable remains of past human activity. The PRB, including the general analysis area, appears to have been inhabited by aboriginal hunting and gathering people for more than 13,000 years. Throughout the prehistoric past, the area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. Several thousand cultural sites have been recorded within the PRB.

Several culture historic chronologies are pertinent to evaluating prehistoric occupations in Wyoming. Frison's (1978, 1991) chronology for the Northwestern Plains divides occupations from early to late into the Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Late Prehistoric, and Protohistoric periods. Frison's chronology is listed below. The Plains designation within the Early, Middle, and Late Archaic periods has been omitted from this list:

- Paleoindian period (13,000 to 7,000 years B.P.)
- Early Archaic period (7,000 to 5,000-4,500 years B.P.)
- Middle Archaic period (5,000-4,500 to 3,000 years B.P.)
- Late Archaic period (3,000 to 1,850 years B.P.)
- Late Prehistoric period (1,850 to 400 years B.P.)
- Protohistoric period (400 to 250 years B.P.)
- Historic period (250 to 120 years B.P.)

The Paleoindian period dates from about 13,000 to 7,000 years ago and includes various complexes (Frison 1978). Each of these complexes is correlated with a distinctive projectile point style derived from a general large lanceolate and/or stemmed point morphology. The Paleoindian period is traditionally thought to be synonymous with "big game hunters" who exploited megafauna such as bison and mammoth (plains Paleoindian groups), although evidence of the use of vegetal resources is noted at a few Paleoindian sites (foothill-mountain groups).

The Early Archaic period dates from about 7,000 to 5,000-4,500 years ago. Projectile point styles reflect the change from large lanceolate types that characterize the earlier Paleoindian complexes to large side- or corner-notched types. Subsistence patterns reflect exploitation of a broad spectrum of resources, with a much-diminished utilization of large mammals.

The onset of the Middle Archaic period (4,500 to 3,000 years B.P.) has been defined on the basis of the appearance of the McKean Complex as the predominant complex on the Northwestern Plains around 4,900 years B.P. (Frison 1978, 1991, 2001). McKean Complex projectile points are stemmed variants of the lanceolate point. These projectile point types continued until 3,100 years B.P. when they were replaced by a variety of large corner-notched points (i.e., Pelican Lake points) (Martin 1999). Sites dating to this period exhibit a new emphasis on plant procurement and processing.

The Late Archaic period (3,000 to 1,850 years B.P.) is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison 1991). The period witnessed a continual expansion of occupations into the interior grasslands and basins, as well as the foothills and mountains.

The Late Prehistoric period (1,850 to 400 years B.P.) is marked by a transition in projectile point technology around 1,500 years B.P. The large corner-notched dart points characteristic of the Late Archaic period are replaced by smaller corner- and side-notched points for use with the bow and arrow. Around approximately 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison 1991). This population shift appears to reflect a narrower subsistence base focused mainly on communal procurement of pronghorn and bison.

The Protohistoric period (400 to 250 years B.P.) witnesses the beginning of European influence on prehistoric cultures of the Northwestern Plains. Additions to the material culture include most notably the horse and European trade goods, including glass beads, metal, and firearms. Projectile points of this period include side-notched, tri-notched, and unnotched points, with the addition of metal points. The occupants appear to have practiced a highly mobile and unstable residential mobility strategy.

The historic period (250 to 120 years B.P.) is summarized from Schneider et al. (2000). The use of the Oregon Trail by emigrants migrating to the fertile lands of Oregon, California, and the Salt Lake Valley brought numerous pioneers through the state of Wyoming, but few stayed. It was not until the fertile land in the West became highly populated, along with the development of the cattle industry in the late 1860s, that the region currently comprising the state of Wyoming became attractive for settlement. The region offered

cattlemen vast grazing land for the fattening of livestock, which could then be shipped across the country via the recently completed (1867-1868) transcontinental railroad in southern Wyoming.

The settling of the region surrounding Gillette, Wyoming began in the late 1800s, after a government treaty in 1876 placed the Sioux Indians on reservations outside the territory. Cattlemen were the first settlers to establish themselves in the area, with dryland farmers entering the area after 1900. The town of Gillette was established by the railroad in 1891 in an effort to promote the settling of undeveloped areas along their rail lines. The presence of the railroad allowed for the greater development of the cattle industry because it facilitated shipping cattle from the area. Several early ranches established in the region include the 4J Ranch (1875), Half Circle L Ranch (1880s), I Bar U Ranch (1888), and the T7 Ranch (1881). Early ranches established in the region surrounding the project area as of 1883 include the Ritchie Ranch, the McCray Ranch, and the 6 Ranch. Later arrivals to the area (as of 1908) include the Grant Ranch on Hay Creek, the Rooney Ranch on Rawhide Creek, and the Gardner and Wilson Ranches on the Little Powder River. The specific project area of Site 48CA3378 was homesteaded by George Oedekoven in 1917, and his family still maintains the property today.

A Class III cultural resources survey is an intensive and comprehensive inventory of a proposed project area conducted by professional archaeologists and consultants. The survey is designed to locate and identify all prehistoric and historic cultural properties 50 years and older that have exposed surface manifestations. The goal of the survey is to locate and evaluate for the NRHP all cultural resources within the project area. Cultural properties are recorded at a sufficient level to allow for evaluation for possible inclusion to the NRHP. Determinations of eligibility are made by the managing federal agency in consultation with the SHPO. Consultation with the SHPO must be completed prior to the approval of the mining plan.

After completion of a Class III cultural resources survey, additional investigations may be undertaken to complete an individual site record. If necessary, site-specific testing or limited excavation may be utilized to collect additional data which will: 1) determine the final evaluation status of a site; and/or 2) form the basis of additional work to be conducted during implementation of a treatment plan if the site is determined eligible for the NRHP. A treatment plan is then developed for those sites that are eligible for the NRHP and are within the area of potential effect. Treatment plans are implemented prior to mining and can include such mitigation measures as avoidance (if possible), large scale excavation, complete recording, Historical American Building Survey/Historic American Engineering Record documentation, archival research, and other acceptable scientific practices.

Data recovery plans are required for sites that are recommended as eligible for the NRHP and cannot be avoided by project development, following testing and consultation with the SHPO. Until consultation has occurred and agreement regarding NRHP eligibility has been reached, all sites recommended as eligible or undetermined eligibility must be protected from disturbance. Full consultation with the SHPO will be completed prior to approval of the mining plans. Those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment.

Numerous Class I (survey records review) and Class III cultural resource surveys associated with oil and gas field development and surface mining operations have been conducted in the general area. CMC contracted with TRC Mariah Associates, Inc. of Laramie, Wyoming to perform Class I and Class III surveys of the Maysdorf LBA Tract and surrounding area in 2005. The 2005 survey covered the Maysdorf LBA Tract as applied for, the additional area evaluated under Alternatives 2 and 3, and the anticipated permit area if the Maysdorf LBA Tract is leased (Figure 3-1). This area is larger than the Maysdorf LBA Tract cultural survey area discussed below.

The Maysdorf LBA Tract cultural survey area refers to the anticipated area that would be disturbed in order to recover the coal in the LBA tract, which is comprised of the BLM study area (the LBA tract as applied for under the Proposed Action and the additional area evaluated under Alternatives 2 and 3) plus a ¼-mile buffer.

The Maysdorf LBA Tract cultural survey area has been entirely surveyed for cultural resources at a Class III level. The Class I review of previous survey records identified 23 archeological sites, of which 13 are prehistoric, six are historic, and four are multi-component. Prehistoric sites consist primarily of open camps and lithic scatters. All prehistoric sites are considered not eligible or are unevaluated. Historic sites consist primarily of homesteads and trash dumps. Three historic trails (Hathaway's-Black Hills Trail, Sawyer's Expedition Trail, and Crook's Military Trail) were identified and all are considered eligible to the NRHP. The remaining three historic sites are considered not eligible. The four multi-component sites consist mostly of lithic and trash scatters and are considered not eligible. A total of 22 isolated occurrences were identified during the Class I records search. The isolates consist of 17 prehistoric flakes and tools, two historic debris items, and three unknown/unidentified finds.

The remainder of the Maysdorf LBA Tract cultural survey area was surveyed at a Class III level in 2005. A total of 16 archaeological sites and 28 isolated occurrences were identified and recorded during this recent Class III inventory. The 28 isolates consist of 26 prehistoric flakes and tools and two historic debris items. The 16 newly recorded cultural sites consist of 14 prehistoric (mostly lithic scatters) sites and two

historic sites. One site (48CA5717), an open campsite, is considered eligible for the NRHP. All other newly recorded sites are recommended as not eligible. One previously recorded site (48CA1442) was updated during the inventory.

To summarize the identified cultural properties, a total of 39 archaeological sites are located in the Maysdorf LBA Tract cultural survey area. Of these 39 sites, 27 are prehistoric, eight are historic, and four are multi-component. Three historic trails (Hathaway's-Black Hills Trail, Sawyer's Expedition Trail, and Crook's Military Trail) and a prehistoric open campsite are the only sites considered eligible to the NRHP by the cultural site recorder. Three sites, Hathaway's-Black Hills Trail (48CA1568), Sawyer's Expedition Trail (48CA1570), and an open campsite (48CA5717), and their associated reports have not yet been concurred by SHPO. Site 48CA4975 (Crook's Military Trail) was concurred by SHPO in 2004. None of the other 35 archaeological sites are recommended as eligible or are unevaluated for the NRHP. Two historic and 26 prehistoric isolated finds were also recorded. Table 3-13 lists the cultural sites and their classifications.

Table 3-13. Sites and Isolated Finds in the Class III Cultural Resource Inventory of the Maysdorf LBA Tract Survey Area.

Prehistoric sites:	
Lithic Scatter:	48CA877, 48CA1332, 48CA1396, 48CA2599, 48CA2600, 48CA3286, 48CA3287, 48CA5625, 48CA5626, 48CA5627, 48CA5628, 48CA5629, 48CA5630, 48CA5633, 48CA5634
Open Campsite:	48CA69, 48CA879, 48CA880, 48CA1436, 48CA5631, 48CA5632, 48CA5686, 48CA5690, 48CA5716, 48CA5717
Stone Circle:	48CA1442
Campsite with Stone Circle:	48CA1438
Isolated finds:	43 lithic items
Historic sites:	
Trail:	48CA1568, 48CA1570, 48CA4975
Debris:	48CA2026, 48CA5601
Marker:	48CA3283
Livestock/Ranching:	48CA2025, 48CA5635
Isolated finds:	4 debris items
Multi-component sites:	48CA878, 48CA1343, 48CA1437, 48CA3285
Unknown/Unidentified Isolated Finds:	3 items

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action and Alternatives 2 and 3

Data recovery plans are required for sites that are recommended eligible to the National Register and cannot be avoided by project development, following testing and consultation with the SHPO. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites would be protected from disturbance.

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

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

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

3.12.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the 2,558.2 or 4,024.7 additional acres that would be disturbed under the Proposed Action or Alternatives 2 and 3, respectively. Currently approved mining operations would continue on the existing Cordero Rojo Mine leases. Cultural resources on the portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be affected as a result of disturbance that would occur during recovery of the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.12.3 Native American Consultation

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering, fasting, or vision quest sites. Other sites of cultural interest and importance may include rock art, stone circles, various rock features,

fortifications or battle sites, burials, and locations that are sacred or part of the oral history and heritage but have no man-made features.

No Native American heritage, special interest, or sacred sites have been formally identified and recorded to date within the general analysis area. However, the geographic position of the general analysis area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west, the Black Hills to the east, and Devils Tower to the north) creates the possibility that existing locations may have special religious or sacred significance to Native American groups. If such sites or localities are identified at a later date, appropriate action must be taken to address concerns related to those sites.

Tribes that have been identified as potentially having concerns about actions in the PRB include the Crow, Northern Cheyenne, Shoshone, Arapaho, Oglala Sioux, Rosebud Sioux, Crow Creek Sioux, Lower Brule Sioux, Standing Rock Sioux, Cheyenne River Sioux, Apache Tribe of Oklahoma, Comanche Tribe of Oklahoma, and Kiowa Tribe of Oklahoma. These tribal governments and representatives have been sent copies of the EIS and they have been provided with more specific information about the known cultural sites on the tract in this analysis and requested to identify potentially significant religious or cultural sites in the general analysis area before a leasing decision is made on the Maysdorf LBA Tract. Two tribes have expressed concerns or requested additional information, but have not identified specific sites that are of concern to their tribes at this time.

Native American tribes were consulted at a general level in 1995-1996 as part of an update to the BLM *Buffalo Resource Area RMP*. Some of the Sioux tribes were consulted by BLM on coal leasing and mining activity in the PRB at briefings held in Rapid City, South Dakota in March 2002.

3.12.4 Regulatory Compliance, Mitigation and Monitoring

Class I and III surveys are conducted to identify cultural properties on all lands affected by federal undertakings. Prior to any mining disturbance, SHPO is consulted to evaluate the eligibility of the cultural properties for inclusion in the NRHP. Cultural properties that are determined to be eligible for the NRHP would be avoided or, if avoidance is not possible, a recovery plan would be implemented prior to disturbance.

Through mitigation procedures involving data recovery plans at each site, the archaeological record will not be negatively affected due to the loss of sites 48CA1568, 48CA1570, 48CA4975, and 48CA5717. Archaeological excavation and analysis will provide information toward a better understanding of local historic sites to coal mining impacts.

Mining activities are monitored during topsoil stripping operations. If a lease is issued for the Maysdorf LBA Tract, BLM would attach a stipulation

to the lease requiring the lessee to notify appropriate federal personnel if cultural materials are uncovered during mining operations (Appendix D).

3.12.5 Residual Impacts

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

3.13 Visual Resources

3.13.1 Affected Environment

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. Landscapes within the general analysis area include rolling sagebrush and short-grass prairie, which are common throughout the PRB. There are also areas of altered landscape, such as oil fields and surface coal mines. The existing active surface mines that are located along the eastern side of the PRB form three geographic groups that are separated by areas with no mining operations. Two of the groups of surface mines are located east of Highway 59 from south of Gillette to south of Wright; the third mine group is located on the east side of U.S. Highway 14-16 from Gillette north for about 13 miles (Figure 1-1). Other man-made intrusions include ranching activities (fences, homesteads, and livestock), oil and gas development (pumpjacks, pipeline ROWs, CBNG well shelters, and CBNG compressor stations), transportation facilities (roads and railroads), environmental monitoring installations, road signage, and electrical power transmission lines. The natural scenic quality in and near the immediate lease area is fairly low because of the industrial nature of the adjacent existing mining operations and oil and gas development.

VRM guidelines for BLM lands are to manage public lands for current VRM classifications and guidelines. The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. The VRM classes constitute a spectrum ranging from Class I through Class V that provides for increasing levels of change within the characteristic landscape.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the 2001 BLM Buffalo RMP update (BLM 2001a). The inventoried lands were classified into VRM classes. In the general analysis area, including the BLM-administered surface land, the predominant VRM class is Class IV for lands not yet disturbed by mining and Class V for lands that have already been disturbed by mining. For lands classified as VRM Class IV, activities, such as mining, attract attention and are dominant features of the landscape in terms of scale. Class V applies to areas where the natural character of the landscape has been disturbed up to a point where rehabilitation is needed to

bring it up to the level of one of the other four classifications.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action and Alternatives 2 and 3

Much of the Maysdorf LBA Tract is visible from State Highway 59, which is two to three miles west of the tract. Therefore, some mining activities on the LBA tract would be visible from this major travel route.

If the Maysdorf LBA Tract is leased and mined, the portions of the general analysis area that would be disturbed under the Proposed Action or Alternatives 2 or 3 would be considered as VRM Class V prior to reclamation. After reclamation of the LBA tract and adjoining mines, the areas classified as Class V would improve to resemble the surrounding undisturbed terrain. No visual resources that are unique to this area have been identified on or near the Maysdorf LBA Tract.

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

3.13.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal and associated disturbance and impacts would not occur on the 2,558.2 or 4,024.7 additional acres that would be disturbed under the Proposed Action or Alternatives 2 and 3, respectively, and the current VRM Class IV and V designations would not change for those lands. Currently approved mining operations would continue on the existing Cordero Rojo Mine leases. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.13.3 Regulatory Compliance, Mitigation and Monitoring

Landscape character would be restored during reclamation to approximate original contour and would be reseeded with an approved seed mixture, including native species.

See Section 3.2 and Section 3.9 for additional discussion of the regulatory requirements, mitigation, and monitoring for topography and vegetation.

3.13.4 Residual Impacts

No residual impacts to visual resources are expected.

3.14 Noise

3.14.1 Affected Environment

Existing noise sources in the general analysis area include coal mining activities, traffic on the nearby state highway and county roads, rail traffic, wind, and CBNG compressor stations. Noise originating from CBNG development equipment (e.g., drilling rigs and construction vehicles) is apparent locally over the short term (i.e., 30 to 60 days) where well drilling and associated construction activities are occurring. The amount of noise overlap between well sites is variable and depends on the timing of drilling activities on adjacent sites and the distance between the site locations.

Studies of background noise levels at PRB mines indicate that ambient sound levels generally are low, owing to the isolated nature of the area. The unit of measure used to represent sound pressure levels (decibels) using the A-weighted scale is a dBA. It is a measure designed to simulate human hearing by placing less emphasis on lower frequency noise because the human ear does not perceive sounds at low frequency in the same manner as sounds at higher frequencies. Figure 3-18 presents noise levels associated with some commonly heard sounds.

No site-specific noise level data are available for the proposed lease area. Because the Cordero Rojo Mine is adjacent to the proposed LBA tract, the current median noise level is estimated to be 40-60 dBA for day and night, with the noise level increasing with proximity to active mining operations at the adjacent mine. Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992).

The nearest occupied dwellings to the Maysdorf LBA Tract include three residences located less than three miles from the LBA tract; the closest being approximately 6,600 ft from the western edge of the area added under Alternatives 2 and 3. Figure 3-8 depicts the locations of occupied residences with respect to the Maysdorf LBA Tract.

OSM prepared a noise impact report for the Caballo Rojo Mine (OSM 1980) that determined that the noise level from crushers and a conveyor would not exceed 45 dBA at a distance of 1,500 ft. The air overpressure created by blasting is estimated to be 123 dBA at the location of the blast. At a distance of approximately 2,500 ft (0.47 mile), the intensity of this blast would be reduced to 55 dBA (no adverse impact level).

3.14.2 Environmental Consequences

3.14.2.1 Proposed Action and Alternatives 2 and 3

Noise levels on the LBA tract would be increased considerably by mining activities such as blasting, loading, hauling, and possibly in-pit crushing. Since the LBA tract would be mined as an extension of existing operations under the Proposed Action or Alternatives 2 and 3, no rail car loading would take place on the LBA tract.

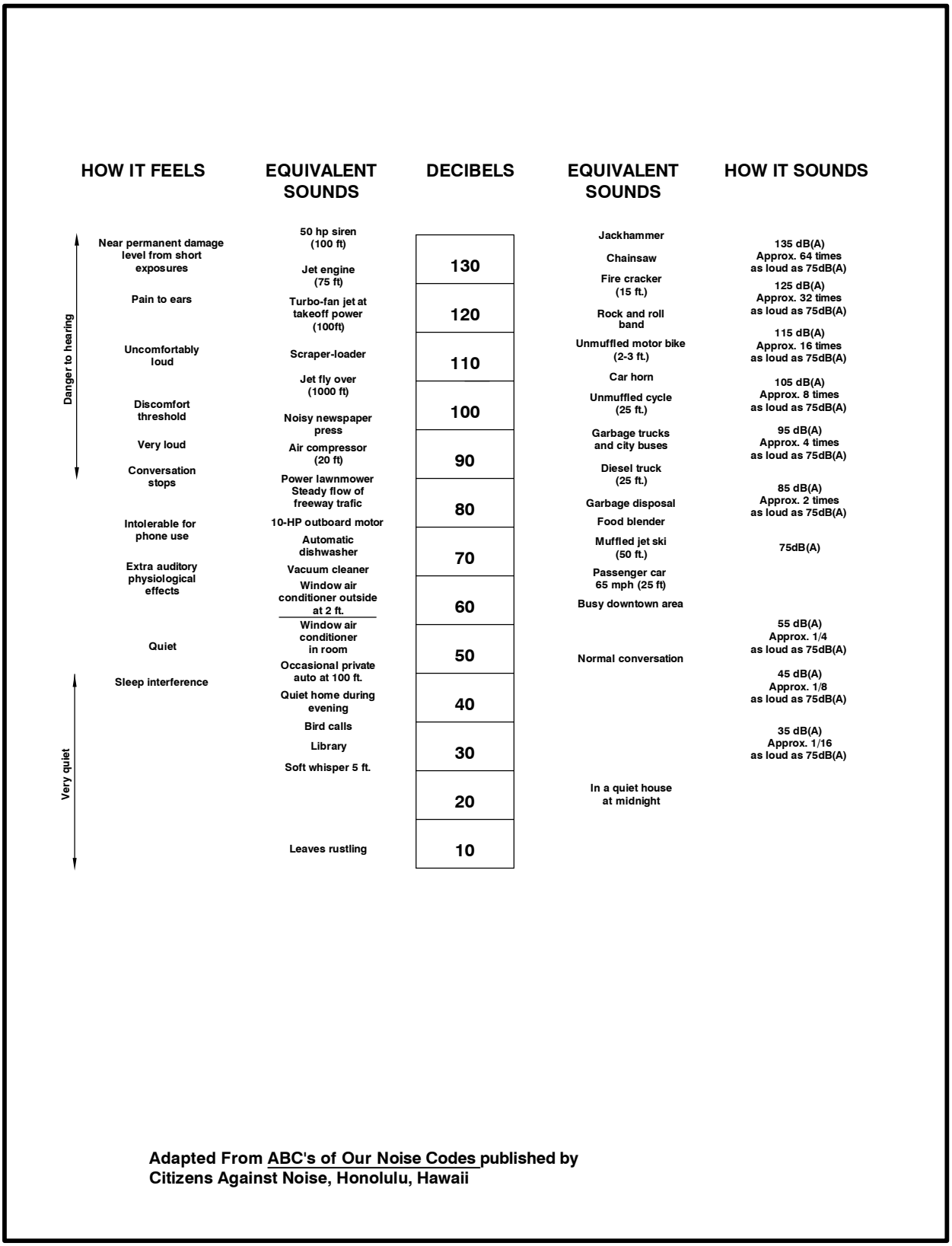


Figure 3-18. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

The Noise Control Act of 1972 indicates that a 24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact. The nearest occupied dwelling to the Maysdorf LBA Tract is located more than one mile from the western edge of the LBA tract as configured under Alternatives 2 and 3. The estimated maximum noise level associated with blasting at this residence would be approximately 48 dBA. No major noise impacts are expected for this dwelling.

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

3.14.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected; coal removal and the associated noise impacts would not occur on the 2,558.2 or 4,024.7 additional acres that would be disturbed under the Proposed Action or Alternatives 2 and 3, respectively. Currently approved mining operations and associated noise impacts would continue on the existing Cordero Rojo Mine leases. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.14.3 Regulatory Compliance, Mitigation and Monitoring

Mine operators are required to comply with MSHA regulations concerning noise, which include protecting employees from hearing loss associated with noise levels at the mines. MSHA periodically conducts mine inspections to ensure compliance with the requirements of the Federal Mine Safety and Health Act of 1977.

3.14.4 Residual Impacts

No residual impacts to noise are expected.

3.15 Transportation

3.15.1 Affected Environment

Transportation resources near the Maysdorf LBA Tract include State Highway 59, a number of improved, two-lane county roads (i.e., Haight Road, T-7 Road, Hilight Road, Hoadley Road, and Bishop Road), several unimproved local roads and accesses (unnamed two-track trails), the Gillette-Douglas rail spur used jointly by BNSF & UP Railroads, oil and gas pipelines, utility/power lines, telephone lines, and associated ROWs. Figure 3-19 depicts the current transportation facilities,

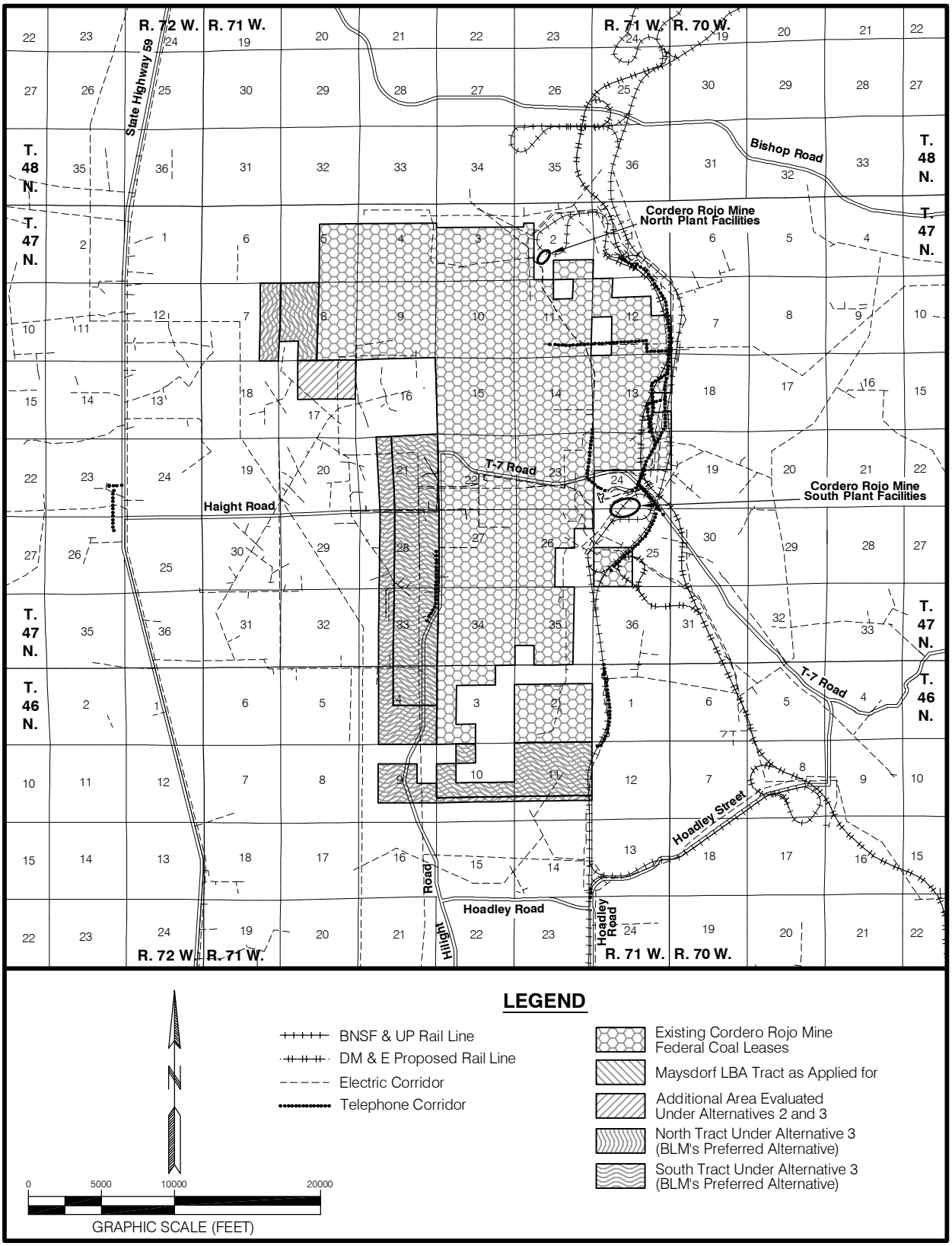


Figure 3-19. Transportation Facilities Within and Adjacent to the Maysdorf LBA Tract.

excluding the oil and gas pipelines, within and near the proposed lease area. Figure 3-20 depicts the oil and gas pipelines within and near the proposed lease area.

State Highway 59, a paved two-lane road located two to three miles west of the LBA tract, is the major north-south public transportation corridor in this area. The principal east-west public transportation corridor is the Haight Road and the T-7 road, which crosses the Cordero Rojo Mine's permit area. Access to the LBA tract is on Haight Road from the west, the Hilight Road from the south, or the T-7 road from the east. These county roads all provide public and private access within the general analysis area. The unimproved local roads and accesses in the area are for both public and private use.

The Gillette-Douglas rail spur runs north-south just east of the Cordero Rojo Mine and the adjacent mines in this area, roughly parallel to State Highway 59, with individual spur lines that connect each mine to the railroad for the purpose of transporting the coal that is mined in the eastern PRB.

The DM&E Railroad has proposed an expansion into the PRB of Wyoming. The STB gave final approval to the expansion project in 2002. However, in response to a successful appeal, the 8th Circuit Court of Appeals directed the STB to give further consideration to four environmental issues that were raised. The STB issued a final SEIS on the expansion project December 30, 2005, which addressed the four issues that were remanded back to the STB with input from various Federal agencies, Tribes, organizations, environmental groups, businesses, and members of the general public (STB 2006). The issue-driven alignment has been determined and the tracks would terminate at the three coal mines nearest the Maysdorf LBA Tract (Caballo, Belle Ayr, and Cordero Rojo Mines). If constructed, the DM&E project would be the largest railroad construction project in the United States in the last 100 years (Sheridan Press 2006). The STB granted final approval to construct the rail line on February 15, 2006. DM&E had hoped federal officials would approve a loan request to help finance the project, but the Federal Rail Administration denied the loan on February 26, 2007 (Sheridan Press 2007a). Without the federal loan, DM&E is seeking private investment for the $6 billion project (Sheridan Press 2007b).

3.15.2 Environmental Consequences

3.15.2.1 Proposed Action and Alternatives 2 and 3

Essentially all of the coal mined on the LBA tract would be transported by rail. Since the Maysdorf LBA Tract would be an extension of the existing Cordero Rojo Mine operations, the existing rail facilities and infrastructure would be used during mining of the proposed lease area. BNSF & UP have upgraded and are continuing to upgrade their rail capacities to handle the increasing coal volume projected from the PRB, with or without the leasing of the proposed Maysdorf LBA Tract. The

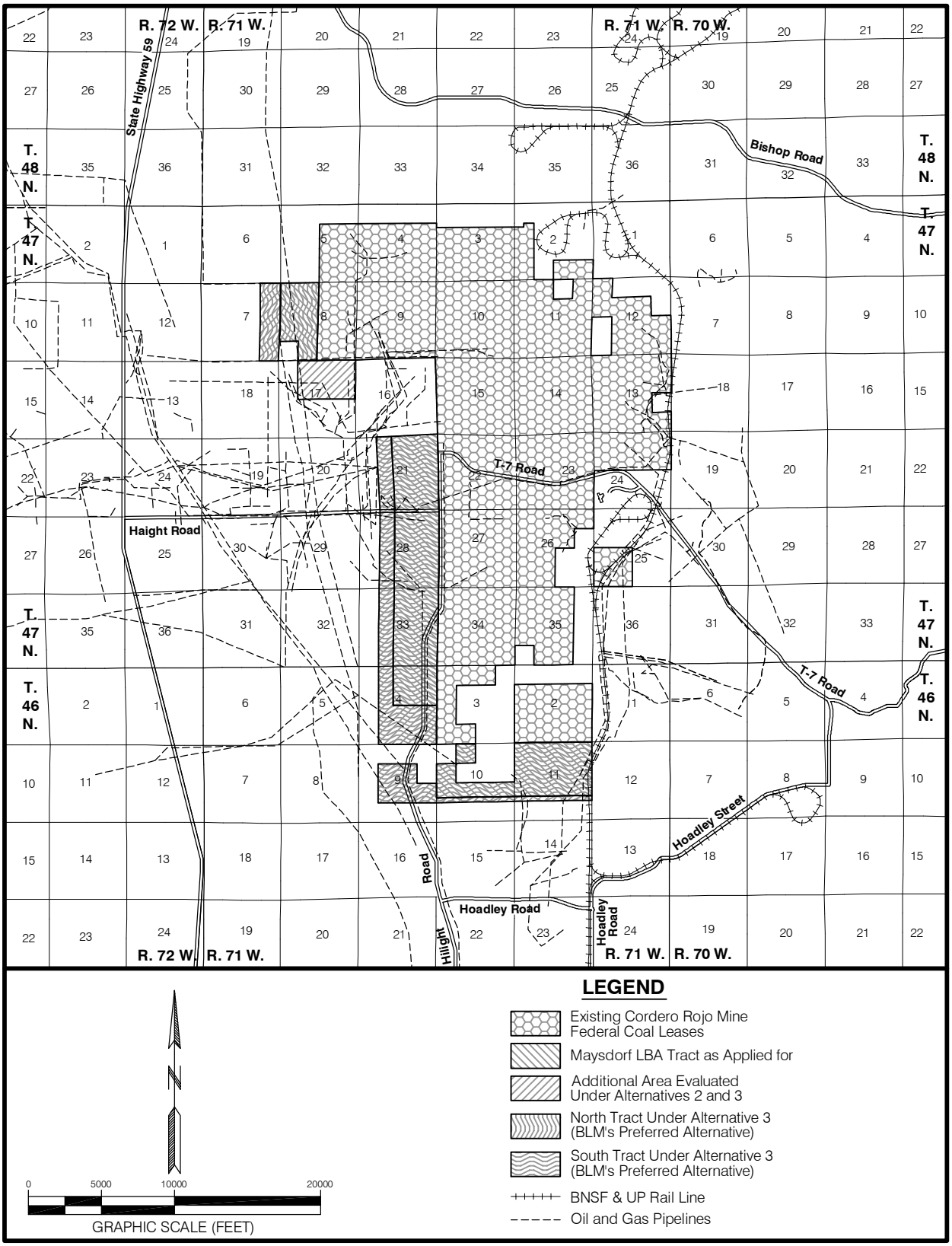


Figure 3-20. Oil and Gas Pipelines Within and Adjacent to the Maysdorf LBA Tract.

proposed DM&E Railroad expansion into this area is not dependent on leasing the LBA tract.

Active pipelines and utility/power transmission lines currently cross the LBA tract. Any relocation of these pipelines and utility lines would be handled according to specific agreements between the coal lessee and the pipeline and utility owners, if the need arises.

The Cordero Rojo Mine is currently evaluating options to relocate the Hilight, T-7, and Haight Roads in order to recover the coal in the existing leases (Figure 3-19). If the Maysdorf LBA Tract were leased under the Proposed Action or Alternatives 2 and 3, the areas of mining would extend onto the LBA tract, which would therefore require the mine to reconsider some or all of its current road relocation plans. All of Cordero Rojo Mine's road relocation option plans will be reviewed and approved by the Campbell County Commissioners prior to road construction, with or without leasing of the Maysdorf LBA Tract. Vehicular traffic to and from the mine would continue at existing levels for up to nine additional years, depending on which alternative is selected.

3.15.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected, coal removal would not occur on the 2,558.2 or 4,024.7 additional acres that would be disturbed under the Proposed Action or Alternatives 2 and 3, respectively, and the transportation resources located in those areas would not be affected by mining. Currently approved mining operations and any associated impacts to transportation resources would continue on the existing Cordero Rojo Mine leases. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.15.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding transportation facilities require that existing pipelines and utility lines be relocated, if necessary, in accordance with specific agreements between the coal lessee and the pipeline and utility owners.

3.15.4 Residual Impacts

No residual impacts to transportation facilities are expected.

3.16 Hazardous and Solid Waste

3.16.1 Affected Environment

Potential sources of hazardous or solid waste on the Maysdorf LBA Tract would include spilled, leaked or dumped hazardous substances, petroleum products, and/or solid waste associated with coal and oil and gas exploration, oil and gas development, the BNSF & UP railroad, utility line installation and

maintenance, or agricultural activities. No such hazardous or solid wastes are known to be present on the Maysdorf LBA Tract. Wastes produced by current mining activities at the Cordero Rojo Mine are handled according to the procedures described in Chapter 2, Section 2.1.2.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Action and Alternatives 2 and 3

If the applicant mine acquires the LBA tract, the wastes that would be generated in the course of mining the tract would be similar to those currently being generated by the existing mining operation. The procedures that are used for handling hazardous and solid wastes at the existing mine are described in Chapter 2, Section 2.1.2. Wastes generated by mining the Maysdorf LBA Tract would be handled in accordance with the existing regulations using the procedures currently in use and in accordance with WDEQ-approved waste disposal plans at the Cordero Rojo Mine.

3.16.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and coal removal would not occur on the 2,558.2 or 4,024.7 additional acres that would be disturbed under the Proposed Action or Alternatives 2 and 3, respectively, and no waste materials would be generated as a result of coal removal on the tract. Currently approved mining operations would continue on the existing Cordero Rojo Mine leases. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.16.3 Regulatory Compliance, Mitigation and Monitoring

The regulatory requirements regarding production, use, and/or disposal of hazardous or extremely hazardous materials are discussed in Chapter 2. All mining activities involving the hazardous materials are and would continue to be conducted so as to minimize potential environmental impacts.

3.16.4 Residual Impacts

No residual hazardous and solid waste impacts are expected.

3.17 Socioeconomics

The social and economic study area for the proposed project includes Campbell County and the City of Gillette. The community of Gillette would most likely attract the majority of any new residents due to its current population levels and the availability of services and shopping amenities.

3.17.1 Local Economy

3.17.1.1 Affected Environment

Wyoming's coal mines produced 404.49 million tons in 2005, according to the Wyoming State Inspector of Mines. This was an increase of 2.2 percent over the 395.7 million tons produced in the state in 2004. PRB coal production (from 13 active mines in Campbell and Converse Counties) was over 390 million tons in 2005, which represented more than 96 percent of the state coal production.

In the fourth quarter of 2003, 29 percent of the total employment and 44 percent of the total payroll in Campbell County were attributed to the mining sector, which also includes oil and gas employment (Wyoming Department of Employment 2005b). In 2004, Campbell County employment grew faster than the statewide average, adding 731 jobs (3.5 percent increase). Job growth occurred in construction, manufacturing, and local government, but the most dramatic increase was in the mining sector (Wyoming Department of Employment 2005c).

In 2004 and 2005, BLM held competitive sealed-bid lease sales for six coal tracts (NARO South, West Antelope, West Hay Creek, Little Thunder, West Roundup, and NARO North). As a result, the greatest source of revenue to the state and federal governments from federal coal in 2004 and 2005 was lease bonus bids. Bonus bids are paid to the federal government for the right to enter into lease agreements for federal coal. They are paid in five annual installments; the state receives half of each installment.

The successful bonus bids for the six lease sales held in 2004 and 2005 ranged from 30 cents per ton to 97 cents per ton and totaled $1.69 billion (BLM 2006b). Annual bonus bid payments from the six lease sales total $338.2 million. Combined with remaining bonus bid payments from lease sales held in previous years of $90.1 million, the annual bonus bid payment total for 2004 was $428.3 million, derived directly from federal coal in Campbell and Converse Counties.

Wyoming, Campbell County and the cities and towns in the county receive revenue from a variety of taxes and royalties on the production of federal coal in addition to the bonus bids. These include ad valorum taxes, severance taxes, royalty payments, and sales and use taxes and required contributions to the AML program and the Black Lung Disability Trust Fund.

The royalties are collected by the federal government at the time the coal is sold and equal 12.5 percent of the sale price. Royalty and bonus bids are divided equally with the State of Wyoming, while half of Wyoming's AML contributions are earmarked for later use in the state. Additional sources of revenue include federal income tax and annual rentals that are paid to the government.

Sales and use taxes are distributed to cities and towns within the county

and to the county's general fund. According to the Excise Tax Division of the Wyoming Department of Revenue (2004), the sales and use taxes collected from coal mines and coal mining-related services in Campbell County in FY 2004 was $8.2 million.

In 1994, the University of Wyoming estimated that the total fiscal benefit to the State of Wyoming for coal produced in the PRB was $1.10 per ton (Borden et al. 1994). This study did not include AML fees or bonus bid payments in the calculation for fiscal benefits to the State of Wyoming. Calculating the estimated total fiscal benefit to the State of Wyoming in 2005 by including half of the bonus bid payments, half of the federal mineral royalties based on current prices, half of the AML fees, and all of the ad valorum taxes, severance taxes, and sales and use taxes for coal produced in Campbell County in 2004 results in an estimated $620 million, or $1.53 per ton. Figure 3-21 depicts the estimated total revenues to state and federal governments from 2004 coal production in Campbell County.

Recent GDP calculations for Wyoming (2002) indicate that the minerals industry accounted for 22 percent of the GDP, which made it the largest sector of the Wyoming economy. Mining alone accounted for 8.7 percent of the Wyoming GDP (Wyoming Department of Administration and Information 2005).

3.17.1.2 Environmental Consequences

3.17.1.2.1 Proposed Action and Alternatives 2 and 3

The federal and state revenues that would be generated by the leasing and mining of the Maysdorf LBA Tract would depend on which alternative is selected and the sale price of the coal. Coal prices increased in 2005, generally as a result of concerns over coal transportation and stockpile issues, but declined in 2006. According to the WSGS, the average spot price of 8,400 Btu coal in the PRB in the second half of 2005 was $11.06 per ton, compared with an average spot price during the first half of 2005 of $7.29 per ton and an average spot price of $4.93 per ton the year before (WSGS 2006). Average spot prices for 8,400 Btu coal declined to $9.17 per ton in the first half of 2006 (WSGS 2007). The Wyoming Consensus Revenue Estimating Group is forecasting that the average gross sales prices for Wyoming coal production will range from $8.51 to $9.20 per ton from 2006 through 2010 (Wyoming CREG 2006). PRB prices are generally lower than prices for coal produced in other areas of Wyoming, however, most of the coal produced in Wyoming is from the PRB. For the purposes of this EIS, a conservative average price of $5.80 per ton is estimated for the coal included in the Maysdorf LBA Tract, which has an average Btu value of a little over 8,400.

Using the coal tonnages shown in Table 3-1, projected federal and state revenues for the Maysdorf LBA Tract

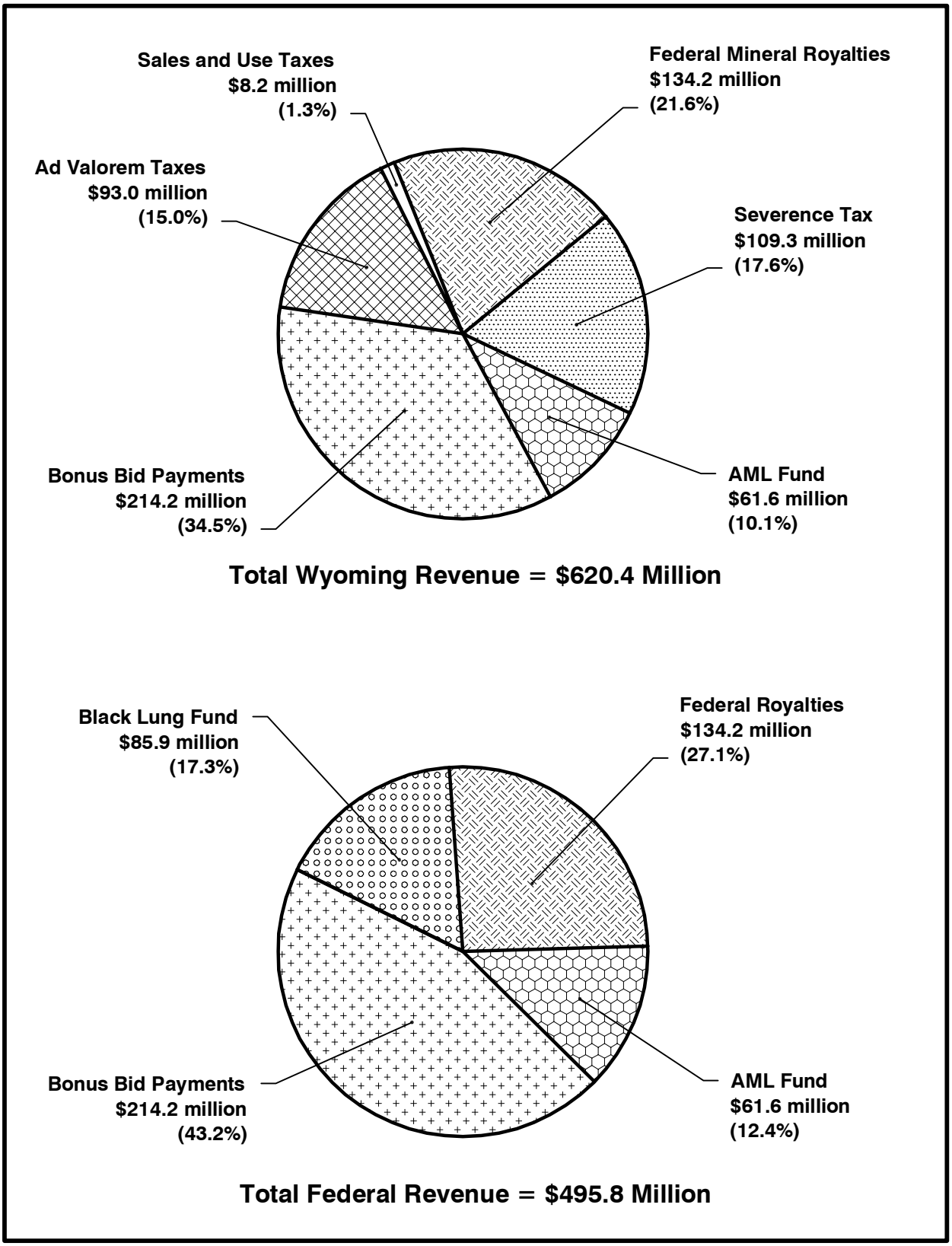


Figure 3-21. Estimated Wyoming and Federal Revenues from 2004 Coal Production in Campbell County.

are presented in Table 3-14, assuming an average coal price of $5.80 per ton recovered and a potential range of bonus payments on the leased (minable) coal of 30 to 97 cents per ton.

If the Maysdorf LBA Tract is leased and mined under the Proposed Action, the potential additional federal revenues would range from approximately $201 to $278 million. Under Alternatives 2 and 3, potential additional federal revenues would range from approximately $295 million to $408 million.

If the LBA tract is leased and mined under the Proposed Action, the potential additional state revenues would range from about $279 to $357 million. Under Alternatives 2 and 3, potential additional state revenues would range from about $410 to $523 million.

The base of economic activity provided by wages and local purchases would continue for up to nine additional years, depending on which alternative is selected.

3.17.1.2.2 No Action Alternative

Under the No Action Alternative, the potentially recoverable coal included in the LBA tract under the Proposed Action (216.5 million tons) or Alternatives 2 and 3 (317.6 million tons) would not be mined and the economic benefits associated with mining that coal would not be realized by the state or federal government. Currently approved mining operations and associated economic benefits would continue on the existing Cordero Rojo Mine leases. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.17.2 Population

3.17.2.1 Affected Environment

Campbell County had a population of 33,698 in 2000, an estimated population of 36,240 in 2003, and an

Table 3-14. Projected Socioeconomic Impacts from Leasing the Maysdorf LBA Tract Under the Proposed Action or Alternatives 2 and 3.

Item	No Action Alternative (Existing Cordero Rojo Mine)	Proposed Action	Alternatives 2 and 3
State Revenues	$ 412.5 mm	$ 691.9 to $ 769.0 mm	$ 822.3 to $ 935.5 mm
Federal Revenues	$ 280.7 mm	$ 481.9 to $ 559.0 mm	$ 575.8 to $ 689.0 mm
Increased Mine Life	0 yrs	6 yrs	9 yrs
Additional Employees	0	20	52

estimated population of 37,816 in 2004. This represents a 12.2 percent growth rate since 2000 and makes Campbell County the second fastest growing county in the state. Campbell County's population ranks it as the fourth largest of Wyoming's 23 counties and Gillette is the fourth largest city in the state, following only Cheyenne, Casper, and Laramie (USDOC 2000, CCEDC 2006, and Wyoming Department of Administration and Information 2005).

Gillette's population totaled 17,054 in 1987 and, according to census data, by 2000 Gillette's population was 19,646 and Wright's population was 1,347. Between 1990 and 2000, Gillette grew by 2,011 persons, averaging 1.1 percent per year. From December 2001 through December 2006, the population of Gillette increased from 22,867 to 27,533 (City of Gillette 2007). Wright had an average growth rate of 0.9 percent during the period from 1990 and 2000. In 2003, Gillette accounted for 21,840, or 60 percent, of the county's residents (USDOC 1990 and 2000 and Wyoming Department of Administration and Information 2005).

3.17.2.2 Environmental Consequences

3.17.2.2.1 Proposed Action and Alternatives 2 and 3

As indicated by Table 3-14, leasing and subsequently mining the LBA tract would extend the life of the Cordero Rojo Mine, and current employment at the mine, by up to nine additional years, depending on which alternative is selected. Average yearly employment at the mine would increase by up to 52 positions under the Proposed Action and Alternatives 2 and 3 (Table 2-2). It is likely that the additional employees would be available from the existing workforce in Campbell County and no influx of new residents would occur as a result of filling these new positions.

3.17.2.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the coal included in the LBA Tract under the Proposed Action or Alternatives 2 and 3 would not be mined. Population levels would not be affected by any additional employment at the Cordero Rojo Mine. Currently approved mining operations and associated employment levels would continue on the existing Cordero Rojo Mine leases for approximately nine years.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.17.3 Employment

3.17.3.1 Affected Environment

Coal mining has changed a great deal since the 1970s, and new technologies have been a major contributor to these changes. The local coal mining labor force grew during the 1970s. Between 1980 and 1998, overall production rose while employee numbers generally

decreased or remained constant. The employment declines followed large industry capital investments in facilities and production equipment, the majority of which were aimed at increasing productivity. Direct employment in Campbell County at coal mines increased from 3,011 to 4,168 between 1998 and 2005 (Wyoming Department of Employment 1998 and 2005a).

The mining sector, which includes oil and gas workers, accounts for almost 28 percent of all employment in Campbell County, nearly four times the statewide percentage.

In 2005, around 6,007 people were directly employed by surface coal mines or coal contractors in Campbell County, representing about 25 percent of the employed labor force (Wyoming Department of Employment 2005a). Campbell County also has slightly higher percentages of construction and wholesale trade employment, which is keeping with the development demands of continuing growth and the county's position as a commercial center for northeast Wyoming.

3.17.3.2 Environmental Consequences

3.17.3.2.1 Proposed Action and Alternatives 2 and 3

Leasing and subsequently mining the Maysdorf LBA Tract would extend the life of the Cordero Rojo Mine by up to nine additional years, depending on which alternative is selected. As discussed above, average yearly employment at the mine would increase by up to 52 positions under the Proposed Action and Alternatives 2 and 3 (Table 2-2). In July 2005, the unemployment rate in Campbell County was 2.7 percent (641 persons) (Wyoming Department of Employment 2005d). It is likely that additional employees would be available from the existing workforce in Campbell County, depending on the timing of the hiring at the mine as compared to the timing of hiring for other ongoing and proposed projects in the county, which are discussed in Section 4.1. The economic stability of the community of Gillette would benefit by having the current Cordero Rojo Mine workforce living in the community and employed at the mine for up to nine additional years.

3.17.3.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the coal included in the Maysdorf LBA Tract under the Proposed Action or Alternatives 2 and 3 would not be mined. Mine life and existing employment levels would not be extended for up to nine additional years, and any increase in employees associated with mining the coal in the tract would not occur. Currently approved mining operations and associated employment would continue on the existing Cordero Rojo Mine leases for approximately nine years. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not

preclude an application to lease the tract in the future.

3.17.4 Housing

3.17.4.1 Affected Environment

According to a 2001 report on housing needs in Campbell County, roughly 61 percent of PRB surface coal mining employees live in Gillette and surrounding areas, 14 percent live in Wright, and 25 percent live outside of Campbell County (BLM 2003a).

There were 11,538 housing units in Campbell County reported in the 1990 census. The 2000 census counted 13,288 housing units in Campbell County, of which 12,207 were occupied at the time. There were 8,989 (73.6 percent) owner occupied units and 3,218 (26.4 percent) occupied rental units (U.S. Census Bureau 2000).

The number of housing units in Gillette increased from 7,078 in 1990 to 7,931 in 2000, an increase of 12 percent. According to the City of Gillette, the housing stock in Gillette increased to 10,194 at the end of December 2006 (City of Gillette 2007). The number of units added in unincorporated, rural areas of Campbell County is not known because the county does not require building permits or certificates of occupancy for residential development in unincorporated areas (Braunlin 2004).

The types of housing units counted in 2000 included 6,698 single-family detached units, 794 single-family attached units, 2,276 multi-family units, 3,432 mobile homes, and 88 RVs, vans, or similar types of units. Subsequent construction added 561 single-family detached, 61 single-family attached, 498 manufactured homes, and 352 multi-family units in Gillette and Wright, plus an unknown number of single-family and manufactured units in rural areas. The resulting totals are estimated at 7,259 single-family detached units (49.2 percent), 855 single-family attached units (5.8 percent), 2,628 multi-family units (17.8 percent), 3,930 mobile/manufactured units (26.6 percent), and 88 RV/vans (0.6 percent) (CSI 2005).

The overall vacancy rate in Campbell County in 1990 was 13.6 percent, although the homeowner vacancy rate was just 3.6 percent while rental vacancies were at 19.4 percent (U.S. Census Bureau 1990). By 2000, the overall vacancy rate in the county had dropped to 8.1 percent with the rate for rental units at 9.0 percent and the rate for owner units at 1.2 percent (U.S. Census Bureau 2000). Due to the population growth that has recently occurred in association with CBNG development, the housing vacancy rate within the City of Gillette has continued to decrease. A survey conducted in October 2004 estimated the vacancy rate of rental units to be 7.0 percent, based on a sample of approximately 40 percent of all rental units, mostly in larger complexes (CSI 2005). According to the City of Gillette, there was a 0.15 percent vacancy rate for rental property in 2006, while the average annual vacancy rate for manufactured home/mobile home

rentals within the city limits was 9.05 percent (City of Gillette 2007). Many apartments had waiting lists.

The average selling price of a house in Campbell County was $133,482 in 2002. Prices tend to be lowest in Wright and highest in unincorporated areas, with the City of Gillette in between. Average selling prices in the first three quarters of 2004 ranged from $78,189 for a manufactured home in Gillette to $230,601 for a site-built home in rural Campbell County (CSI 2005).

An October 2004 survey found average apartment rents ranging from $363 per month for an efficiency apartment to $572 per month for a three-bedroom unit (CSI 2005). In the fourth quarter of 2003, average rent for a house in Campbell County was $707 and the average rent for a mobile home was $590 (Wyoming Department of Administration and Information 2005).

In addition to permanent housing, temporary or transient housing is a consideration for any project that might have a construction component. Temporary housing can include hotels or motels, campgrounds, and possibly mobile home parks.

There are 17 motels in Gillette with 1,346 guest rooms, one additional 27-room motel in Wright and a two-room bed & breakfast in Gillette. Hotel occupancy rates have recently been very high and several new hotels are proposed for construction (Gillette News Record, 2006a). Gillette has two year-round commercial campgrounds with 150 hookups for RVs plus tent areas (Gillette Convention and Visitor's Bureau 2004). Campbell County has a multi-event facility, the CAM-PLEX, located in Gillette. It has 1,821 RV sites, which vary from 688 full service sites with rest rooms and shower facilities to electric only sites. The CAM-PLEX facilities are generally available only for scheduled special events, not for public camping (CAM-PLEX 2005).

Gillette also has approximately 1,595 mobile home park spaces. Mobile home parks are generally considered permanent housing resources, but they sometimes provide temporary spaces for RVs as well if there are vacant spaces available. As of early October 2004, the average vacancy rate in Gillette's mobile home parks was 35 percent, or 558 spaces (CSI 2005).

3.17.4.2 Environmental Consequences

3.17.4.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, average yearly employment at the mine would increase by up to 52 positions and employment at the mine would be extended by up to nine additional years, under the Proposed Action and Alternatives 2 and 3. No additional demands on the existing infrastructure or services in the community would be expected because little or no influx of new residents would be needed to fill new jobs. Although housing is tight in Gillette, it is likely that housing for the additional employees would be

available from the existing and proposed units in Campbell County.

3.17.4.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the coal included in the Maysdorf LBA Tract under the Proposed Action or Alternatives 2 and 3 would not be mined. Housing occupancy would not be affected by any additional employment at the Cordero Rojo Mine. Currently approved mining operations and associated employment levels would continue on the existing Cordero Rojo Mine leases for approximately nine years. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.17.5 Local Government Facilities and Services

3.17.5.1 Affected Environment

The availability of revenues generated by mineral production has helped local government facilities and services keep pace with growth and are adequate for the current population.

Campbell County School District No. 1's 2005 enrollment was stable at 7,500 students, making it the third largest school district in Wyoming. Enrollment has increased since the end of the 2005-2006 school year and some schools are becoming more crowded (Gillette News Record 2006b). The district facilities include: one high school (with two campuses) and two junior high schools in Gillette, a junior-senior high school in Wright and 15 elementary schools (including one in Wright and four in rural areas). The district also operates an alternative high school and aquatic center in Gillette (CCSD 2005).

The Campbell County Sheriff provides police protection throughout the county, except within the City of Gillette. In addition to general law enforcement, the Sheriff's staff provides court security, detention facilities, and animal control. For the 2004 fiscal year, the department budgeted for 60 law enforcement employees. Recent improvements have increased the Campbell County detention facility to 128 beds, which includes separate modules for women and juveniles (BLM 2005b).

Fire protection throughout Campbell County is provided by the Campbell County Fire Department, which is governed by a city-county joint powers board (Vonsik 2005). The department maintains four stations in Gillette and six dispersed throughout the county. The department has 17 full-time staff and 150 trained volunteers. In addition, there are 30 to 40 volunteers in outlying areas who are trained and equipped primarily to fight wildland fires. Campbell County coal mines generally provide equipment and trained staff to fight fires on mine property. The County Fire

Department provides backup assistance with personnel and equipment (Vonsik 2005).

The primary medical care facility in Campbell County is Campbell County Memorial Hospital, a 90-bed acute care hospital. The hospital has a medical staff of over 50 affiliated physicians in 20 specialties and a total staff of 800 (CCMH 2005). The hospital also operates the Wright Clinic, a satellite clinic with a full-time, family practice physician. Ambulance service for Campbell County is provided by the hospital, which has a 24-hour emergency service capability. The Campbell County Fire Department provides first responder service to emergency calls, but transport is the responsibility of the hospital affiliated ambulance service (Vonsik 2005).

Water and wastewater treatment systems are provided by the City of Gillette and by the Wright Water and Sewer District. Gillette serves the city and some urbanized areas nearby from groundwater wells. The water system has the capacity to serve approximately 25,000 people. Water use approaches capacity during the summer months when parks and private lawns are being irrigated (Morovits 2005). An additional well field is being planned for completion in about five years. In the interim, the city has other wells it can pump if necessary, but high natural fluoride levels require careful monitoring if they are used (Morovits 2005). Gillette's sewer treatment system was designed for a service population of approximately 35,000 and improvements begun in the fall of 2004 were designed to increase treatment capacity to accommodate a projected population of 41,000. Currently, the system serves an estimated 25,000 people in the city and surrounding areas. The Wright district's water and sewage treatment facilities were designed to serve a population of approximately 3,000, albeit with an additional sewage lagoon required when the service population reached about 2,500 people. The district is planning an additional well to increase its water supply capacity by about 30 percent. The district facilities in Wright currently serve a population of approximately 1,400 people; essentially the entire town is hooked on to the water system and most lots are on the sewer system unless they have private septic systems.

3.17.5.2 Environmental Consequences

3.17.5.2.1 Proposed Action and Alternatives 2 and 3

As discussed above, average yearly employment at the mine would increase by up to 52 positions and mine life would be extended by up to nine additional years under the Proposed Action and Alternatives 2 and 3. No additional demands on the existing community facilities or services in the county would be expected because little or no influx of new residents would be needed to fill new jobs. It is likely that the demand for public facilities and services will be satisfied by the existing facilities and services currently in place in Campbell County.

3.17.5.2.2 No Action Alternative

Under the No Action Alternative, the Maysdorf coal lease application would be rejected and the coal included in the Maysdorf LBA Tract under the Proposed Action or Alternatives 2 and 3 would not be mined. Local government facilities and services would not be affected by any additional employment at the Cordero Rojo Mine. Currently approved mining operations and associated employment levels would continue on the existing Cordero Rojo Mine leases for approximately nine years. Portions of the Maysdorf LBA Tract adjacent to the Cordero Rojo Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the Maysdorf lease application at this time would not preclude an application to lease the tract in the future.

3.17.6 Environmental Justice

3.17.6.1 Affected Environment

Environmental Justice issues are concerned with actions that unequally impact a given segment of society either as a result of physical location, perception, design, noise, or other factors. On February 11, 1994, Executive Order 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations", was published in the *Federal Register* (59 FR 7629). The Executive Order requires federal agencies to identify and address disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations (defined as those living below the poverty level). The Executive Order makes it clear that its provisions apply fully to Native American populations and Native American tribes, specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Native American communities.

Communities within Campbell County, entities with interests in the area, and individuals with ties to the area all may have concerns about the presence of surface coal mines in the area. Environmental Justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Native American access to cultural and religious sites may fall under the umbrella of Environmental Justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right.

Compliance with Executive Order 12898 concerning Environmental Justice was accomplished through opportunities for the public to receive information on this EIS in conjunction with consultation and coordination described in Section 1.6 of this document. This EIS and contributing socioeconomic analysis provide a consideration of the impacts with regard to disproportionately adverse impacts on minority and/or

low-income groups, including Native Americans.

3.17.6.2 Environmental Consequences

3.17.6.2.1 Proposed Action and Alternatives 2 and 3

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, or that they would be unequally impacted if the Maysdorf LBA Tract is leased under the Proposed Action or Alternatives 2 or 3. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the proposed LBA site. Consequently, implementation of the proposed project would not adversely affect the environmental justice considerations in the area.

3.17.6.2.2 No Action Alternative

Economic and demographic data indicate that neither minority populations nor people living at or below the poverty level make up "meaningfully greater increment" of the total population in Gillette or Campbell County than they do in the state as a whole, or that they would be unequally impacted if the Maysdorf LBA Tract is leased under the Proposed Action or Alternatives 2 or 3. Also, the Native American population is smaller than in the state as a whole and there are no known Native American sacred sites on or near the existing Cordero Rojo Mine. Consequently, the No Action Alternative would not adversely affect the environmental justice considerations in the area.

3.17.7 Regulatory Compliance, Mitigation and Monitoring

Surface coal mines are required to pay royalty and taxes as required by federal, state, and local regulations. The BLM compares the amount of coal reported as produced with the estimated amount of coal in the ground to verify that the federal coal is efficiently mined and that royalties are paid on all of the coal that is mined.

3.17.8 Residual Effects

No socioeconomic residual impacts are expected.

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

From 2006 on, the Cordero Rojo Mine would be able to produce coal at an average production level of 40 mmtpy for another nine years under Alternative 1 (No Action Alternative), compared with an average of 40 mmtpy for 15 years under the Proposed Action, or an average of 40 mmtpy for another 18 years under Alternatives 2 and 3 (Table 2-2).

As the coal is mined, almost all components of the present ecological

system, which have developed over a long period of time, would be modified. In partial consequence, the reclaimed land would be topographically lower, and although it would resemble original contours, it would lack some of the original diversity of geometric form.

The forage and associated grazing and wildlife habitat that the LBA tract provides would be temporarily lost during mining and reclamation. During mining of the LBA tract there would be a loss of native vegetation on 2,558 acres (Proposed Action) up to a maximum of 4,025 acres (Alternatives 2 and 3) with an accompanying disturbance of wildlife habitat and grazing land. This disturbance would occur incrementally over a period of years. The mine site would be returned to equivalent or better forage production capacity for domestic livestock before the performance bond is released. Long-term productivity would depend largely on postmining range-management practices, which to a large extent would be controlled by private landowners.

Mining would disturb pronghorn and sage grouse nesting habitat. There would be loss and displacement of wildlife during mining, but 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, would be expected to take even longer.

CBNG is currently being recovered from within and/or near the LBA tract and BLM's analysis suggests that a large portion of the CBNG resources on the tract has been recovered or would be recovered prior to mining. CBNG that is not recovered prior to mining would be vented to the atmosphere during the mining process. CBNG is composed primarily of methane, which is a greenhouse gas that contributes to global warming. According to the Energy Information Administration (USDOE 2005a):

- U.S. anthropogenic methane emissions totaled 26.6 million metric tons in 2005.

- U.S. 2005 methane emissions from coal mining were estimated at 2.85 million metric tons, which represents approximately 10.7 percent of the U.S. total anthropogenic methane emissions in 2005.

- Methane emissions from surface coal mining in the U.S. were estimated at about 0.54 million metric tons in 2005, which represents approximately 2.03 percent of the estimated U.S. anthropogenic methane emissions in 2005.

Approximately 51.3 percent of the coal mined using surface mining techniques in the U.S. in 2005 came from the Wyoming PRB (USDOE

2005b), which means that Wyoming PRB surface coal mines were responsible for approximately 1.04 percent of the estimated U.S. anthropogenic methane emissions in 2005.

Total U.S. methane emissions attributable to coal mining would not be likely to decrease if the Maysdorf LBA Tract is not leased at this time because a decision to lease or not to lease the tract would not directly affect total U.S. coal production. However, the methane on an LBA tract could be more completely recovered if leasing is delayed.

Coal is a major source of electricity generation in the U.S. Approximately 51.1 percent of electric power in the U.S. is provided by coal (USDOE 2005b). Coal-fired power plant emissions include greenhouse gasses that contribute to global warming. According to the Energy Information Administration (USDOE 2005a):

- CO_2 emissions represent about 84 percent of the total U.S. greenhouse gas emissions.
- Estimated CO_2 emissions in the U.S. totaled 6,008.6 million metric tons in 2005, which was 0.3 percent more than 2004.
- Estimated CO_2 emissions from the electric power sector totaled 2,375.0 million metric tons, or about 40 percent of total U.S. energy-related CO_2 emissions in 2005.
- Estimated CO_2 emissions from coal electric power generation in 2005 totaled 1,994.2 million metric tons or about 33 percent of total U.S. energy-related CO_2 emissions in 2005.

The Wyoming PRB produced about 37.6 percent of the coal used for power generation in the U.S. in 2005, which means that Wyoming PRB surface coal mines were responsible for approximately 12.5 percent of the estimated U.S. CO_2 emissions in 2005. The applicant mine plans to produce the coal included in the LBA tract at currently permitted levels using existing production and transportation facilities. As a result, leasing the Maysdorf LBA Tract to an existing mine under the Proposed Action or Alternatives 2 and 3 would not be expected to result in new emissions of CO_2 from coal-fired power plants.

Coal also releases mercury into the air when it is burned. Mercury in the air settles into water or onto land, where it can be washed into the water. Certain microorganisms can change it into methyl mercury, which is a highly toxic mercury compound that builds up in fish and shellfish when they feed. There are adverse health effects to both humans and other animals who consume these fish and shellfish. Research has shown that most people's fish consumption does not cause a health concern, but high levels of methyl mercury in the bloodstream of unborn babies and young children may harm the developing nervous systems of those children (EPA 2006c). According to the EPA, coal-fired power plants are the largest remaining source of human-

generated mercury emissions in the U.S., accounting for more than 40 percent of all domestic human-caused mercury emission; however, these emissions contribute very little to the global mercury pool. EPA estimates that mercury emissions from U.S. coal-fired power plants account for about one percent of the global total (EPA 2007). As indicated above, the Wyoming PRB produced about 37.6 percent of the coal used for power generation in the U.S. in 2005, which would represent less than 0.4 percent of the global mercury emissions. As indicated previously, the Cordero Rojo Mine plans to produce the coal included in the LBA tract at currently permitted levels using existing production and transportation facilities. As a result, leasing the Maysdorf LBA Tract under the Proposed Action or Alternatives 2 and 3 would not be expected to result in new emissions of mercury from coal-fired power plants.

If the Maysdorf LBA Tract is leased and mined, there would be a deterioration of the groundwater quality in the lease area; however, the water quality would still be adequate for livestock and wildlife. This deterioration would probably occur over a long period of time. As a result of mining alone, depth to groundwater would increase in an area extending roughly six miles west of the Cordero Rojo Mine pits in the coal aquifer. The water levels in the coal aquifer should return to premining levels at some time after mining has ceased, as discussed in Section 3.5.4, because recharge areas would not be disturbed in order to recover the coal in the LBA tract.

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

Short-term impacts to recreation values may occur from reduction in big game populations due to habitat disturbance and reduction in access to some public lands. 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 and access to public lands would be restored, there should be no long-term adverse impacts on recreation.

The long-term economy of the region would be enhanced as a result of the Proposed Action and Alternatives 2 and 3. The Proposed Action and Alternatives 2 and 3 would extend the life of the Cordero Rojo Mine from six to nine years (Table 2-1).

3.19 Irreversible and Irretrievable Commitments of Resources

The major commitment of resources would be the mining and consumption of 216.5 million tons (Proposed Action) up to a maximum of 317.6 million tons (Alternatives 2 and 3) of coal to be used for electrical power generation. CBNG that is not recovered prior to mining would also be irreversibly and irretrievably lost (see additional discussion of the

impacts of venting CBNG to the atmosphere in Section 3.18). It is estimated that one to two percent of the energy produced would be required to mine the coal, and this energy would also be irretrievably lost.

The quality of topsoil on approximately 2,558 acres (Proposed Action) up to a maximum of approximately 4,025 acres (Alternatives 2 and 3) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining-related activities. Newly formed soil material would be unlike that in the natural landscape.

Direct and indirect wildlife deaths caused by mining operations or associated activity would be an irreversible loss.

Loss of life may conceivably occur due to the mining operations 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.