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 West Antelope II LBA[1] tract (the affected environment) and analyzes the potential associated direct and indirect impacts to those resources if the tract is leased and mined under the Proposed Action or Alternatives 1 or 2 (the environmental consequences). The potential environmental consequences of the No Action Alternative (Alternative 3, rejecting the application for the tract) are also considered in this chapter.

In addition, this chapter considers regulatory compliance; mitigation; monitoring; residual impacts; the relationship between local short-term uses of man's environment and the maintenance of long-term productivity; and the irreversible and irretrievable commitments of resources that would occur with the implementation of the Proposed Action or Alternatives 1 or 2.

The West Antelope II LBA tract as applied for consists of two non-contiguous blocks of federal coal. Under the Proposed Action, the two blocks as applied for would be offered for lease at one sale. As discussed in Chapter 2, BLM has identified a study area for the tract which consists of the tract as applied for and adjacent lands that BLM is considering adding to the tract. Alternative 1 evaluates holding one sale for a tract modified by BLM. Alternative 2 evaluates splitting the application and offering one or both blocks, either as applied for or as modified by BLM, for sale. The two tracts are referred to as the North and South tracts. Under Alternatives 1 and 2, lands included in the Thunder Basin National Grassland, administered by USDA-Forest Service, would potentially be included in the lands that would be offered for lease. The proposed North and South tracts are not considered separately in the following discussions of the affected environment and the potential consequences of mining the tract on the environment.

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 tract (the West Antelope II LBA tract as applied for and the adjacent lands that BLM is considering adding to the tract) and the anticipated permit amendment study area for the Antelope Coal 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 contained within the amended mine permit area if they acquire the tract.

The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

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

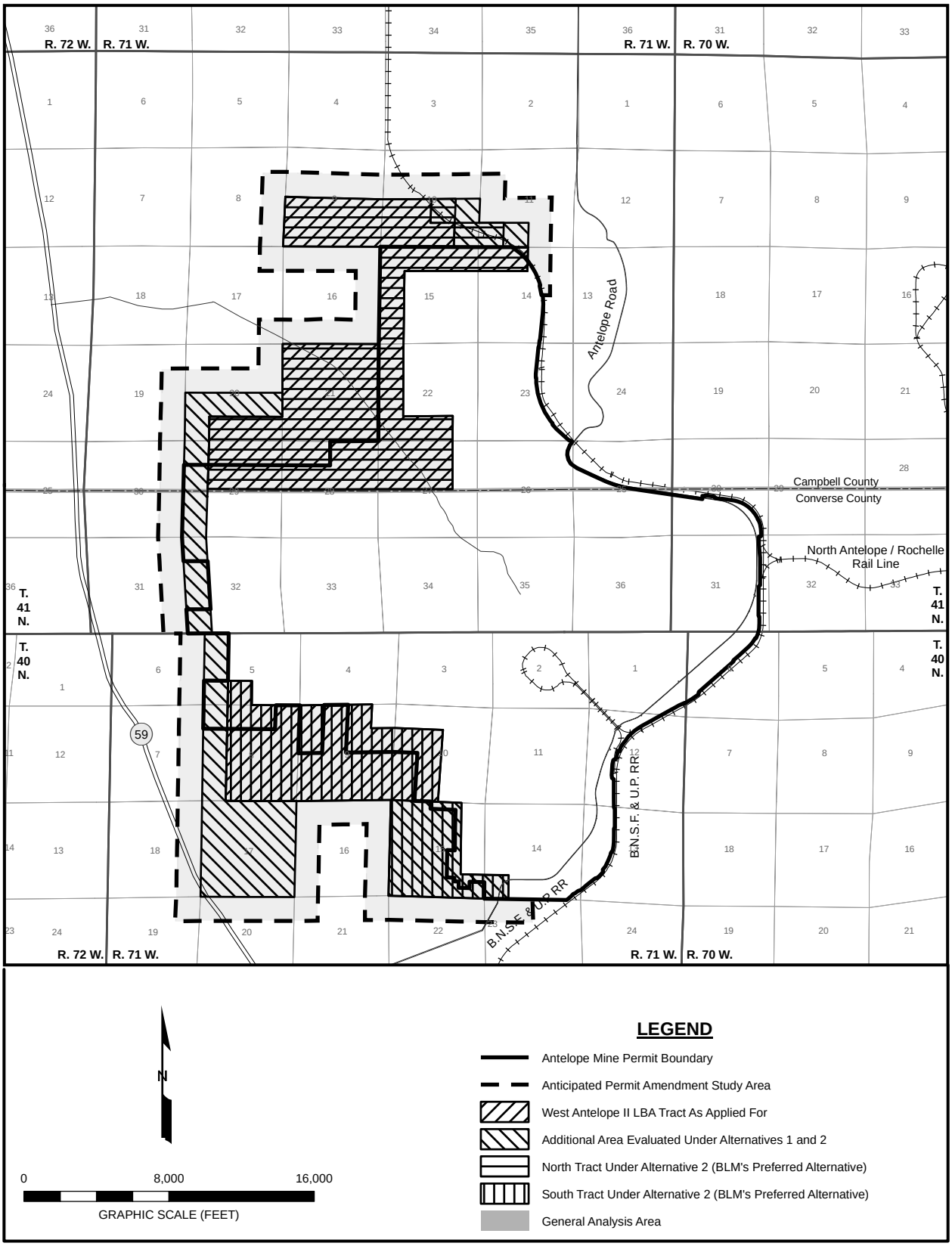


Figure 3-1. General Analysis Area.

Critical elements of the human environment (BLM 1988) that could potentially be affected by the Proposed Action or Alternatives 1 and 2 include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, invasive non-native species, and environmental justice. Five other critical elements (areas of critical environmental concern, prime or unique farmlands, wild and scenic rivers, floodplains, and wilderness) are not present in the general 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.

Table 3-1 shows the acreage leased and disturbance area for the existing Antelope Mine (which represents the No Action Alternative). As indicated in Table 3-1, the Antelope Mine's coal leases currently include 11,635.5 acres and, under the approved mining and reclamation plan, the mine would disturb a total of 12,104.8 acres in order to recover that coal. According to the 2005 Annual Report for the Antelope Mine, which was submitted to WDEQ/LQD, the mine had disturbed a total of 5,581.4 acres as of September 30, 2005 (ACC 2005). Of that area of disturbance, approximately 1,522.5 acres (27 percent) were occupied by permanent or temporary facilities (stockpiles, hydrologic control structures, mine buildings, coal loading facilities, railroad loop, environmental monitoring areas, etc.), 2,266.1 acres (41 percent) were occupied by mined and unreclaimed areas or areas of active mining, and 1,792.8 acres (32 percent) were occupied by reclaimed areas.

If the West Antelope II LBA tract is leased to the applicant as a maintenance tract under the Proposed Action or Alternatives 1 or 2, the permit area for the adjacent Antelope Mine would have to be revised to include the newly leased area before the tract could be disturbed by mining activities. Table 3-1 shows how the leased area and disturbance area would change, for the tract as applied for and under Alternatives 1 and 2, if all the federal coal in the BLM study area discussed in chapter 2 is included in the tract that is offered for lease. Portions of the West Antelope II LBA tract lie 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 the portions of the LBA tract outside of 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 1 and 2 would be similar in nature, but selection of the Proposed Action would disturb a smaller area of land surface.

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

	No Action Alternative (Existing Permit Area)	Proposed Action	Alternatives 1 and 2
Additional Lease Area (Acres)	---	4,108.6	6,309.2
Total Lease Area (Acres)[1]	11,635.5	15,744.1	17,944.7
Increase in Lease Area (Percent)	---	35.3	54.2
Estimated Additional Mine Disturbance Area (Acres)[2]	---	4,314.0	6,624.6
Estimated Total Mine Disturbance Area (Acres)	12,104.8	16,418.8	18,729.4
Increase in Estimated Disturbance Area (Percent)	---	35.6	54.7
Estimated Additional Recoverable Coal (Million Tons)[3]	---	377.8	453.9
Estimated Recoverable Coal for Mine as of 1/07 (Million Tons)	394.3	772.1	848.2
Increase in Estimated Recoverable Coal as of 1/07 (Percent)	---	95.8	115.1

1 Includes federal and state 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 (approximately 91 to 93 percent).

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 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/NWS meteorological station (Wright 12 W), located about 20 miles north-northwest of the general analysis area (see Figure 1-1), is 13.27 inches (WRCC 2007). May (2.00 inches) and June (1.99 inches) are the wettest months, whereas December (0.34 inch) and January (0.37 inch) are the driest. Snowfall averages 55.3 inches per year, with most occurring in March (8.9 inches) and April (9.7 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 annual mean temperature for the NOAA/NWS meteorological station at Wright for the period of record is 44.6 degrees F, and daily extreme temperatures have ranged from -39 degrees F to 107 degrees F. July is the warmest month, with a mean daily temperature of 69.7 degrees F, and January is the coldest month, with a mean daily temperature of 23.9 degrees F. The frost-free period is 100-120 days (Curtis 2004).

The 2000 average annual wind speed at the Antelope Mine was 10.7 mph, with winter gusts often reaching 30-40 mph. Winds are predominantly from the southwest and west and tend to be strongest in the winter and spring and calmer in the summer. Local variations in wind speed and direction are primarily due to differences in topography. Wind velocity tends to increase during the day in response to solar insolation and decrease during the night. 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). The wind rose diagram for the Antelope Mine is shown in Figure 3-2.

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 name PRB has been used to refer to both a structural basin and a drainage basin. The structural PRB is an elongated, asymmetrical syncline that is bounded in Wyoming by the Black Hills on the northeast, the Hartville Uplift on the southeast, the Big Horn Mountains on the northwest, the Casper Arch on the southwest, and the Laramie Mountains on the south. The northern terminus of the structural basin in Montana separates the PRB from the Williston Basin. The

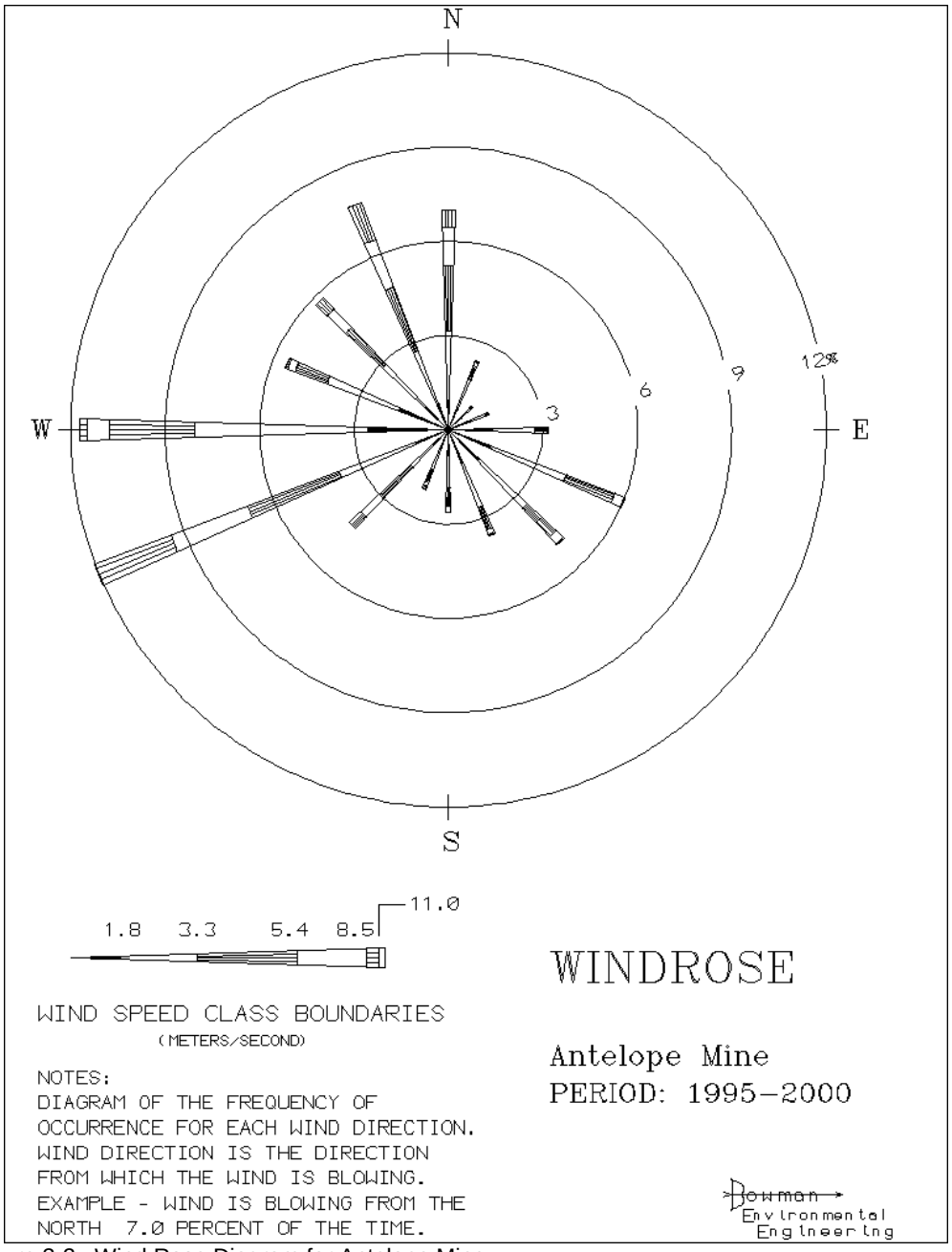


Figure 3-2. Wind Rose Diagram for Antelope Mine.

axis of the PRB trends from southeast to northwest near the western margin of the basin, and the Antelope Mine is located on the gently dipping eastern limb of the syncline. In general, geologic units dip to the west at 1 to 2 degrees toward the center of the basin on the eastern limb of the PRB. The structural PRB includes the Powder River drainage basin as well as the upstream portions of the Belle Fourche River, Cheyenne River, and Tongue River drainage basins.

Broad plains, rolling hills, and tablelands dominate the PRB landscape. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone. In general, the topography of the basin varies from open hills with 500-1000 ft of local relief in the northern part of the PRB to plains and tablelands

with 300-500 ft of local relief in the southern PRB. 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 characterized by gently rolling terrain broken by steeply cut washes. Elevations range from approximately 4,500 ft to 5,100 ft above sea level. Overall, the West Antelope II LBA tract is similar in topography to the rest of the Antelope Mine permit area where slopes range from flat to about 34 percent and average about five percent. The area is drained by Antelope Creek and its tributaries, a series of south and north trending ephemeral drainages including Horse Creek and Spring Creek.

3.2.2 Environmental Consequences

3.2.2.1 Proposed Action and Alternatives 1 and 2

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. A highwall with a vertical height equal to overburden plus coal thickness would exist in the active pits. Spring Creek and Horse Creek channels would be diverted around the active mining area during the period of disturbance.

Typically, a direct permanent impact of coal mining and reclamation is topographic moderation. After reclamation, the restored land surfaces are generally gentler, with more uniform slopes and restored basic drainage networks. The original topography of the West Antelope II LBA tract ranges from relatively flat to gently rolling hills. Slopes range from flat to around 34 percent, as discussed above, and the average slope is about 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 would be from approximately two to eight feet lower due to coal removal. The removal of the coal would be partially offset by the swelling that occurs when the overburden (and interburden, 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 1 and 2. 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 surface coal mining permit for the existing mine is amended to include 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.

Table 3-2. Comparison of Average Overburden and Coal Thicknesses and Approximate Postmining Surface Elevation Changes Under the No Action Alternative and the Proposed Action and Alternatives 1 and 2.

	No Action Alternative (Existing Leases)	**Proposed Action (As Applied For LBA Tract)**	**Alternatives 1 and 2**
Average Overburden Thickness (ft)[1]	122	280	260
Average Coal Thickness (ft)	86.0	60	50
Swell Factor (percent)	17	17	17
Coal Recovery Factor (percent)	92.5	92.5	92.5
Postmining Elevation Change[2]	59 ft lower	8 ft lower	2 ft lower

[1] The average overburden thickness includes the interburden where present.
[2] Reclaimed (postmining) elevation surface change calculated as:
(overburden thickness + coal thickness)-((coal thickness × (1- coal recovery factor)) + ((1 + swell factor) × overburden thickness)).

The approximate original drainage pattern would be restored and stock ponds would be replaced to provide livestock and wildlife watering sources. These topographic changes would not conflict with regional land use, and the postmining topography would be designed to adequately support anticipated land use. These impacts are occurring on the existing Antelope Mine coal leases as coal is mined and mined-out areas are reclaimed. Under the Proposed Action or Alternatives 1 and 2, 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 West Antelope II coal lease application would be rejected and coal removal would not occur on the LBA tract. The impacts to topography and physiography described above and in Table 2-4 would continue as permitted on the existing adjacent Antelope Mine coal leases. Table 3-2 presents the approximate postmining surface elevation change for the existing mine. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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. If the West Antelope II LBA tract is leased, the topographic configuration would be developed and approved as part of the required revision to the mining and reclamation plan for the Antelope 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 (Holocene age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal beds). Figure 3-3 is a chart describing the surface and subsurface geologic units in the general analysis area and showing the stratigraphic relationships.

Surficial deposits within the general analysis area include alluvial and eolian deposits, clinker, and weathered Wasatch and Fort Union Formations. Although clinker is present in the general analysis area, the tract has no appreciable amounts of clinker. There are thin alluvial deposits along ephemeral streams. These alluvial deposits typically consist primarily of poorly to well-sorted, irregularly bedded to laminated, unconsolidated sand, silt, and clay with minor intervals of fine gravel. The valley floors of Horse Creek, Spring Creek and Antelope Creek contain appreciable amounts of alluvium both in width and depth. The alluvial deposits in Horse Creek, Spring Creek and Antelope Creek contain much more coarse-grained material (sands and gravels) than the ephemeral tributaries that drain most of the general analysis area.

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

The Eocene Wasatch Formation forms most of the overburden overlying the mineable coal seams in the general analysis area. It consists of interbedded lenticular sandstones, siltstones, shales, and thin discontinuous coals. There is no distinct boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. Overburden thickness averages 260 feet in the BLM study area (as indicated in Table 3-2) and ranges from around 20 ft to more than 460 ft. The overburden is relatively thin in the vicinity of the major channels within the tract and increases in thickness away from the channel bottoms.

The Fort Union Formation consists primarily of shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the mineable coal seams), Lebo, and Tullock, in descending order (Figure 3-3).

The Tongue River Member of the Fort Union Formation consists of interbedded claystone, silty shale, carbonaceous shale, and coal, with lesser amounts of fine-grained sandstone and siltstone.

The nomenclature of the mineable coal seams in the Fort Union Formation varies from mine operator to mine operator. The U.S. Geological Survey (Flores et al. 1999) refers to the thick mineable coals in the Gillette coal field as the Wyodak-Anderson coal zone of the Tongue River Member of the Fort Union Formation. Locally these beds are referred to as Wyodak, Wyodak-Anderson, Anderson, and Canyon. There are four mineable seams in the West Antelope II LBA tract (referred to by the operator as the Anderson, Lower Anderson, Canyon/Upper Canyon, and Lower Canyon). Figure 3-4 presents geologic cross sections through the tract. The total coal thickness ranges from 15 to 86 ft. Interburden between the coal seams varies from 5 to around 115 ft. The total overburden thickness (including interburden where present) ranges from about 20 ft to approximately 550 ft.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined has a higher heating value and lower sulfur content south of Gillette than north of Gillette. In the tract under consideration for leasing, the heating value of the coal seams is expected to range from 8,500 to 9,200 Btu/lb. The ash content in the coal seams is expected to vary from 3.5 to 8 percent, the sulfur content from 0.15 to 0.4 percent, and the moisture content from 23 to 28 percent.

The Lebo and Tullock Members of the Fort Union Formation underlie the Tongue River Member (Figure 3-3). They consist primarily of sandstone, siltstone, mudstone, shale, and coal. In general, the Tullock Member contains more sand than the Lebo Shale Member.

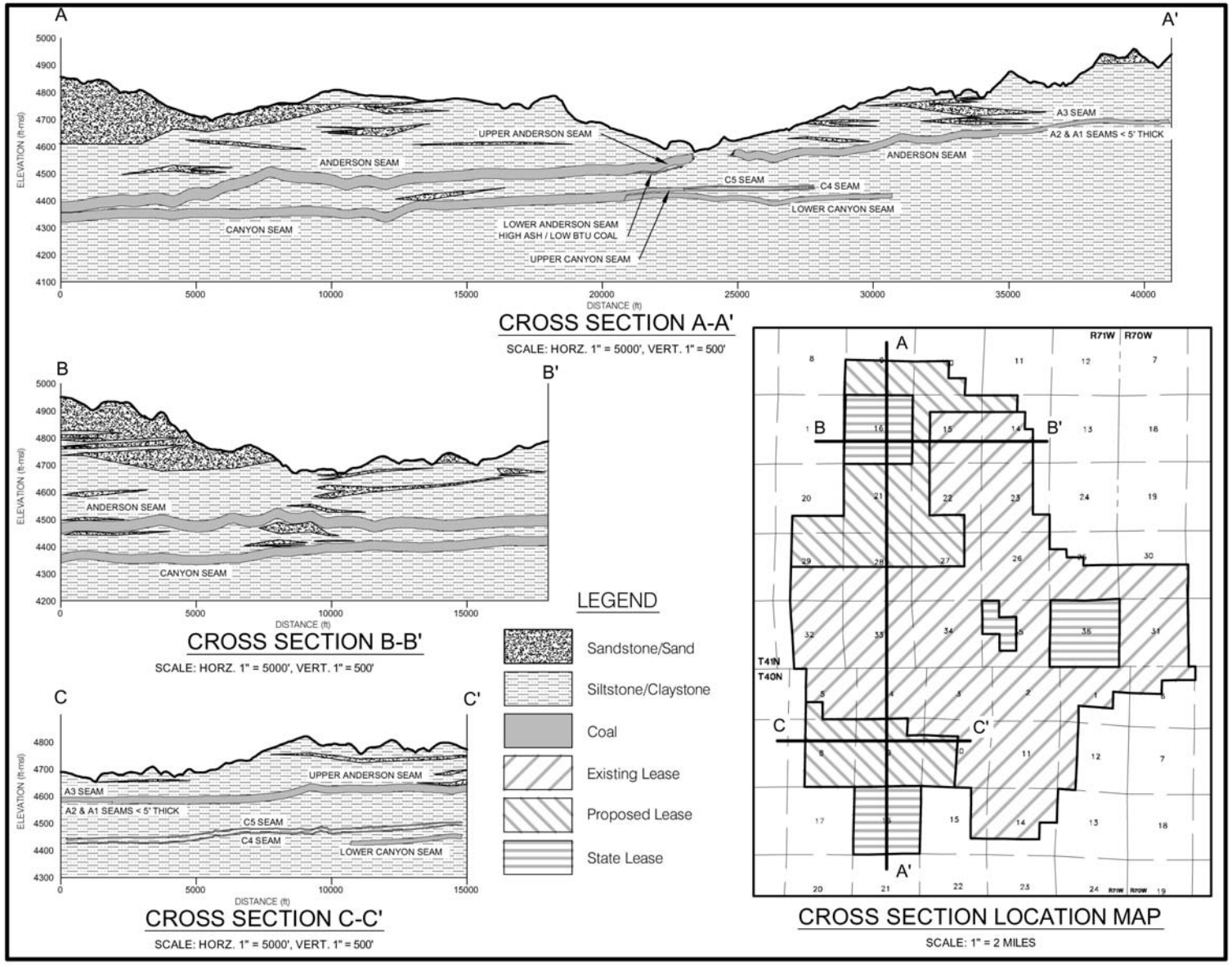


Figure 3-4. North-South and East-West Geologic Sections, West Antelope II LBA tract

3.3.1.2 Environmental Consequences

3.3.1.2.1 Proposed Action and Alternatives 1 and 2

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 1 and 2. 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, the physical characteristics of the backfill would be different from the physical characteristics of the existing layered overburden.

Mining would remove an average of 280 ft of overburden and 60 ft of coal on about 4,109 acres under the Proposed Action. Mining would remove an average of 260 ft of overburden and 50 ft of coal on up to 6,309 acres under the tract configuration for Alternatives 1 and 2. These acreage figures represent the estimated area of actual coal removal under the Proposed Action and Alternatives 1 and 2. Table 3-2 presents the average overburden and coal thicknesses for the tract as applied for and Alternatives 1 and 2. The replaced overburden and interburden would be a relatively homogeneous (compared to the premining layered overburden and interburden) and partly recompacted mixture averaging about 323 ft in thickness under the Proposed Action and about 310 ft in thickness under Alternatives 1 and 2. Approximately 772.1 million tons of coal would be recovered under the Proposed Action, compared to an estimated 848.2 million tons under Alternatives 1 and 2.

3.3.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope coal lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. Mining operations, coal removal and the associated impacts described above would continue as permitted on the existing adjacent Antelope Mine coal leases. Table 3-2 presents the average overburden and coal thicknesses for the existing Antelope Mine permit area. Impacts to the overburden on portions of the West Antelope II LBA tract adjacent to the Antelope Mine would occur in order to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 Antelope Mine and would be developed for the West Antelope II 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

The PRB contains large reserves of fossil fuels including oil, natural gas (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria are mined in the PRB (WSGS 2003).

3.3.2.1.1 Conventional Oil and Gas

Oil and conventional (i.e., non-CBNG) gas have been produced in the PRB for more than 100 years (Crockett 1999) from reservoirs that range in age from Mississippian to Oligocene (WOGCC 2007a). Depth to gas and oil-bearing strata generally ranges from 4,000 ft to 13,500 ft, but some wells are as shallow as 250 ft. The USGS estimated means of the total undiscovered oil and gas resources in the PRB are 639 million barrels of oil, 16.6 trillion ft^3 of gas, and 131 million barrels of natural gas liquids (USGS 2006). The total undiscovered gas resource estimate of 16.6 trillion ft^3 includes an estimated mean of about 14.3 trillion ft^3 of CBNG resources (USGS 2004a), thus the non-CBNG gas resource is estimated to be approximately 2.3 trillion ft^3.

There are several conventional oil and gas fields that produce in the vicinity of the West Antelope II LBA tract, including the Porcupine and Dennell Draw Oil and Gas Fields. The Porcupine Field is producing from or has produced from the Upper Cretaceous Parkman, Sussex, Teapot, and Turner Sandstones and the Niobrara Shale and the Lower Cretaceous Muddy and Dakota Sandstones, and the Dennell Draw Field produces from the Upper Cretaceous Turner Sandstone (WOGCC 2007b).

There are no producing conventional oil and gas wells on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2. One productive well in the Porcupine Field, the Hedgehog State 1-16 operated by Nance Petroleum

Corporation, is located adjacent to the West Antelope II LBA tract in the NE¼NE¼ of Section 16, T.41N., R.71W. The well, which is currently shut in, produced gas and oil from the Cretaceous Turner Sandstone at a depth of 9,677 ft (WOGCC 2007b). There are two plugged and abandoned conventional wells located on the tract, one in the SW¼SE¼ of Section 21, T.41N., R.71W., and one in the SW¼NE¼ of Section 27, T.41N., R.71W.

See Section 3.11 for a discussion of the ownership of the oil and gas resources in the BLM study area.

3.3.2.1.2 Coal Bed Natural Gas (CBNG)

CBNG has been commercially produced in the PRB since 1989 when production began at the Rawhide Butte Field, west of the Eagle Butte Mine. CBNG exploration and development is currently ongoing throughout the PRB in Wyoming.

The following discussion is based on a report on CBNG resources in the lands adjacent to the existing surface coal mines in the Wyoming PRB, prepared by the WSO-RMG in May 2006 (WSO-RMG 2006). Extensive CBNG development has occurred on lands underlying and immediately west of the surface coal mines. The predominant CBNG production to date has occurred from coal beds that the USGS describes as the Wyodak-Anderson zone, which are the same coal beds (or equivalent to the coal beds) being mined by the surface coal mines. The Wyodak-Anderson zone appears to be gas-bearing throughout the PRB and the methane in the coal beds has been determined to be biogenic in origin. CBNG is being produced from other, deeper seams locally throughout the PRB, but not in this area.

In order for CBNG to be produced, the hydrostatic pressure in the coal must be reduced to a level, which can vary from coal to coal, that allows the gas to desorb from the coal. This is accomplished by removing water from the coal seam. CBNG reservoirs can be affected by any nearby activities, including coal mining, that reduce the hydrostatic pressure in the coal seam.

WSO-RMG and the USGS have collected coal gas content data from coal cores near the mines and in other areas of the PRB. Measured gas content was minimal in all of the cores collected in 2000 at locations near the surface coal mines, indicating that the coal seams were already substantially depleted of CBNG in the vicinity of the mines at that time. Average total gas content from the core desorption analyses was approximately 6.8 scf/ton near the coal mines in 2000, compared with an average measured gas content of 37.6 scf/ton from coal cores taken outside the mining areas. Ongoing reservoir depletion from both mining operations and CBNG production since that time has diminished and continues to diminish the gas in place adjacent to the mine areas.

CBNG production was established near the northern and middle groups of coal

mines earlier than it was established in the southern mine group, where the Antelope Mine is located. WOGCC well data from the areas adjacent to the surface coal mines generally show that operator interest peaked prior to 2000 and declined following 2001. By 2005, drilling activity in the areas adjacent to the coal mines had declined significantly, with only 128 applications to drill CBNG wells filed in all of the townships including and bordering the coal mines in 2005.

Currently, there are no active, abandoned or proposed CBNG wells in the southern portion of the LBA tract in T.40N., R.71W. However, CBNG development has been extensive in T.41N., R.71W. WOGCC records show that as of April 2007, 258 wells had been drilled for CBNG production and 181 wells were capable of producing from the Wyodak-Anderson coal zone in T.41N., R.71W. (Appendix E). In the sections that include the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated under Alternatives 1 and 2), 30 of the 40 permitted CBNG wells are capable of producing (WOGCC 2007c).

The ownership of the oil and gas resources in the BLM study area, 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.

Layers of bentonite (decomposed volcanic ash) of varying thickness are present throughout the PRB. Some of the thicker layers are mined where they are near the surface, mostly around the edges of the basin. Bentonite has a large capacity to absorb water, and because of this characteristic it is used in a number of processes and products, including cat litter and drilling mud. No mineable bentonite reserves have been identified on the West Antelope II LBA tract under the Proposed Action or Alternative 1 or 2.

There are substantial uranium resources in southwestern Campbell and northwestern Converse Counties. There is one producing uranium operation in Wyoming, which is located in the southern Powder River Basin (WSGS 2006). No known uranium reserves exist on the West Antelope II LBA tract.

Scoria, which is also referred to as clinker or burn, is present in the general analysis area and has been and continues to be a major source of aggregate for road construction in the area. Scoria consists of sediments that were baked, fused, or melted in place when the underlying coal burned spontaneously. No scoria is present within the West Antelope II LBA tract.

A search of the BLM mining claim index revealed that no active mining claims are presently located within the West Antelope II study area.

3.3.2.2 Environmental Consequences

3.3.2.2.1 Proposed Action and Alternatives 1 and 2

During mining, other minerals present on the LBA tract could not be developed. Some of these minerals could, however, be developed after mining and reclamation is completed.

The conventional oil and gas reservoirs are located below the mineable coal beds and would not be directly disturbed by removal of the coal. There are currently no producing conventional oil and gas wells on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2, as discussed above. In the event that productive conventional oil and gas wells are drilled before the coal is removed, they would have to be removed, along with any associated facilities, to a level below the coal before mining could occur. Following mining and reclamation, the oil and gas lessee could re-complete old wells or drill new wells to recover oil and gas resources from any productive subcoal oil and gas reservoirs. This would only occur if they believe that the value of the reserves would justify the expense of recompleting or drilling wells.

WSO-RMG's analyses have shown that CBNG depletion had already occurred near the mining areas in the Wyodak-Anderson zone by the time that CBNG development began to accelerate in the late 1990s (WSO-RMG 2006). Several analyses prepared in 2002, based on data compiled by GAGMO in 2000-2001 and earlier, show widespread pressure depletion in the coal beds near the active mines. Analyses in the southern and northern mine groups, based on 2000 and 2001 groundwater measurements, indicated that hydrostatic pressure had declined by an estimated 20 to 60 percent since mining was initiated. Coal gas in place can be inferred to have been depleted by similar proportions. Ongoing reservoir depletion from mining and CBNG production has continued to diminish gas in place adjacent to the active mines.

There are active CBNG wells in the northern portion of the West Antelope II LBA tract. Before mining operations could begin, these wells and associated facilities would have to be abandoned. However, mining operations could not be initiated until permitting is completed, which generally requires several years after a lease is acquired. By that time, it is likely that the most of the economically recoverable CBNG resource would have been produced. CBNG reservoirs below the mineable coal seams would not be directly disturbed by surface coal mining operations.

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.

Coal mining would not directly affect production of CBNG from coal seams below the Wyodak-Anderson, however, it would delay any proposed CBNG development

in the deeper seams in order to avoid interference with mining.

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 West Antelope II coal lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. The limitations to the development of other mineral resources described above and in Table 2-4 would continue on the existing adjacent Antelope Mine coal leases and on portions of the West Antelope II LBA tract adjacent to the Antelope Mine, which would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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

No conventional reservoirs containing producible quantities of oil and/or gas are known to underlie the West Antelope II LBA tract. There are CBNG wells actively producing on the tract, however, the analyses conducted by the BLM's WSO-RMG indicated that most of the recoverable CBNG resources on the tract would be produced before mining operations would begin.

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:

- 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 which directs BLM decision-makers to optimize the recovery of both resources and ensure that the public receives a reasonable return (BLM 2006d). This policy 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 West Antelope II 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 continue to 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 formations exposed on the surface of the West Antelope II LBA tract are the sedimentary Paleocene Fort Union and Eocene Wasatch Formations, which are known to produce fossil vertebrates of scientific significance throughout Wyoming, including the PRB (Delson 1971, Winterfeld 1978, EVG 2001). The Probable Fossil Yield Classification, developed by the USFS and used by the BLM, is a planning tool used 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. The Fort Union Formation is classified as a Class 3 unit (BLM 2005c). PFYC classes 3, 4 and 5 are described as follows:

Class 3 - Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.

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 - Fossiliferous 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 ostracods have also been described from the Wasatch.

The Fort Union Formation is not as widely distributed as the Wasatch Formation, but occurs around the margins of the basin. This formation contains locally abundant fossil vertebrates, invertebrates, and plants, and displays an important time interval during the early Tertiary evolution of mammals. Invertebrate trace fossils (burrows) occur in sandstones in the Fort Union Formation.

Fossil plant material, primarily leaves and fossilized wood, is common in the Fort Union and Wasatch Formations. 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.

The West Antelope II general analysis area was covered by pedestrian surveys, either specifically for paleontological resources in 2007 or in conjunction with cultural Class II block clearance surveys in previous years. All but the extreme southeastern corner of the general analysis area was included in those pedestrian surveys. The ¼-mile strip in Sections 16 and 21-23, T40N, R71W was assessed based on comparisons between existing BLM fossil records and maps for the project area and results from extension field coverage of adjacent lands.

Intensive pedestrian inventories by GCM Services (Ferguson 1998, 2000, 2001, 2003; Munson and Ferguson, 1996; and Humphrey and Kingham, 1993) included inspections for paleontological resources. Fossil wood was observed at many unrecorded locations, particularly associated with coal. Invertebrate remains of mollusks, bivalves and gastropods were occasionally observed within weathering

shale exposures. These were typically fragmentary and are considered to be of minimal scientific significance. Because of the ubiquitous nature of fossilized plants and invertebrates, reporting was confined to vertebrate specimens or unique finds. None of these projects reported vertebrate specimens or unique finds.

During 2007, the 240-acre tract on USFS lands in the general analysis area (W½ E½ Section 15; SE¼ SE¼ Section 15; and SW¼ SW¼ Section 14) was intensively inventoried by foot. Fossilized wood, leaves and plant fragments, and invertebrate trace fossils (including *Planolites*) were observed, recorded and collected at several localities in SW¼ SW¼ Section 14, and in NW¼ SE¼ and SE¼ SE¼ Section 15. Just beyond the 240 acres, fossil wood in SE¼ SW¼ Section 15 and invertebrate trace fossils in NW¼ NW¼ Section 23 were observed and recorded. All areas covered in this paleontological survey were within the Paleocene Fort Union Formation.

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

3.3.3.2 Environmental Consequences

3.3.3.2.1 Proposed Action and Alternatives 1 and 2

The rock outcrops present on the West Antelope II 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 1 and 2, 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 West Antelope II lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. Mining operations and the potential associated impacts to paleontological resources described above would continue as permitted on the existing adjacent Antelope Mine coal leases and on portions of the West Antelope II LBA tract adjacent to the Antelope Mine which would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 West Antelope II 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

The information in this section and in the air quality appendix (Appendix F) is based on the Air Quality Technical Support Document prepared for ACC by McVehil-Monnett Associates, Inc. for use in this EIS. The Air Quality Technical Support Document (MMA 2007) is a stand alone document which is available for review. This section summarizes the affected environment in the area of the Antelope Mine and the potential environmental impacts if the West Antelope II LBA tract is leased and mined. Appendix F provides background information on the air quality regulatory framework, regional conditions, dispersion model methodology, the BACT process, etc. Existing and projected cumulative air quality impacts are discussed in Section 4.2.3.

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 can also be strongly affected by local or regional topography and microscale and mesoscale meteorological effects. 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. Generally, local effects are superimposed on the overall weather patterns and are most important when the large-scale wind flow is weak.

The general analysis area, shown in Figure 3-1, is located in the southern 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 4,500 ft to 5,100 ft above sea level. The climate in the general analysis is semiarid with relatively short warm summers and longer cold winters. Evaporation exceeds annual precipitation. Section 3.1.1 includes additional information about the climate in the general analysis area.

Air Quality 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 in Appendix F. Air pollution impacts are limited by local, state, tribal, and federal air quality regulations and standards, and state implementation plans, or SIPs, 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 SIP.

3.4.1.1 Emission Sources

Air quality conditions in rural areas are probably better than in large urban/industrial centers. Rural areas generally have a smaller number of emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches) and favorable atmospheric dispersion conditions which can result in relatively low air pollutant concentrations. Occasional high concentrations of CO and particulate matter may occur in more urbanized areas (for example, the cities of Gillette, Sheridan, and Buffalo) and around industrial facilities in these areas, especially under the stable atmospheric conditions that occur during winter.

Surface coal mining activities generate fugitive dust and particulate and gaseous tailpipe emissions from large mining equipment. Specifically, activities such as blasting, excavating, loading and hauling of overburden and coal, and wind erosion of disturbed and unreclaimed mining areas produce fugitive dust. Coal crushing, storage, and handling facilities are the most common stationary or point sources associated with surface coal mining and preparation. Particulate matter is the pollutant emitted from coal mine point sources, although small amounts of gaseous pollutants are emitted from small boilers and off-road diesel engines. Wyoming's ambient air standards for particulates are shown in Table 3-3.

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 types of air pollutant emission sources within the PRB include:

- CO and NO_x from internal combustion engines used at natural gas and CBNG pipeline compressor stations;
- CO, NO_x, PM_{10}, $PM_{2.5}$, SO_2, and VOCs from gasoline and diesel vehicle tailpipe emissions;
- Particulate matter (dust) generated by vehicle travel on unpaved graded roads, agricultural activities such as plowing, and paved road sanding during the winter months, as well as windblown dust from neighboring areas;

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

Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	WAAQS	PSD Class I Increments[3]	PSD Class II Increments[3]
Carbon monoxide	1-hour	3,336[4]	40,000	40,000	40,000	None	None
	8-hour	1,381	10,000	10,000	10,000	None	None
Nitrogen dioxide	Annual	9[5]	100	100	100	2.5	25
Ozone	8-hour	131[6]	157	157	157	None	None
Sulfur dioxide	3-hour	131[7]	None	1,300	1,300	25	512
	24-hour	73[7]	365	None	260	5	91
	Annual	10[7]	80	None	60	2	20
PM_{10}[8]	24-hour	78[9]	150	150	150	8	30
	Annual	12[10]	None	None	50	4	17
$PM_{2.5}$[8]	24-hour	10[11]	35	35	65	None	None
	Annual	3.9[11]	15	15	15	None	None

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 All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.
4 Data collected by Amoco at Ryckman Creek for an eight-month period during 1978-1979, summarized in the Riley Ridge EIS (BLM 1983).
5 Data collected at Antelope Site 3, Campbell County, WY, 2004-2006.
6 Data collected at site located 15 miles SSW of Gillette, Campbell County, WY, 2005-2007 (8-hour 4th high).
7 Data collected at Wyodak Site 4, Campbell County, WY, 2005-2007.
8 On October 17, 2006, EPA published final revisions to the NAAQS for particulate matter that 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.
9 Data collected at Antelope Site 4 (2005-2007).
10 Background determination developed for recent permitting actions at the Antelope Mine, based on data collected at the Antelope Mine.
11 Data collected at Antelope Site 3 (2005-2007)
Source: (BLM 2005a) and WDEQ/AQD

- NO_2 and PM_{10} emissions from railroad locomotives used to haul coal;
- SO_2 and NO_x from power plants. The closest coal-fired power plants are the Dave Johnston plant, located about 35 miles southwest of the West Antelope II LBA tract, and the Wyodak, Wygen, and Neil Simpson plants, located about 50 miles north of the West Antelope II LBA tract; and
- Air pollutants transported from emission sources located outside the PRB.

3.4.2 Particulate Emissions

3.4.2.1 Affected Environment for Particulate Emissions

The federal standard for particulate matter pollutant was specified as total suspended particulates until 1987. This measurement included all particulates generally less than 100 microns in diameter. In 1987, the form of the standard was changed from TSP to PM_{10} to better reflect human health effects. PM_{10} represents particulate matter with a mean aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. In 1997, EPA set separate standards for fine particles ($PM_{2.5}$), based on their link to serious health problems. In 2006, EPA revised the air quality standards for particulate matter by tightening the 24-hour fine particle standard from the previous level of 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and revoking the annual PM_{10} standard of 50 $\mu g/m^3$. EPA retained the existing annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ and the 24-hour PM_{10} standard of 150 $\mu g/m^3$. These revisions took effect on December 18, 2006. The current federal ambient air standards are shown in Table 3-3.

While retaining the TSP standard until March 2000, Wyoming added the PM_{10} standard in 1989. Wyoming also adopted a $PM_{2.5}$ standard in March 2000. In view of the December 2006 revisions to the NAAQS for particulate matter, the State of Wyoming will enter into rulemaking to revise the WAAQS for particulate matter so that they remain as stringent as or more stringent than the NAAQS. Even with the evolution of state or federal small size particulate standards, TSP is still monitored in some PRB locations as a surrogate for PM_{10} and as an indication of overall atmospheric levels of particulate matter.

WDEQ/AQD requires monitoring data to document the air quality at all of the PRB mines. TSP and PM_{10} data have been collected since 1980 and 1989, respectively. As a result, over 57,000 TSP and 27,000 PM_{10} samples were collected through 2004. Information about the monitoring network, the data that have been collected and PM_{10} concentration trends since monitoring began is included in Appendix F.

Air quality and meteorological sampling locations for the Antelope Mine are shown on Figure 3-5. The wind rose diagram for the Antelope Mine is shown in Figure 3-2.

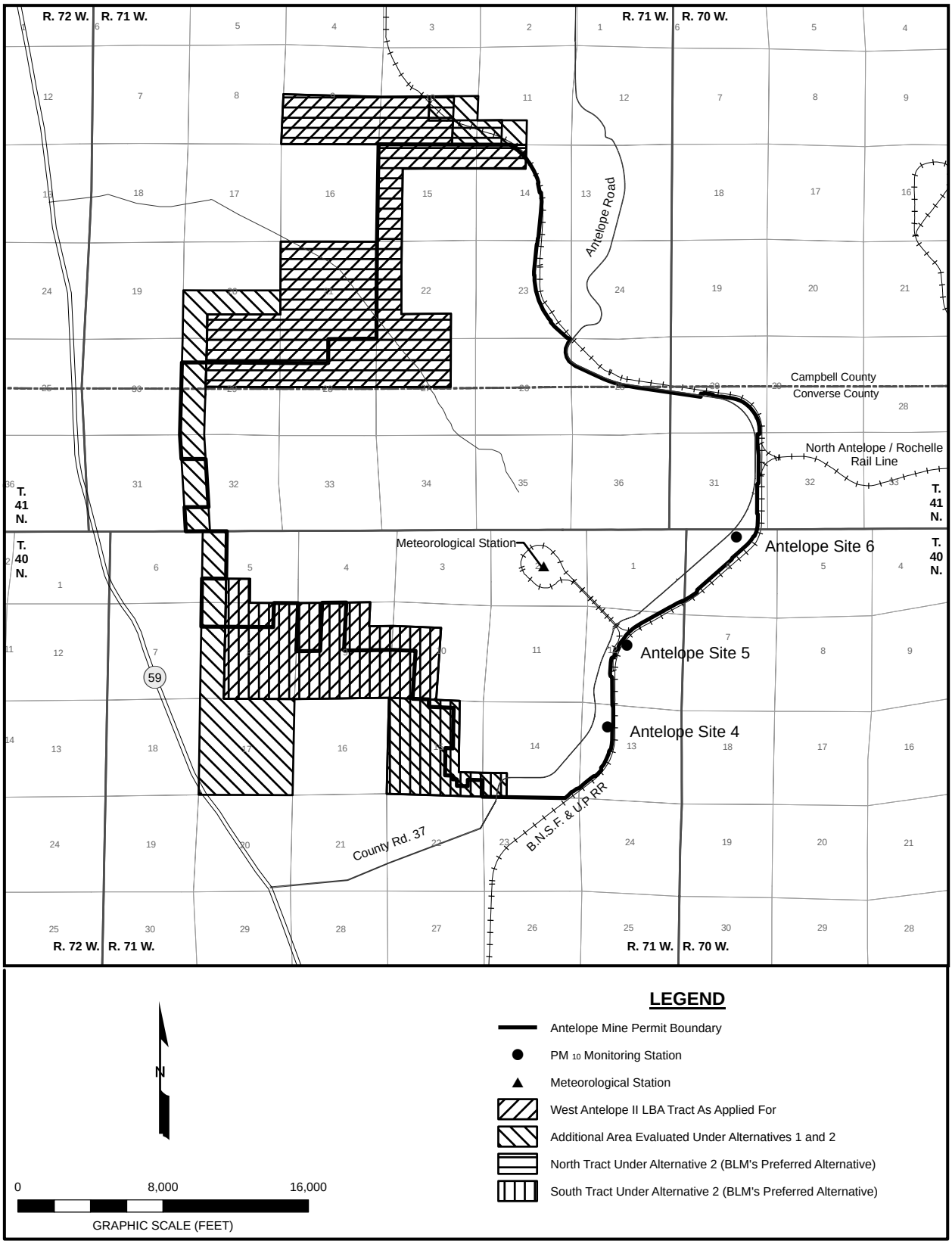


Figure 3-5. Air Quality and Meteorological Stations at the Antelope Mine.

Figure 3-6 presents the annual PM_{10} measured at the Antelope Mine monitoring sites. These data were collected from 2003 through 2006. Cumulative coal and overburden production for the Antelope Mine for these years are also shown in this figure. Table 3-4 presents a summary of 24-hour PM_{10} monitoring data for the Antelope Mine for 2003 through 2005.

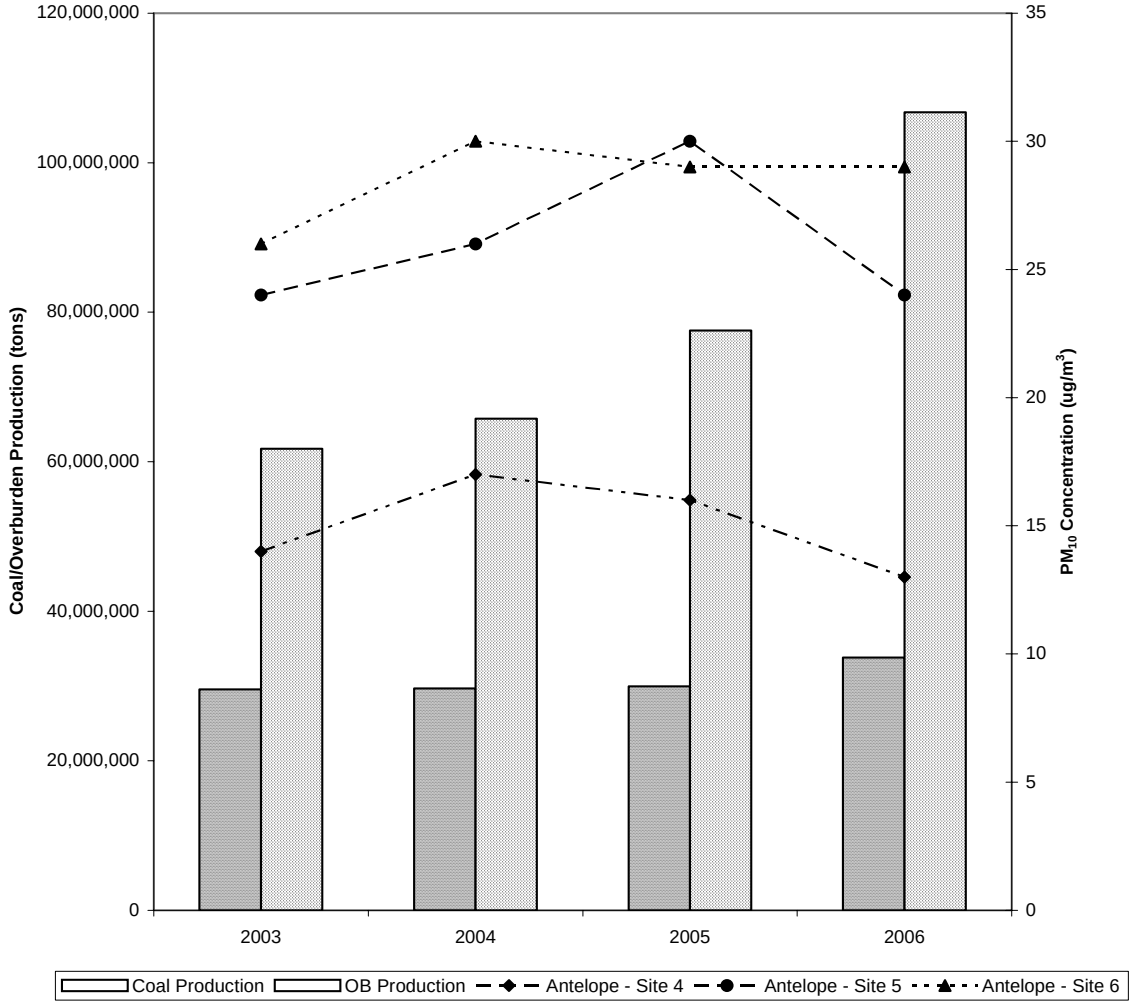


Figure 3-6. Annual Coal Production and Overburden Removal vs. Monitored PM_{10} for the Antelope Mine

Table 3-4. Summary of PM_{10} Monitoring Data for the Antelope Mine (24-hr Highest Second-High Concentrations in $\mu g/m^3$).

Monitor ID	Latitude (degrees N)	Longitude (degrees W)	2005	2006	2007
Site 4	43.83	105.45	40	96	76
Site 5	43.46	105.33	114	117	105
Site 6	43.48	105.31	68	111	94
NAAQS			150	150	150

Source: EPA web page http://www.epa.gov/air/data/reports.html

Table 3-4a. Summary of PM_{10} Monitoring Data for the Antelope Mine (24-hr Highest 4th-High over 3 Years - $\mu g/m^3$)

Monitor ID	Latitude (degrees N)	Longitude (degrees W)	2005	2006	2007
Site 4	43.83	105.45	43	51	76
Site 5	43.46	105.33	73	114	114
Site 6	43.48	105.31	80	91	94
NAAQS			150	150	150

Source: EPA web page http://www.epa.gov/air/data/reports.html

There were no monitored exceedances of the PM_{10} standard in the PRB through 2000. Between 2001 and 2006, there were 29 monitored exceedances of the 24-hour PM_{10} standard at seven operating mines in the Wyoming Powder River Basin (WDEQ/AQD 2006a). In early 2007, nine exceedances were monitored at four mines. Many of these exceedances occurred in the group of mines located south and east of the town of Wright, which is identified as the Wright Area Subregion in Chapter 4 of the EIS. Although the Antelope Mine is located in that group of mines, most of the exceedances were located roughly ten to fifteen miles north of the Antelope Mine. In 2005, one exceedance was recorded at one of the monitoring stations at the Antelope Mine, however, that exceedance was attributed by WDEQ/AQD to maintenance/construction operations on the adjacent railroad line and not to mining operations at the Antelope Mine. In general these exceedances are likely attributable to a variety of causes including long-term drought conditions, associated high winds, contributions from non-mining sources such as increased traffic on unpaved roads proximate to some of the sampling locations, as well as proximity of un-reclaimed mining activity to sampler locations.

PM_{10} monitoring results for the other mines in the Wright Area Subregion are summarized in Table 3-5.

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 (EPA 2007a). 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.

Table 3-5. Summary of PM_{10} Monitoring Data for the Wright Area Subregion (24-hr Highest Second-High Concentrations in μg/m³).

Site	2005	2006	2007
North Antelope Rochelle			
NA-5	149	120	145
NA-6B	98	104	67
RO-1	100	108	126
Black Thunder			
31-1	109	138	--
26-2	83	90	92
36-1	116	124	136
E&F	167	96	190
Relocated #1	102	97	128
J	117	94	123
Jacobs Ranch			
JRM-3	83	89	103
JRM-4	47	65	49
JRM-5PM	103	97	143

Source: EPA web page http://www.epa.gov/air/data/reports.html

3.4.2.2.1 Proposed Action and Alternatives 1 and 2

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine under the Proposed Action and Alternatives 1 and 2. ACC projects that the Antelope Mine would produce between 36 mmtpy and 42 mmtpy after 2007, regardless of whether the LBA tract is leased or not. Comprehensive studies demonstrating compliance with applicable ambient air standards would be required to obtain a permit modification if ACC proposes to increase their permitted production level in the future.

ACC conducted a modeling analysis for a maximum coal production rate of 42 mmtpy as part of a request for an air quality permit modification for the Antelope Mine submitted in May 2006 and issued by the WDEQ on April 23, 2007. For that analysis, mining years 2010 and 2012 were selected as "worst-case" based on Antelope Mine-specific and regional LOM emission inventories for PM_{10} and NO_x. The highest model-predicted PM_{10} impact during year 2012 was 49.9 ug/m³ (as per WDEQ-AQD AP-4809 Application Analysis for the Antelope Coal Company - Antelope Mine, dated February 1, 2007, application received May 2006). The highest model-predicted PM_{10} impact during year 2010 was 47.8 ug/m³ (Figures 3-7 and 3-8).

As discussed in Appendix F, surface coal mines in the Wyoming PRB have not been subject to PSD requirements. The PSD rules, which are intended to prevent deterioration of air quality, are summarized in Appendix F. 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

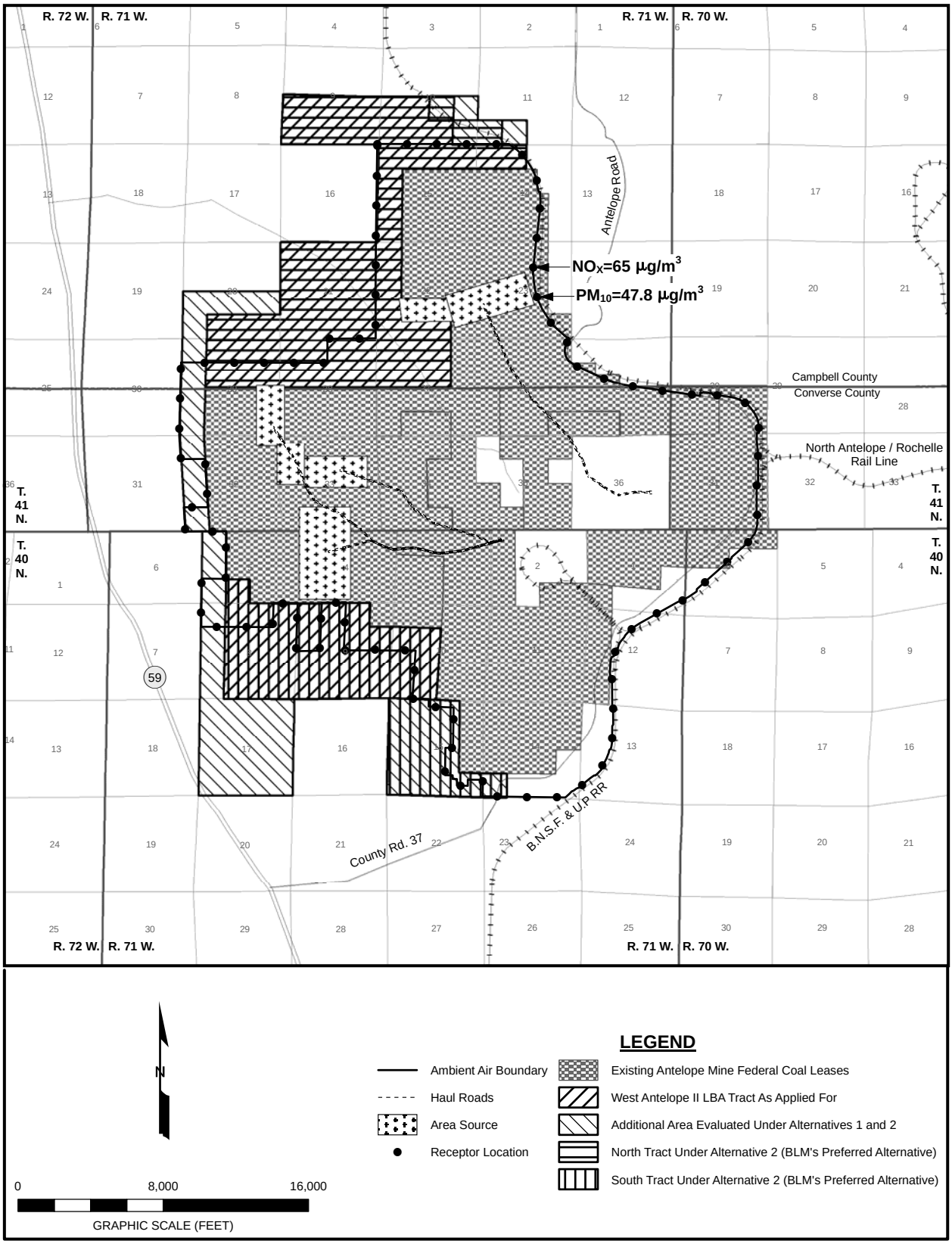


Figure 3-7. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2010.

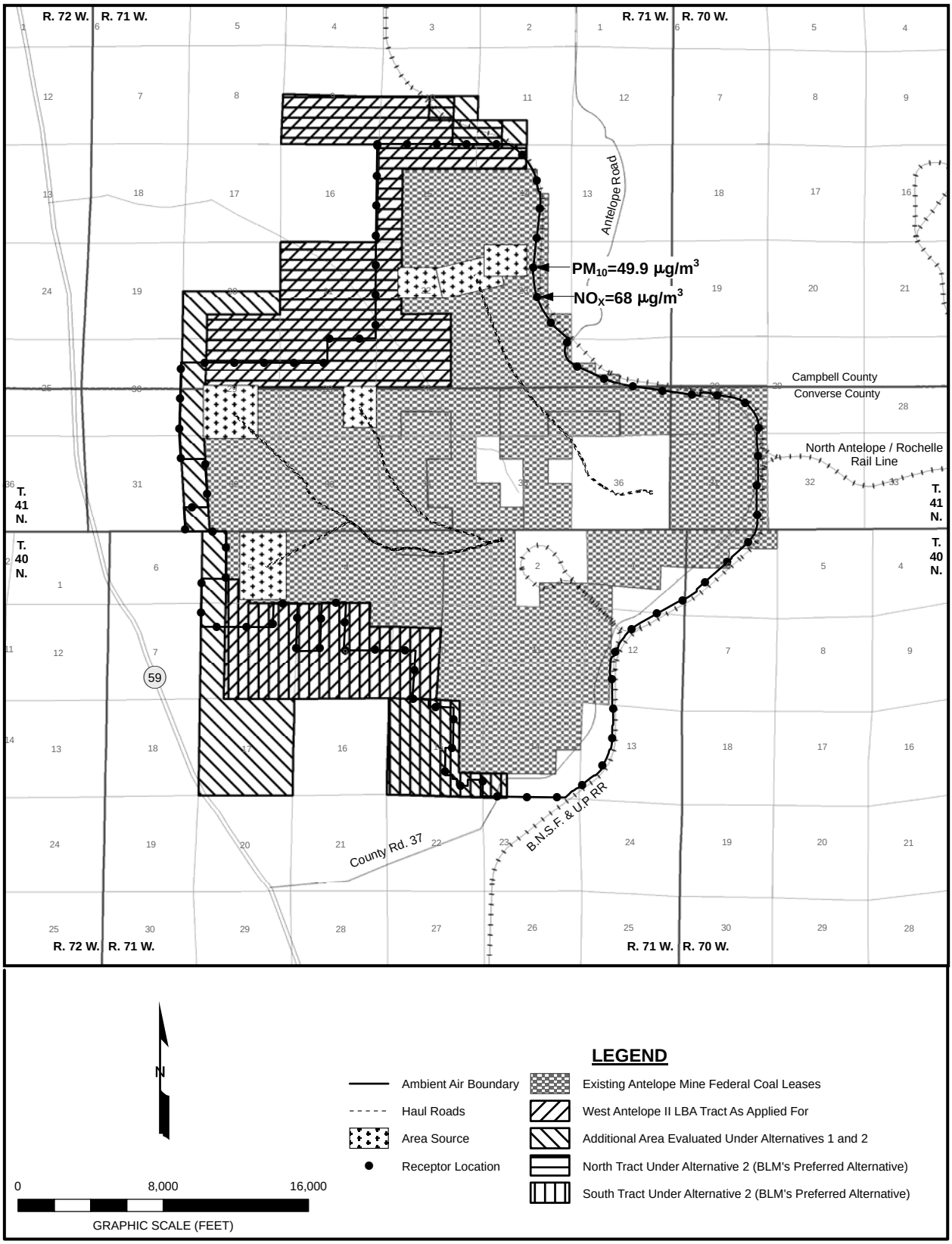


Figure 3-8. Maximum Modeled PM_{10} and NO_X Concentrations at the Antelope Mine Ambient Air Boundary for the Year 2012.

analyses should not be compared to PSD increments.

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. In accordance with this policy, ACC also prepared a demonstration regarding compliance with the 24-hour PM_{10} standard. The short-term compliance analysis focused on historical monitoring data and continuing employment of BACT on mine-wide emissions and concluded that mining operations would not be expected to cause exceedances of the 24-hour PM_{10} WAAQS.

ACC proposes using the same mining methods and emission mitigation methods to recover the coal on the West Antelope LBA tract as they are currently using to recover the coal on the existing leases. The mine would continue to utilize draglines, shovels, and trucks to remove and replace overburden and shovels and trucks to remove coal. Facilities shown in the current air quality permit would not change as a result of proposed mining of the LBA tract. Haul distances to transport the coal to the rail facilities are not expected to increase because overland conveyors are likely to be extended into the tract. ACC does not plan to change blasting procedures or blast sizes associated with the mining of the LBA tract. However, as indicated in Table 3-2, overburden thicknesses are greater and coal thicknesses are less on the West Antelope II LBA tract as compared to the existing leases at the Antelope Mine. As a result, blasting size and/or frequency may need to increase in order to recover the coal included in the tract, which could result in an increase in fugitive emissions per ton of coal mined. Therefore, blasting-related particulate emissions may increase. However, blasting makes up a very small fraction of the overall mine-wide emissions inventory, so the effect on mine-wide particulates will be minimal.

Under the Proposed Action and Alternatives 1 and 2, mine life would be extended by up to 13 years, assuming a coal production rate from 36 to 42 mmtpy. If ACC acquires the tract, they would need an air quality permit modification from the WDEQ-AQD before they could initiate mining operations on the tract. New air quality modeling would need to be conducted in support of that application demonstrating on-going compliance with all applicable ambient standards.

The modeling conducted for the current Antelope Mine permit predicted no exceedances of the annual PM_{10} WAAQS at the maximum mining rate proposed for the West Antelope II LBA tract. The maximum modeled concentrations predicted by the modeling would occur along the northeast portion of the Antelope Mine's permit boundary, along the railroad right-of-way. Mining operations on the LBA tract will, in general, generate dust emissions farther from this high impact area. As a result, maximum predicted impacts should decrease as the tract is mined. Therefore, fugitive dust emissions should remain in compliance with daily and annual air quality standards.

Public exposure to particulate emissions from surface mining operation is most likely to occur along publicly accessible roads and highways that pass through the areas of mining operations. Occupants of dwellings in the area could also be affected. Roads, highways, occupied dwellings, businesses and school bus stops in the vicinity of the Antelope Mine and the study area for the West Antelope II LBA tract are shown in Figure 3-9.

3.4.2.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the Antelope Mine would continue to operate as currently permitted. The currently permitted mining operations and projected impacts related to PM_{10} emissions are discussed in Section 3.4.2.2.1, above. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and the related impacts 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 West Antelope II 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 Powder River Basin require the following dust control measures, which are considered to be BACT measures:

1. No mines are allowed to have out-of-pit open coal stockpiles. All coal removed from the mine pits must be stored in totally enclosed coal silos or barns.
2. Unless specifically exempted, all coal mine main access roads must be paved.
3. As use and conditions warrant, the minor access roads at coal mines which are unpaved must be watered or treated with dust suppressants.
4. All coal conveyor transfer points must be shrouded or otherwise enclosed to direct coal fines from one belt to the next.
5. The transfer point and crushers within coal processing plants must be 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.
6. All out-of-pit conveyors must be hooded or contained in a conveyor gallery.

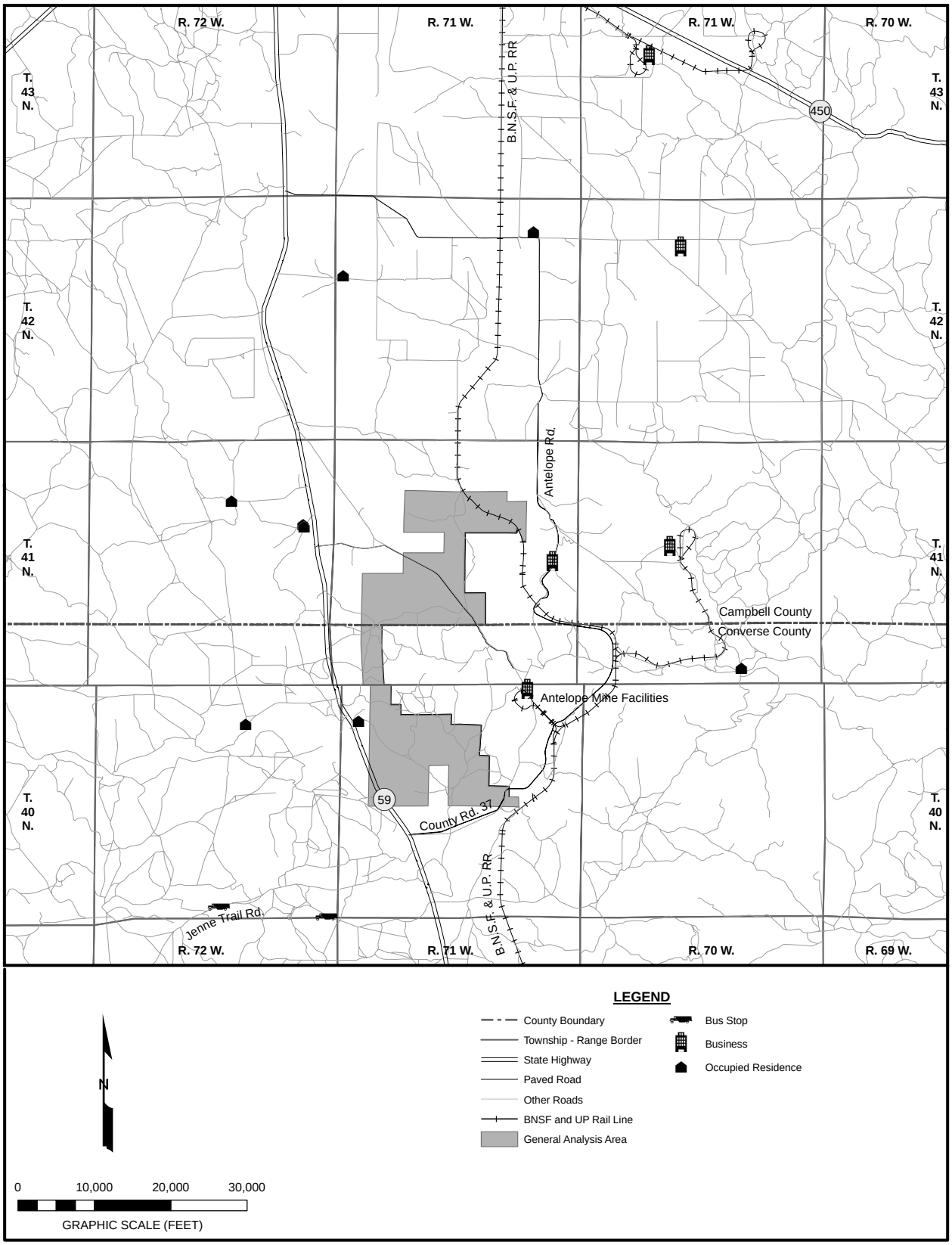


Figure 3-9. Roads, Highways, Occupied Dwellings, Businesses and School Bus Stops in the Vicinity of the Antelope Mine and the West Antelope II General Analysis Area.

7. All out-of-pit coal dump hoppers must be fitted with a dust control stilling shed, water sprays, or a baghouse dust collector.
8. Active longer-term coal haul roads must be treated with dust control chemicals and/or water.
9. Active short-term mine haul roads which must be continuously relocated are maintained and watered while in use.
10. All haul roads must be regularly maintained to reduce the amount of dust re-entrained by haulage equipment (WDEQ/AQD 2006a).

Additional site-specific requirements related to mine-specific layout and mining practices may be included in individual mine permits.

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 Antelope Mine.

Mines often apply dust suppressants to adjoining county roads. In 2006, the Antelope Mine paved its access road.

In April 2006, the WDEQ in a joint effort with PRB mining stakeholders developed a detailed Natural Events Action Plan or NEAP for the coal mines of Campbell and Converse Counties, Wyoming. The NEAP was developed under the framework afforded by U.S. EPA's Natural Events Policy of May 30, 1996. Formal approval of the NEAP by EPA Region VIII was received in January 2007. Additionally, on May 21, 2007, EPA finalized the Exceptional Event Rule (40CFR50 and 40CFR51) which has many of the same features as the NEAP. The PM_{10} control strategies, including BACM, listed in the NEAP are applicable to the Exceptional Event Rule as Reasonable and Appropriate controls. The Antelope Mine is presently complying with the NEAP as approved by EPA and developed jointly by the WDEQ/AQD and the PRB coal operators.

The NEAP recognizes that certain NAAQS exceedances due to natural events are uncontrollable. While all practical mitigation measures need be implemented during those events, the exceedances should not be considered against the NAAQS attainment designation for the region. Specific NEAP goals include:

- Provide for the protection of public health,
- Develop public information program,
- Provide a mechanism for "flagging" exceedances due to uncontrollable natural events,
- Implement BACM and RACM based on the severity of the event, and
- Provide mechanism for excluding flagged data when they meet specific

wind speed criteria and BACM and RACM are in place.

The NEAP identifies two categories of control measures designed to prevent exceedances during high wind events in addition to the BACT measures discussed above (WDEQ/AQD 2006a). One of these categories, 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:

1. Stabilizing topsoiled areas as soon as practical following topsoil replacement.
2. 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.
3. Ripping, windrowing, temporarily seeding or chemically treating graded backfill areas greater than 300 contiguous acres in size.
4. Ripping, mulching, temporarily seeding or chemically treating long-term out-of-pit overburden and topsoil stockpiles that have been graded.
5. Applying non-vegetative barriers such as gravel or other large-diameter particles to erodible surfaces to reduce surface erosion where appropriate.
6. Cleaning, treating, and maintaining pads in front of truck dumps to prevent accumulations of spilled materials from getting pulverized.
7. Scheduling topsoil removal, backfill grading and topsoil replacements concurrently to minimize open areas when possible.
8. 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 2006a). These include:

1. The mine operator will consider relevant information, including NWS forecasts and local meteorological information, to confirm that a high wind event is occurring.
2. The mine operator will visually determine areas of mining activity that are generating excessive visible dust and direct water trucks to those areas.
3. The mine operator should direct overburden operations to the shortest haul distance available during a high wind event.
4. The mine operator will evaluate the practicality of dumping the overburden as low as possible.
5. Mine employees will inspect for and extinguish coal fires.
6. The mine operator will evaluate shutting down scoria crushing operations that appear to be generating excess dust.

7. The mine operator will evaluate shutting down road maintenance activities that are generating dust.
8. The mine operator will evaluate ordering contractors to increase water, reduce operating equipment or shut down haulage.
9. 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, Jacobs Ranch, and former North Rochelle 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, site-specific watering of inactive areas and problem areas; 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. WDEQ/AQD has increased monitoring frequency requirements and required installation of continuous PM_{10} monitors at all PRB coal mines. The agency has initiated enforcement actions where appropriate. Notices of violation have been issued on occasion, and consent decrees and modified permit conditions have been used as tools to mitigate dust problems. 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 SIP.

WDEQ has required several mines to stop traffic on public roads during blasting due to concerns with fly rock and the “startle factor”. However, the WDEQ has not required that of Antelope Mine. Antelope has voluntarily implemented this measure from time to time, based on blast location and wind direction.

The PRB has one of the most extensive networks of monitoring sites for PM_{10} in the nation; 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. A discussion of the monitoring network and monitoring requirements is included in Appendix F.

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, nitrogen dioxide (NO_2), is a highly reactive, reddish brown gas that is heavier than air and has a pungent odor. NO_2 is by far the most toxic of several species of NO_x. NO_2 can combine with atmospheric moisture to form nitric acid and nitric oxide. Because several NO_x species can be chemically converted to NO_2 in the atmosphere, NO_2 emissions control is focused on all NO_x species, while the ambient standard is expressed in terms of NO_2.

According to the EPA (EPA 2001a):

- NO_2 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.

Nitrogen oxides form when fuel is burned at high temperatures. They can be formed naturally or by human activities. The primary manmade sources are motor vehicles, electric utilities, and other fuel-burning sources. According to EPA, motor vehicles produce about 55 percent of the manmade NO_x emissions, utilities and industrial/commercial/residential activities each produce about 22 percent of the manmade NO_x emissions, and other sources account for the remaining one percent of the manmade emissions (EPA 2007b).

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 nitrogen-based 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. The rate of release is not well known but is believed to be dependent on a wide number of factors which likely include, but are not necessarily limited to: downhole confinement; downhole moisture; type/blend of ammonium nitrate, fuel oil (ANFO), and emulsion; and detonation velocity.

3.4.3.1.1 Site Specific NO_x Emissions

Sources of NO_x emissions at the Antelope 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 Antelope 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 cast blasting has been conducted at Antelope and will be continued to be implemented in the west tract. Antelope has instituted voluntary measures based on blast locations and wind direction to mitigate exposure to railroad employees and other segments of the population as necessary.

NO_x modeling was also conducted in support of the May 2006 permit application. Similar in scope to the PM_{10} analysis, NO_x emissions from the Antelope Mine and other regional sources were modeled for the two worst-case years of 2010 and 2012 (Figures 3-7 and 3-8.) A maximum annual NO_2 impact of 67.5 $\mu g/m^3$ was predicted in 2012, as compared to the annual NO_2 NAAQS of 100 $\mu g/m^3$.

3.4.3.2 Environmental Consequences Related to Short-Term NO_x Emissions

There are various compounds and derivatives in the family of nitrogen oxides, including NO_2, nitric acid, nitrous oxide, nitrates, and nitric oxide, which may cause a wide variety of health and environmental impacts. According to EPA, the main causes of concern with respect to NO_x are:

- it is one of the main ingredients involved in the formation of ground level ozone, which can trigger serious respiratory problems;
- it reacts to form nitrate particles, acid aerosols, as well as NO_2, which also cause respiratory problems;
- it contributes to the formation of acid rain;
- it contributes to nutrient overload that deteriorates water quality;
- it contributes to atmospheric particles which cause visibility impairment, most noticeably in national parks;
- it reacts to form toxic chemicals;
- one member of the NO_x family, nitrous oxide or N_2O, is a greenhouse gas that contributes to global warming; and
- it can be transported over long distances (EPA 2007c).

Potential health risks associated with inhalation of ground level ozone and NO_x-related particles include acute respiratory problems, aggravated asthma, decreases in lung capacity in some healthy adults, inflammation of lung tissue, respiratory-related hospital admissions and emergency room visits, and increased susceptibility to respiratory illnesses, including bronchitis and pneumonia (EPA 2007d).

Neither the EPA nor the WDEQ have established NAAQS for NO_2 for averaging times shorter than one year. 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).

While extensive expert testimony was provided to the Wyoming EQC during hearings in 2002 arguing for the establishment of a de facto "standard" ranging from 0.5 to 5.0 ppm for a 10-minute exposure, the EQC determined there was insufficient evidence to establish a short-term exposure limit and concluded additional study was required. The primary control measure for mitigating exposures to offsite residences is to avoid shooting cast blasts when wind direction or atmospheric conditions are unfavorable. Such approaches are employed at Antelope and will be continued to be employed. Studies that have been conducted to evaluate NO_2 exposures from blast clouds in the PRB are described in Appendix F.

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 emission. 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 $\mu g/m^3$);
- EPA's Significant Harm Level, a one-hour average, is 2.0 ppm (3,760 $\mu g/m^3$);
- OSHA's Short-Term Exposure Limit, a 15-minute time weighted average, which was developed for workers, is 5.0 ppm (9,400 $\mu g/m^3$, 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 $\mu g/m^3$) 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 $\mu g/m^3$) for a 10-minute exposure to protect sensitive members of the public (EPA 2003a).

Blast clouds are of a short-term, transient nature. While disagreement still exists regarding acceptable exposure levels, a large amount of actual data are now available from which informed decisions can be made regarding blasting practices. The data show clearly that reduction in blast (agent) size and increases in setback distances are effective methods for mitigating the frequency and extent of public exposure to blasting clouds. See Appendix F for additional information about studies that were conducted to evaluate the levels of public exposure to NO_x.

3.4.3.2.1 Proposed Action and Alternatives 1 and 2

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine. The average annual coal production is not anticipated to exceed the projected post-2006 coal production rate of 42 mmtpy, with or without the West Antelope II LBA tract. Coal production is anticipated to increase to a rate of 42 mmtpy, then taper off during the mine's later years, with or without the West Antelope II LBA tract. The Antelope Mine's currently approved air quality permit from the WDEQ/AQD allows up to 42 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 between 36 and 42 mmtpy for a longer period of time (up to 13 more years). Potential NO_x emissions related to mining operations at the existing Antelope 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 plan revisions. As discussed in Section 3.4.2.2.1, ACC conducted a modeling analysis for PM_{10} and NO_x for a maximum coal production rate of 42 mmtpy as part of a request for an air quality permit modification for the Antelope Mine submitted in May 2006. On April 23, 2007, WDEQ issued Permit MD-1543 for this modification which allows 42 mmtpy production at the mine.

There have been no reported events of public exposure to NO_2 from blasting activities at the Antelope 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. Figure 3-9 shows occupied dwellings, businesses, and bus stops in the vicinity of the West Antelope II LBA tract. If the West Antelope II LBA tract is mined, blasting operations will be conducted in closer proximity to Highway 59 and some residences located west of the existing mine. However, because the prevailing wind direction is from the southwest (Figure 3-2), emissions from blasting are not expected to substantially affect public exposure. There will be no significant changes in blasting techniques except when mining occurs in the LBA tract. Because overburden is thicker in the LBA tract, Antelope would employ state-of-the-art methods to minimize any increases in blast sizes and/or total agent used. Those methods would include, but would not necessarily be limited to, the use of more efficient agent formulations and use of electronic detonators. Thus, emissions from blasting are not expected to increase significantly, notwithstanding the large overburdens to be excavated in the tract.

If ACC acquires the West Antelope II 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 Antelope Mine permit projected no exceedances of the annual NO_x NAAQS at a 42 mmtpy production. Therefore, air quality impacts that result from mining the West Antelope II LBA tract by the applicant should also be within annual NAAQS limits.

3.4.3.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the mine would continue to operate as currently permitted. A discussion of the currently permitted mining operations and projected impacts related to NO_x emissions is included in Section 3.4.3.2.1, above. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and the related impacts 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 West Antelope II 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 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". However, the WDEQ has not required that of Antelope Mine. The mine has voluntarily implemented this measure from time to time, based on blast location and wind direction.

To date, there have been no reported events of public exposure to NO_2 from blasting activities at the Antelope 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.

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

- neighbor telephone notification (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.

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. Two mines in the Wyoming PRB, Black Thunder and Eagle Butte, currently have blasting restrictions in their permits to address NO_x.

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

- establishment of safe setback distances for blasting operations from the mine boundary.

Mine operators in the 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 (Emme 2003, Chancellor 2003). The Eagle Butte Mine, which does not use cast blasting techniques, has almost eliminated NO_x production. 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.

Annual mean NO_2 concentrations have been periodically measured in the PRB since 1975. NO_2 was monitored in Gillette from 1975 through 1983 and then from 2003 to 2006 in the PRB. The results of these monitoring programs are summarized in Tables 3-6 and 3-7.

NO_2 data have been measured in the vicinity of the Antelope Mine since 2003. The maximum annual average NO_2 concentration measured at the Antelope site was 9.4 µg/m^3 in 2005 and again in 2006, as compared to the NAAQS of 100 µg/m^3 (Table 3-7).

Table 3-6. Annual Ambient NO_2 Concentration Data (µg/m^3).

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. 2003 Through 2006 Annual Ambient NO_2 Concentration Data (µg/m^3).

Year	Antelope Mine	Belle Ayr Mine	TBNG	Tracy Ranch
2003	7.5	13.2	5.6	
2004	7.5	13.2	3.8	7.5
2005	9.4	15	3.8	
2006	9.4	15	3.8	

Source: EPA web page http://www.epa.gov/air/data

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 as a result of development of all types in the 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 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. WDEQ/AQD and respective mines maintain these monitoring stations. The WDEQ/AQD is relying on the ongoing 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

An AQRV is a resource identified by a federal land manager that may be adversely affected by a change in air quality. Visibility is a potentially affected resource. The potential air pollutant effects on visibility are applied to PSD Class I and Class II areas. The land management agency with jurisdiction for the Class I area sets an LAC or LOC for each AQRV. The AQRVs reflect the land management agency's policy and are not legally enforceable standards. Table 3-8 shows the distances from 31 PSD Class I and Class II areas in the vicinity of the PRB and their distances from the West Antelope II general analysis area.

Table 3-8. Approximate Distances and Directions from the West Antelope II General Analysis Area to Mandatory Federal Class I, Tribal Class I, and Federal Class II PSD Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I Area		
Badlands Wilderness Area[1]	152	E
Bridger Wilderness Area	219	W
Fitzpatrick Wilderness Area	217	W
Gates of the Mountain Wilderness Area	401	NW
Grand Teton National Park	275	W
North Absaroka Wilderness Area	256	WNW
Red Rocks Lake Wilderness Area	330	WNW
Scapegoat Wilderness Area	440	NW
Teton Wilderness Area	234	WNW
Theodore Roosevelt National Park (North Unit)	275	NNE
Theodore Roosevelt National Park (South Unit)	259	NNE
U.L. Bend Wilderness Area	266	NNW
Washakie Wilderness Area	239	WNW
Wind Cave National Park	94	E
Yellowstone National Park	269	WNW
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	329	N
Northern Cheyenne Indian Reservation	155	NNW
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	255	WNW
Agate Fossil Beds National Monument	109	SE
Bighorn Canyon National Recreation Area	182	NW
Black Elk Wilderness Area	94	ENE
Cloud Peak Wilderness Area	108	NW
Crow Indian Reservation	183	NW
Devils Towner National Monument	86	NNE
Fort Belknap Indian Reservation	363	NNW
Fort Laramie National Historic Site	97	SSE
Jewel Cave National Monument	78	ENE
Mount Rushmore National Memorial	98	ENE
Popo Agie Wilderness Area	202	WSW
Soldier Creek Wilderness Area	127	ESE

[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.

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 3-10 shows annual averages for the 20 percent best, average, and worst visibility days at Badlands and Bridger Wilderness Areas from 1989 through 2004. 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).

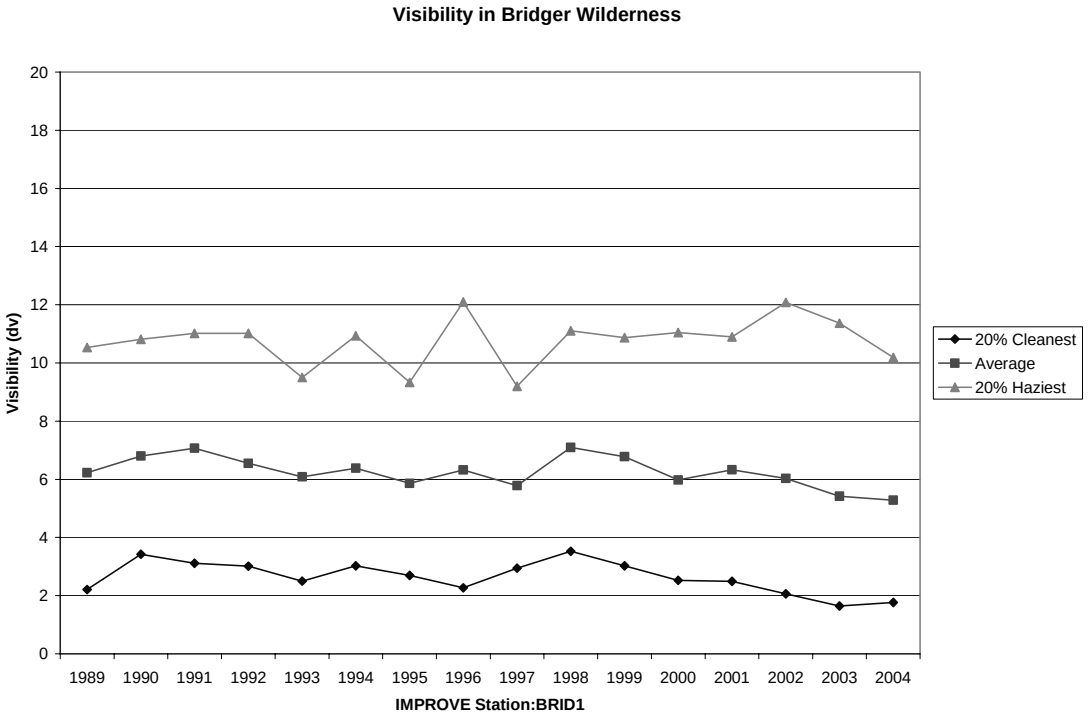
The *Wyoming State Implementation Plan for Class I Visibility Protection* states: "Wyoming's long term strategy will focus on the prevention of any future visibility impairment in Class I areas that can be attributed to a source or small group of sources as the Federal Land Managers have not identified any current impairment in the State's Class I areas due to such sources" (WDEQ/AQD 2005d). WDEQ/AQD prepared the 2*003 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 1 and 2

The impacts to visibility from mining the West Antelope II LBA tract have been inferred from the currently permitted impacts of mining the existing coal leases at the Antelope Mine. The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine. The maximum annual coal production is not anticipated to exceed the projected post-2006 rate of up to 42 mmtpy, with or without the West Antelope II LBA tract. ACC's currently approved air quality permit allows up to 42 million tons of coal to be mined per year. If the mine acquires the additional coal in the LBA tract, they anticipate that the coal production rate would continue to be between 36 and 42 mmtpy for up to 13 additional years. Therefore, impacts to visibility under the Proposed Action and Alternatives 1 and 2 would be similar to the impacts under the No Action Alternative, but they would be extended by as many as 13 years.

Current mining techniques for blasting, coal removal, and coal hauling 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. ACC does not propose to change the facilities shown in the current air quality permit or the blasting procedures or blast sizes if they acquire the 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



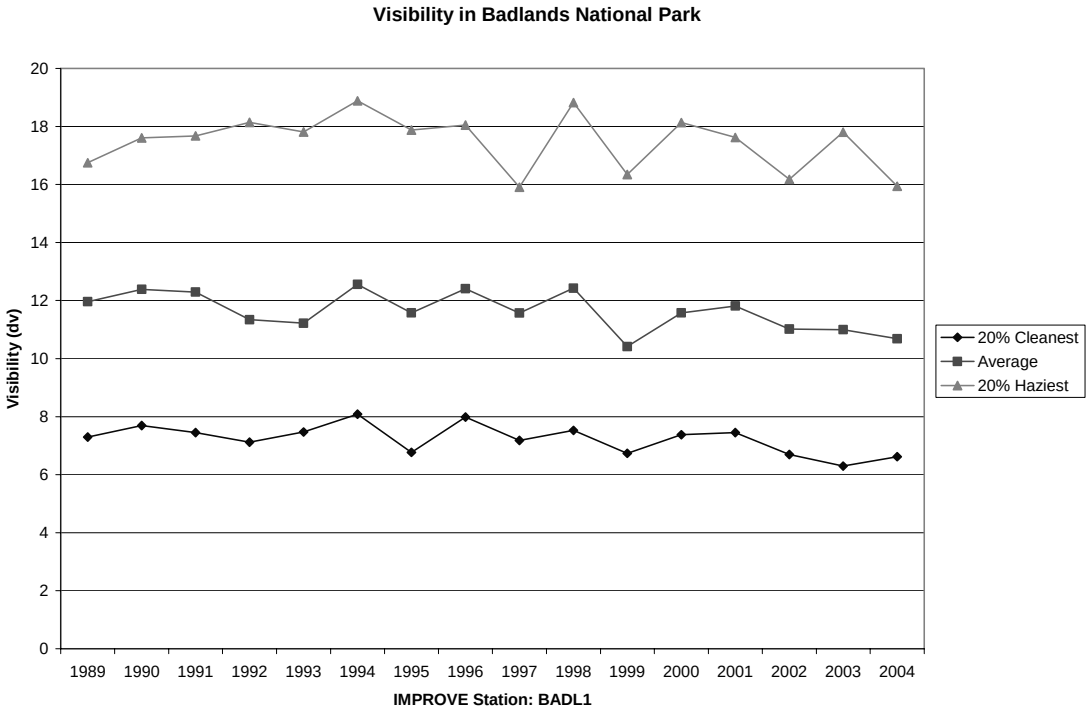


Figure 3-10. Visibility in the Badlands and Bridger Wilderness Areas.

incorporate the BACT protection measures that are in effect at that time. No significant changes in blasting techniques are proposed except when mining occurs in the LBA tract. However, because overburden is thicker in the LBA tract, Antelope will employ state-of-the-art methods to minimize any increases in blast sizes and/or total agent used. Those methods will include, but not necessarily be limited to, the use of more efficient agent formulations and use of electronic detonators. Thus, emissions from blasting are not expected to increase significantly, notwithstanding the large overburdens to be excavated in the tract.

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 West Antelope II coal lease application would be rejected and the mine would continue to operate as currently permitted. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and there would not be visibility impacts related to mining any 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 West Antelope II 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 TBNG 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. 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 from soils into lakes and streams; aluminum is highly toxic to many species of aquatic organisms.

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 2005b). 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 a 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 3-9 shows the existing ANC monitored in some mountain lakes and their distance from the West Antelope II general analysis area.

Table 3-9. 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	200
	Deep	61.0	225
	Hobbs	68.0	221
Cloud Peak	Upper Frozen	5.8[1]	106
	Emerald	55.3	120
	Florence	32.7	111
Fitzpatrick	Ross	61.4	225
Popo Agie	Lower Saddlebag	55.5	195

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

3.4.5.2 Environmental Consequences

3.4.5.2.1 Proposed Action and Alternatives 1 and 2

The West Antelope II LBA tract would be mined as an integral part of the Antelope Mine. In April, 2007, Antelope received a permit modification to have the opportunity to increase production to 42 mmtpy in the future. Therefore, impacts to air quality related to lake acidification under the Proposed Action and Alternatives 1 and 2 could be slightly higher than the impacts under the No Action Alternative and would be extended for up to13 years. Antelope would employ the best measures available to mitigate any potential emission increases associated with mining the LBA tract. These would include, but would not necessarily be limited to, extension of overland conveyors to minimize haul distances and associated particulate and gaseous (nitrogen oxides, carbon oxides) emissions from coal haulage, as well as state-of-the-art blasting practices to mitigate any potential increases in nitrogen oxide emissions, which can also contribute to acidification.

3.4.5.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the mine would continue to operate as currently permitted. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases, but coal removal would not occur on the LBA tract and there would not be any impacts that contribute to lake acidification related to mining any 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 West Antelope II 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 Sections 3.4.2.3, , 3.4.3.3, 3.4.4.3 and 3.4.5.3. 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

Within the West Antelope II LBA tract, there are five water-bearing geologic units that could be disturbed by mining. In descending order, these units are recent alluvium, the Wasatch Formation overburden, the Anderson coal seam, the Fort Union Formation interburden (where present), and the Canyon coal seam. Although saturated, the interburden between the Anderson and Canyon coal seams is not considered an aquifer because it is usually comprised of claystone and siltstone which are not considered aquifer materials though they can be water-bearing (i.e. saturated). The Antelope Mine WDEQ/LQD permit document (ACC 2006a) defines the interburden as a confining unit for the Canyon coal seam. As such, the interburden is not included in this discussion. The underlying sub-coal Fort Union Formation would not be physically disturbed by mining activities but is utilized for water supply by coal mines within the general area, including the Antelope Mine.

Antelope Mine has completed 18 monitoring wells within and adjacent to the West Antelope II LBA tract: one in the alluvium of Horse Creek (PZ-HCAL-13), one in the Alluvium of Antelope Creek (WA-OWAL-1), four in the overburden (HC-OWO-7, WA-OWO-6, WA-OWO-5, WA-OWO-1), six in the Anderson coal seam (HC-OWA-8, WA-OWA-6, WA-OWA-5, WA-OWA-1, OWA-17, OWA-18), two in the interburden between Anderson and Canyon coal seams (WA-OWI-3, WA-OWI-2), three in the Canyon coal seam (HC-OWC-8, WA-OWC-3, WA-OWC-2), and one in the Anderson and Canyon combined seams (HC-OWAC-7). The locations of these monitoring wells, as well as other existing monitoring wells completed by the Antelope Mine, are shown on Figure 3-11. Data from these wells, as well as additional groundwater data collected at the Antelope Mine, were used to prepare the following description of baseline groundwater conditions within the LBA tract.

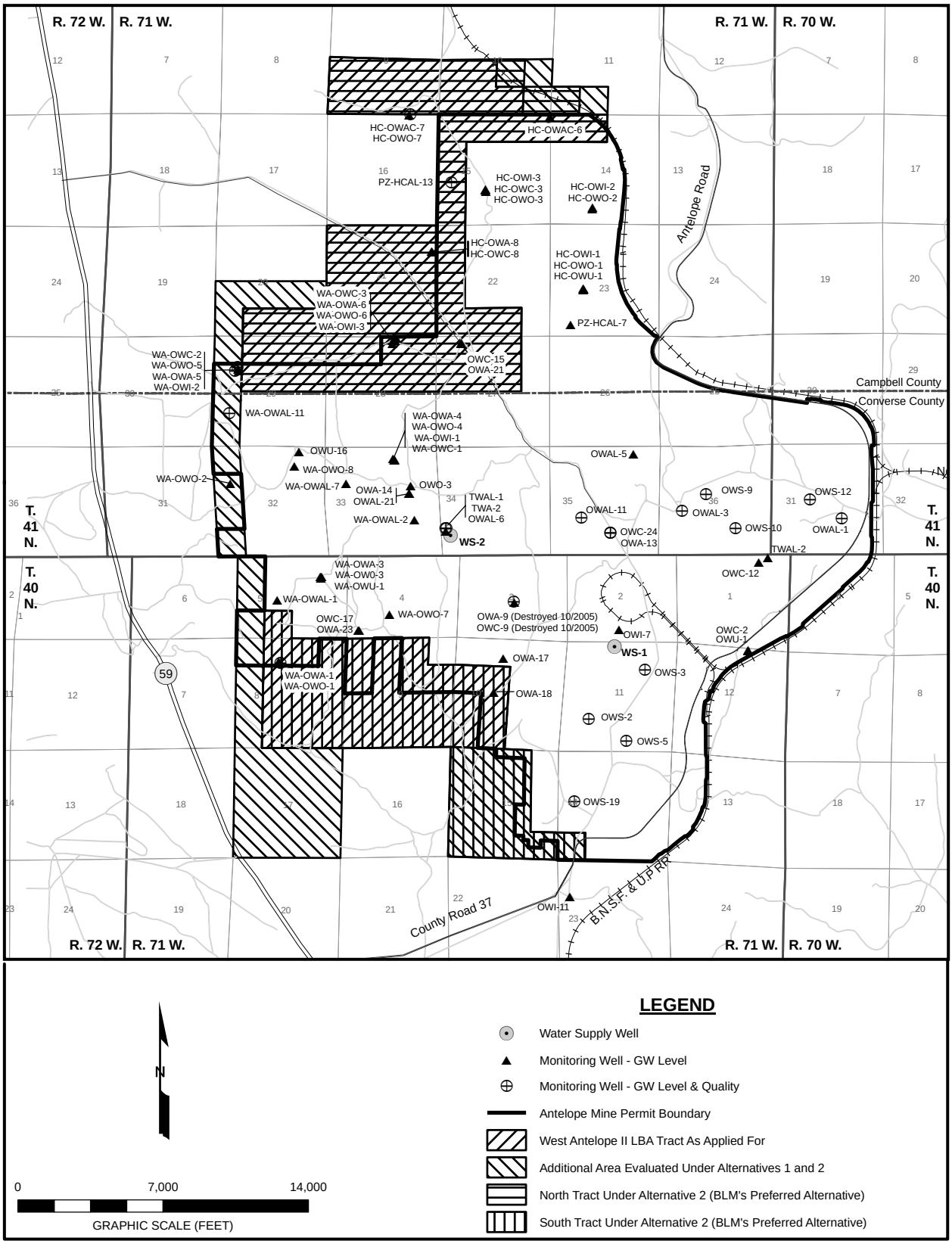


Figure 3-11. Locations of Groundwater Monitoring and Water Supply Wells at the Antelope Mine.

3.5.1.1.1 Recent Alluvium

Within the general analysis area, alluvium occurs along Horse Creek, Spring Creek and Antelope Creek. The Horse Creek alluvium typically consists of silty to clayey sand and varies from 5 to 15 ft thick within the Antelope Mine (ACC 2006a). The alluvium of Spring Creek consists of silty to clayey sand which varies from less than one foot in the upper reaches to about 20 feet thick near the confluence with Antelope Creek (ACC 2006a). The Antelope Creek alluvium generally consists of mixtures of silt and fine- to medium-grained sand and gravel which ranges in thickness from zero to 40 feet (ACC 2006a).

Minor amounts of alluvium may occur in tributaries to Horse Creek and Antelope Creek such as Spring Creek and other unnamed, normally dry tributary draws. The alluvial and colluvial deposits associated with these tributary draws are generally thin and not laterally extensive enough to be considered aquifers. The unconsolidated deposits associated with these dry draws are typically very fine-grained and have very limited permeabilities, precluding any significant storage and movement of groundwater.

Antelope Mine (ACC 2006a) has conducted aquifer tests on wells adjacent to West Antelope II LBA tract: one well was completed in the alluvium of Horse Creek and one well was completed in the alluvium of Antelope Creek. The hydraulic conductivity calculated for the Horse Creek alluvium is 0.17 ft/day. The hydraulic conductivity calculated for the Antelope Creek alluvium is 33.2 ft/day. This value may be slightly high due to leakage from underlying coal seams. The hydraulic conductivity of the Spring Creek alluvium varies from 0.01 ft/day (WA-OWAL-13) to 51.3 ft/day (WA-OWAL-9) and averages 16 ft/day for the ten alluvial wells constructed along Spring Creek (ACC 2006a).

The quality of the alluvial groundwater within and adjacent to the West Antelope II LBA tract is variable among the Horse Creek alluvium, Spring Creek alluvium and the Antelope Creek alluvium. 2006 TDS concentrations in the Horse Creek alluvial groundwater (ACC 2006) were 3,770 mg/L. TDS concentrations in the Spring Creek alluvium range from 3,730 mg/L (WA-OWAL-3) to 20,800 mg/L (WA-OWAL-6) (ACC 2006a). TDS concentrations in 2004 in the Antelope Creek alluvium were 4,705 mg/L. The alluvial groundwater is of the calcium-magnesium-sodium sulfate type, and only suitable for livestock and wildlife use.

3.5.1.1.2 Wasatch Formation

Within the PRB, the Wasatch Formation consists of interbedded sandstones, siltstones, and shale with occasional discontinuous coal stringers and clinker deposits. This description basically holds true for the West Antelope II LBA tract. Saturated strata within the Wasatch are limited in areal extent and are typically thin, lenticular sandstones which are separated laterally and vertically by finer-grained siltstone and shale deposits. The hydraulic connection between sandstone lenses is tenuous due to the intervening shales; thus, groundwater

movement through the Wasatch Formation overburden is limited. The sandstone and thin coal stringers, where saturated, will yield water to wells. This water is primarily used for livestock watering. Since the saturated sandstone and coal units within the Wasatch Formation are not continuous, the Wasatch is not considered to be a regional aquifer. However, discontinuous aquifers can be quite important locally if utilized for stock well or domestic well development.

Another geologic unit that may be considered a part of the Wasatch Formation is scoria, also called clinker or burn, which is described in Section 3.3.2.1.3 . Clinker deposits can be very permeable aquifers and can extend laterally for miles in the eastern PRB. The hydrologic function of clinker is to provide infiltration of precipitation and recharge to laterally contiguous overburden and coal beds. Scoria deposits are not present within the West Antelope II LBA tract.

Recharge to the Wasatch Formation is from the infiltration of precipitation and lateral movement of water from adjacent clinker bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, by vertical leakage into the underlying coal seams, by drainage into mine excavations, and by seepage into the alluvium along stream drainages.

For the Wasatch Formation as a whole, the discontinuous nature of the water-bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well. Martin et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^{-4} ft/day to 10^{2} ft/day, and the geometric mean hydraulic conductivity based on 203 tests was 0.2 ft/day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 ft/day, while that from 63 aquifer tests using wells completed in siltstone and claystone in the Wasatch overburden was 0.007 ft/day (Rehm et al. 1980). The hydraulic conductivity of the Wasatch Formation within and adjacent to the West Antelope II LBA tract ranges from a high of 5.6 ft/day to a low of 0.03 ft/day.

Water quality in the Wasatch Formation near the West Antelope II LBA tract is variable, with TDS concentrations ranging from 380 mg/L to 2,610 mg/L. This compares with a median TDS of 2,000 mg/L in the Wasatch Formation for the group of mines south and east of Wright, as calculated by WDEQ/LQD based on 1,052 samples, (Ogle et al. 2006). The water type is also somewhat variable, but predominantly of the sodium-sulfate type. This water is usually unsuitable for domestic use, marginal to unsuitable for irrigation and suitable for livestock and wildlife.

3.5.1.1.3 Anderson Coal

Due to its continuity, the Wyodak coal seam is considered to be a regional aquifer within the PRB. Historically, the coal seams have been considered a source of groundwater for domestic and livestock uses in the eastern PRB where they are

shallow enough to be an economical source of water.

The Wyodak coal is a single seam to the north and west of West Antelope II LBA tract. Within the tract, partings divide the Wyodak into two mineable seams: the Anderson and the Canyon (see Figure 3-4). The Anderson coal seam is the upper of the two seams and is exposed along the Antelope Creek channel due to erosional downcutting by Antelope Creek. Elsewhere within the West Antelope II LBA tract, the Anderson coal seam ranges from 30 to 40 ft thick and dips west-northwest at less than 5 degrees.

Hydraulic conductivity within the Anderson coal seam is highly variable and is reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. The yield of groundwater to wells and mine pits is the smallest where the permeability of the coal is derived primarily from localized unloading fractures. These fractures, which are the most common, were created by the expansion of the coal as the weight of the overlying sediments was slowly removed by erosion. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the south Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. 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.

Aquifer test data collected by Antelope Mine in the vicinity of the West Antelope LBA tract indicate that the Anderson coal possesses higher permeability north and east of the tract along the Horse Creek lineament. Antelope Mine (ACC 2006a) reported Anderson seam hydraulic conductivity in the LBA tract to be 2.4 ft/day at TWA-2, while that east of the tract along Horse Creek is approximately 14 ft/day based on tests of wells (TWA-1, OWA-1, OWA-2, OWA-3).

With the exception of the exposure along Antelope Creek, the Anderson coal aquifer is deeply confined in the West Antelope II LBA tract, which results in low storage coefficients. Storage coefficients measured in the vicinity of the LBA tract range from approximately 1.6×10^{-5} to 4.1×10^{-4}.

Groundwater from the Anderson coal aquifer in the vicinity of the West Antelope II LBA tract is of the sodium/bicarbonate type with TDS concentrations ranging from 370 mg/L to 5,610 mg/L. This compares to a median TDS of 952 mg/L in the Wyodak Anderson coal aquifer for the group of mines located south and west of the town of Wright, based on 832 samples, as calculated by WDEQ/LQD (Ogle et al. 2006). This water is usually unsuitable for domestic and irrigation use and suitable for livestock and wildlife because the TDS concentrations commonly exceed many suitability criteria for domestic uses. Further, at the higher TDS concentrations, the Anderson groundwater also sometimes exceeds the Wyoming agricultural standards for SAR of 8, rendering it unsuitable for agricultural uses.

SAR values measured near the West Antelope LBA II tract range from 4.4 at well TWA-2 to 9.4 at WA-OWA-1 (ACC 2006). The lower TDS groundwater may be suitable for domestic, irrigation, stock and wildlife use, however.

Prior to mining, the direction of groundwater flow within the Anderson coal aquifer was generally from recharge areas near the outcrop into the basin, following the dip of the coal. Site-specific data collected by Antelope Mine in the vicinity of the West Antelope LBA tract and presented in the GAGMO 20-year report (Hydro-Engineering 2001a) indicate that the groundwater flow directions have been influenced by mining activities and CBNG development (ACC 2006). Groundwater flow within the Anderson coal aquifer in the vicinity of the West Antelope LBA II tract is now toward a regional cone of depression located north and west of the LBA tract.

3.5.1.1.4 Canyon Coal

The Canyon coal seam is the lower of the two West Antelope LBA II tract coal aquifers, and is bounded above and below by Fort Union Formation claystones, siltstones and occasional sand lenses. Within the LBA tract the Canyon coal seam ranges from less than 15 ft to nearly 40 ft thick and dips west-northwest at less than 5 degrees. Just north of Antelope Creek, the Canyon coal seam splits into the Upper and Lower Canyon Coal seams. South of Antelope Creek, the splits in the Canyon coal seam are extensive and ACC considers the coal to be uneconomic for mining. In the northern portion of the LBA tract, in the vicinity of Horse Creek, the Canyon and Anderson seams coalesce into the single Wyodak seam (Figure 3-4).

Hydraulic conductivity within the Canyon coal seam is dependent on the amount and type of fracturing. Localized unloading fractures are primarily responsible for Canyon coal permeability within the LBA tract. Secondary permeability caused by weathering is also thought to contribute to Canyon coal permeability near Antelope Creek. East of the LBA tract the Horse Creek lineament may also locally increase the permeability.

Aquifer test data collected by Antelope Mine in the vicinity of the West Antelope II LBA tract indicate that hydraulic conductivity in the Canyon coal seam ranges from 0.17 ft/day to 1.9 ft/day for the three wells (WA-OWC-1, WA-OWC-2, WA-OWC-3) evaluated. Measured storage coefficients ranged from approximately 1.1×10^{-5} to 2.7×10^{-5}.

Based on 10 samples, groundwater from the Canyon coal aquifer at the West Antelope LBA tract is of the sodium-bicarbonate type with average TDS concentrations ranging from 300 mg/L to 620 mg/L and averaging approximately 389 mg/L. Within this range, the water is suitable for domestic, irrigation, livestock and wildlife use. As discussed above, WDEQ/LQD has calculated a median TDS of 952 mg/L in the Wyodak Anderson coal aquifer for the group of mines locates south and west of the town of Wright, based on 832 samples (Ogle

et al. 2006).

Prior to mining, the direction of groundwater flow within the Canyon coal aquifer was generally from the southwest and north toward the suboutcrop beneath the Antelope Creek alluvium (ACC 2006a). This flow pattern has been reinforced by Canyon coal removal and dewatering in the Antelope Mine east of the LBA tract. According to the GAGMO 20-Year Report (Hydro-Engineering 2001a), groundwater within the Canyon coal seam in the West Antelope LBA tract currently flows to the northwest toward a regional cone of depression (ACC 2006).

3.5.1.1.5 Subcoal Fort Union Formation

In the vicinity of the West Antelope II LBA tract, the Fort Union Formation can be divided into three hydrogeologic units: the Tongue River aquifer, the Lebo confining unit, and the Tullock aquifer (Law 1976). The Tongue River aquifer consists of lenticular fine-grained sandstone, shale, and coal. The Lebo member of the Fort Union Formation consists of siltstones and claystones interbedded with discontinuous coal and sandstone lenses of varying thicknesses. The Tullock aquifer consists of lenticular fine-grained sandstone separated by interbedded shale and siltstone.

Transmissivities are generally higher in the deeper Tullock aquifer than in the Tongue River aquifer, and many mines in the PRB have water supply wells completed in this interval (Martin et al. 1988). The average transmissivity for this member as reported by OSM (1984) is 290 ft^2/day. The water quality of the Fort Union Formation underburden is generally good. The water is of the sodium-bicarbonate type and is marginal to suitable for domestic and irrigation use and suitable for livestock and wildlife watering.

Mining does not directly disturb the hydrogeologic units below the mineable coal but many PRB mines use them for industrial water supply wells. The Antelope Mine has two water supply wells (WS-1 and WS-2) completed in the subcoal Fort Union Formation (Figure 3-11). In 2006, the measured TDS concentration in water collected from wells WS-1 and WS-2 was 590 mg/L and 470 mg/L, respectively (ACC 2006).

3.5.1.2 Environmental Consequences

3.5.1.2.1 Proposed Action and Alternatives 1 and 2

Surface coal mining impacts the quantity of the groundwater resource in two ways: 1) the coal aquifer and any water-bearing overburden strata on the mined land are removed and replaced with unconsolidated backfill, 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 West Antelope II LBA tract is leased, the area of coal removal and

reclamation would increase, which would result in an increase in the area of 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 overburden, interburden (if present), and coal on the existing leases at the Antelope Mine and replace these separate 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 11,636 acres. Mining the LBA tract as a maintenance lease would extend these impacts onto an additional area ranging from about 4,109 acres (Proposed Action) to up to about 6,309 acres (Alternatives 1 and 2).

If the West Antelope II LBA tract is leased and mined, 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 northwest and southwest of the active mine area. The extent that drawdowns would propagate away from the mine pits is a function of the water-bearing properties of the aquifer materials. In materials with high transmissivity and low storativity, drawdowns will extend further from the pit face than in materials with lower transmissivity and higher storage 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 is variable as well. The change in the water levels for the overburden range from an increase in the water level of 6.76 ft in WA-OWO-5 to a drawdown of 23.27 ft in WA-OWO-4, which is approximately 2,000 ft west of the active mine pit (Figure 3-11). The majority of the overburden wells have less then 2 ft of drawdown (ACC 2006).

Water level drawdowns propagate much farther and in a more consistent manner in the Anderson and Canyon coal seams 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 four miles of the active pits at the Antelope Mine (Hydro-Engineering 1996). In 2005 and 2006, Antelope Mine monitored water levels in 12 monitor wells completed in the Anderson coal seam and 10 monitor wells in the Canyon coal seam.

Prior to 1993, mining occurred in relatively dry portions of the Anderson coal

seam and little to no drawdown occurred within that aquifer. The maximum drawdown measured in 2005 and 2006 in an Anderson monitor well was about 95.3 ft at well WA-OWA-5 located approximately 9,300 ft (1.76 miles) northwest of the active pit (ACC 2006).

The water level in the Canyon coal seam has shown a drawdown trend in most monitor wells since 1988, apparently due to mining activities to the north of the Antelope Mine. The downward trend accelerated from 1988 to the present as a result of mining a fully saturated Canyon coal seam in the northeastern part of the Antelope Mine. The maximum drawdown measured to date in the Canyon coal seam is about 146.6 ft at WA-OWC-2, located within 9,300 ft (1.76 miles) northwest of the active pit (ACC 2006).

Drawdowns in both seams have resulted not only from mining, but also from CBNG development. Water levels and maps showing drawdowns in the vicinity of the pit are included in the annual report for the Antelope Mine filed by Antelope Mine with WDEQ/LQD each year.

Antelope Mine used a linear analytical model (line sink analysis) to predict the extent of water level drawdown in the Anderson and Canyon coal seam aquifers as a result of mining the existing leases at Antelope Mine. The results of the groundwater modeling are reported in the Mine Plan, Section MP5, Addendum MP-C of the Antelope Mine 525-T7 permit document (ACC 2006a). The predicted extent of drawdown (five ft contour) in the Anderson-Canyon coal seam over the life of the mine if the Antelope Mine acquires the West Antelope II LBA tract is shown on Figure 3-12. This prediction is approximate and is based on extrapolation of Antelope Mine's earlier predictions by extending the drawdowns westward and northward by the dimensions of the West Antelope II LBA tract. More precise predictions of the extent of drawdowns would be required in order to revise the Antelope Mine permit to include the West Antelope II LBA tract, if the Antelope Mine acquires a lease for the tract.

The subcoal aquifers are not removed or disturbed by mining, so they are not directly impacted by coal mining operations. As discussed above, Antelope Mine has two water supply wells completed in aquifers below the coal. If the LBA tract is leased by the applicant, water would be produced from these wells for a longer period of time, but Antelope Mine probably would not require additional sub-coal wells to mine the LBA tract.

As discussed in Section 3.3.1.2.1, the existing layers of sediment and rock in the area of coal removal would be replaced by generally homogenous, unconsolidated backfill material, which would recover as a single hydrostratigraphic unit. The backfill unit in the LBA tract would be in hydraulic communication with the adjacent undisturbed coal, overburden and existing backfill aquifer units. Surface infiltration recharge rates for the backfill materials should be equivalent to or somewhat greater than infiltration recharge through undisturbed overburden, due

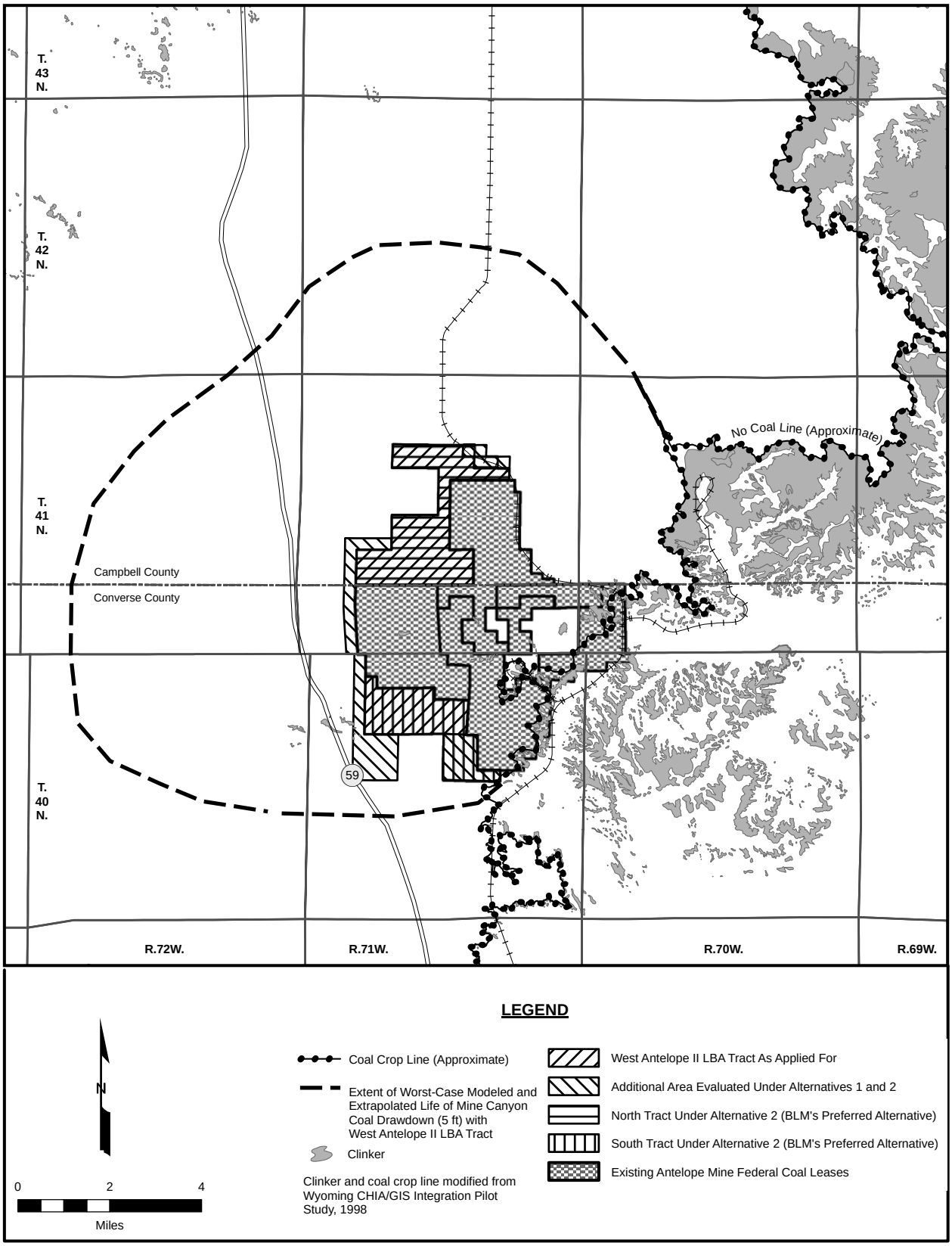


Figure 3-12. Life of Mine Drawdown Map, Resulting from Currently Approved Mining with Addition of the West Antelope II LBA Tract.

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 they are generally equal to or greater than the undisturbed overburden and coal aquifers (Van Voast et al. 1978 and Rahn 1976). The hydraulic properties of the backfill aquifer at the West Antelope II LBA tract would likely be similar to the hydraulic properties measured in existing wells completed in the backfill at nearby mines. To date, no site-specific data are available for the hydraulic properties of the mine's backfill. The hydraulic properties measured in existing wells completed in the backfill at North Antelope Rochelle Mine, located northeast of the Antelope Mine, are variable but in general comparable to the Wasatch Formation overburden and Wyodak coal. At North Antelope Rochelle Mine, the backfill aquifer has been tested at four wells, and the average hydraulic conductivity is 36 ft/day, which exceeds the average hydraulic conductivity (9.5 ft/day) reported for the Wyodak coal seam in the vicinity of the North Antelope Rochelle Mine. The data available indicate that the hydraulic conductivity of the backfill would be greater than or equal to premining coal values, suggesting that wells completed in the backfill would provide yields greater than or equal to premining coal wells.

Mining and reclamation also impact 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. Research conducted by Van Voast and Reiten (1988), who analyzed data from the Decker and Colstrip Mine areas in Montana, 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 return to approximate pre-mine conditions (Van Voast and Reiten 1988). 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. 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 West Antelope II LBA tract would be expected to be similar to groundwater quality measured in existing wells completed in the backfill at Antelope Mine. To date, seven wells have been installed to monitor water levels and water quality in backfill at the Antelope Mine. Four of these backfill monitoring wells are located in the southern part of the mine and have not yet been sampled due to a lack of saturation. Three backfill monitoring wells that were added to Antelope Mine's monitoring program in 2000

are located in the northeastern part of the mine and had sufficient saturation to be sampled. TDS concentrations in these three monitoring wells range from 2,660 to 6,000 mg/L (ACC 2006). WDEQ/LQD calculated a median TDS concentration of 3,670 mg/L for the backfill aquifer in the group of mines south and east of the town of Wright, which includes the Antelope Mine, based on 869 samples (Ogle et al. 2006).

3.5.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. The impacts to groundwater resources described above would continue as a result of existing approved mining and CBNG development. The surface and potentially some shallow aquifers in portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 surface coal mining permit, the Antelope 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 Jacobs Ranch, Black Thunder, North Antelope Rochelle and Antelope Mines. Results of these studies are included in the WDEQ/LQD mine permit (ACC 2006a). If the West Antelope II LBA tract is leased and mined, the permit for the Antelope Mine will have to be amended to include the tract, and these studies will be revised accordingly.

As discussed in Section 3.5.3, 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 Antelope Mine within and around the current permit area have been used to evaluate groundwater conditions since 1979. Through the years, some of the wells have been removed by mining, some have become gaseous and were removed from the monitor plan, and others have been added as mining has progressed. The data gathered from these wells is included in the annual reports prepared by the mine (ACC 1982-2006). The locations of the current monitoring wells are shown on Figure 3-11.

3.5.2 Surface Water

3.5.2.1 Affected Environment

The West Antelope II general analysis area is located within the Antelope Creek drainage basin, which is a major tributary of the Cheyenne River. The area within and surrounding the West Antelope II LBA tract consists of gently rolling topography. In general, the streams within this area are typical for the region, and their flow events are closely reflective of precipitation patterns. Flow events frequently result from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore percentage of annual runoff volume can be considerable. During the spring, both rain and snow storms increase soil moisture, hence decreasing infiltration capacity, and subsequent rainstorms can result in both large runoff volumes and high peak discharges. The area's surface water quality varies with streamflow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration.

The northern portion of the general analysis area is drained by several unnamed tributaries of Spring Creek and the upper reaches of Horse Creek (Figure 3-13). A short reach of Spring Creek and two short reaches of Horse Creek cross the general analysis area. Spring Creek and Horse Creek are southward-flowing ephemeral tributaries of Antelope Creek.

The southern portion of the general analysis area is drained by a few small, unnamed tributaries of Antelope Creek. A short reach of Antelope Creek crosses the southern portion of the general analysis area (Figure 3-13). Antelope Creek is an intermittent stream that, prior to mining, received a small degree of baseflow from coal seams in the Antelope Mine area.

Except for two crossings, Antelope Creek flows undisturbed from west to east across Antelope Mine's current permit area. The Antelope Creek drainage area is 796 square miles upstream of Station SW-2, which was established on Antelope Creek in March 1979 immediately downstream of the Spring Creek confluence (station SW-2 was removed from the monitoring network in 2006).

Flows and water quality data in Antelope Creek, Spring Creek, Horse Creek, and several minor tributaries have been and continue to be monitored on and near the Antelope Mine and are reported annually to the WDEQ/LQD. According to hydrologic correlation using the mine's SW-2 gauging station data on Antelope Creek, the annual average discharge is approximately 5.6 cfs (4,013 ac-ft/yr) (ACC 2005). The surface water of Antelope Creek is generally classified as a calcium-sulfate type, with an average TDS concentration of approximately 1,800 mg/L. Suspended sediment concentrations measured in samples collected from Antelope Creek within the Antelope Mine permit areas have historically ranged from 100 to 300 mg/L for stream flows up to 21.5 cfs (ACC 2005). This water, when available, is usually unsuitable for domestic use, marginal for irrigation, and suitable for

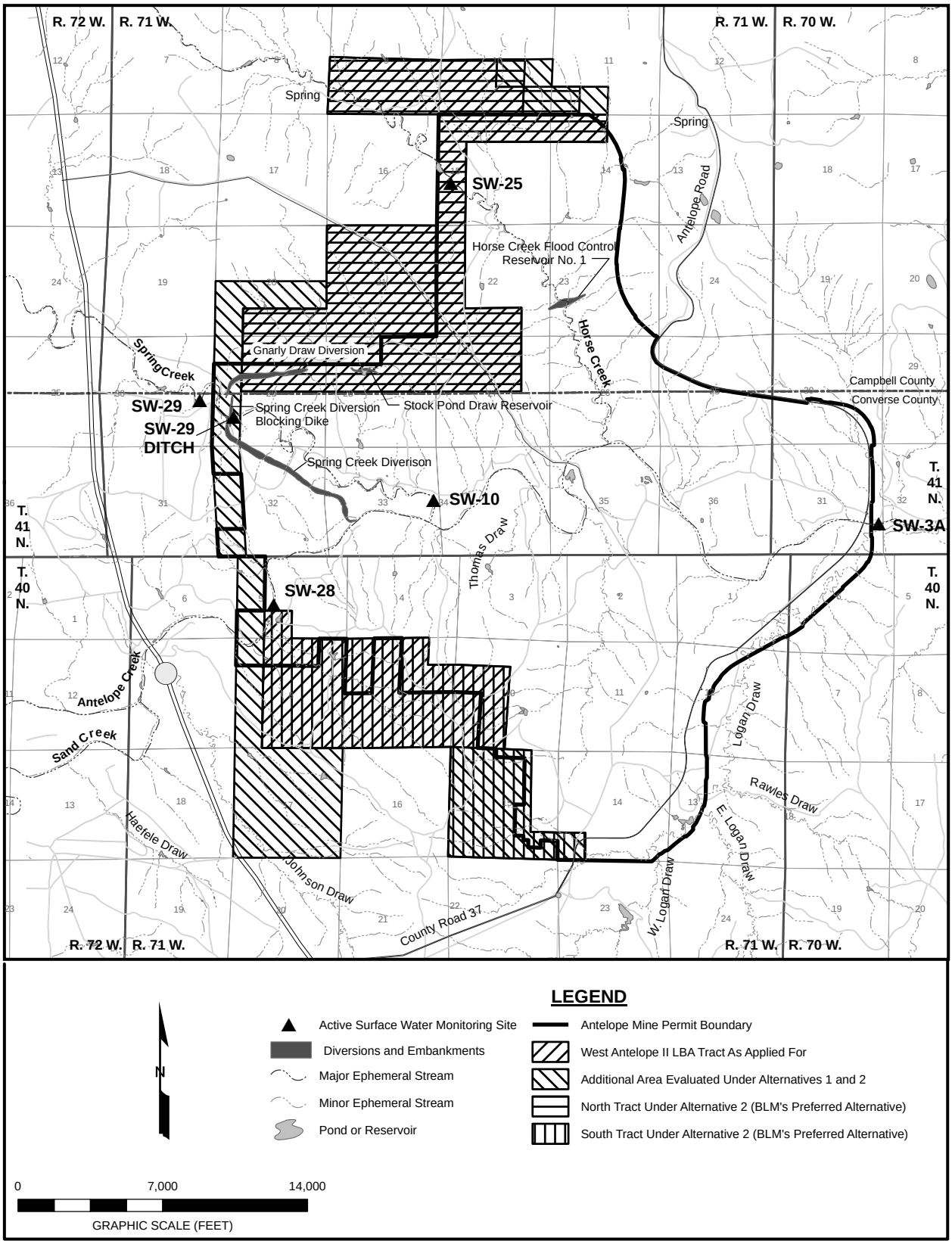


Figure 3-13. Surface Water Features Within and Adjacent to the West Antelope II Study Area.

stock and wildlife use.

Spring Creek has a relatively large drainage area of approximately 66.8 square miles. It is classified as ephemeral because it receives no measurable base flow from groundwater and flows only in response to snowmelt and precipitation runoff. Two locally-named ephemeral tributaries of Spring Creek, Stock Pond Draw and Gnarly Draw, drain a portion of the LBA tract. Recently, there has been sustained flow from April through July that is due to discharge water from CBNG activity on Spring Creek. All of the water quality and TSS samples that have been collected from Spring Creek have been during low-flow conditions. TDS concentrations of all samples collected at Spring Creek range from 210 to 8,050 mg/L, while TSS concentrations ranged from 3.3 to 2,510 mg/L.

Antelope Mine recently constructed a channel to divert Spring Creek around its upcoming mining activities and plans to disturb Spring Creek in 2007. Gnarly Draw and Stock Pond Draw are within the current permit area for the Antelope Mine and will be disturbed under the currently approved permit. Gnarly Draw will be diverted and Stock Pond Draw will receive a flood control reservoir (Figure 3-13). Both Gnarly Draw and Stock Pond Draw will be disturbed within the next five years of mining.

Horse Creek has a drainage area of about 15 square miles. It is classified as ephemeral and the average annual runoff near its confluence with Antelope Creek is 140 ac-ft/yr for the years 1991 through 1996. In 1997 an anomalously large runoff volume of 3,134 ac-ft/yr was measured at Station SW-9. Horse Creek is currently disturbed by mining in the Horse Creek Amendment Area of the Antelope Mine. As part of the mining activities in Horse Creek, Station SW-9 was removed in 1998. Replacement monitoring stations have been installed, but these sites do not have a long history of data to obtain an effective average of annual runoff. The surface water in Horse Creek is typically of the calcium-magnesium-sodium-sulfate type. TDS concentrations range from 1,020 to 5,888 mg/L, and average 3,507 mg/L.

3.5.2.2 Environmental Consequences

3.5.2.2.1 Proposed Action and Alternatives 1 and 2

Changes in runoff characteristics and sediment discharges would occur during mining of the LBA tract as a result of the destruction and reconstruction of drainage channels and the use of sediment control structures to manage discharges of surface water. 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 that are located inside the mine permit area before the surface runoff water is allowed to leave the permit area.

Because the LBA tract would be mined as an extension of the existing mine under the Proposed Action and Alternatives 1 and 2, 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.

The loss of soil structure would act to increase runoff rates in reclaimed areas of the LBA tract after the coal is removed. 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 maintain runoff to approximately premining levels.

Significant runoff from the West Antelope II LBA tract may occur in the Antelope Creek, Horse Creek, and/or Spring Creek drainages. No mining has been conducted on Antelope Creek nor on an adjacent buffer zone of 100 ft on either side of the creek within the existing Antelope Mine coal leases. No mining is planned through the Antelope Creek channel nor through the adjacent buffer zone; therefore, with the exception of two crossings, it passes unimpeded through the LBA tract and mine area.

A flood control reservoir is located on Horse Creek upstream of the mining activities. Based on Antelope Mine's permitted mine plan, another flood control reservoir is planned to be constructed upstream of the existing structure. An additional flood control reservoir may be required to provide flood control for the West Antelope II LBA tract. This structure would be located on Horse Creek west of the tract. Under the Proposed Action, the existing diversion on Spring Creek will provide adequate flood protection for the downstream mining activities. Under Alternatives 1 and 2, the channel would either be diverted or a large flood control reservoir would be constructed. The remaining channels within the West Antelope II LBA tract are small enough that flood control structures would not be constructed; flows would accrue to the mine pits and would be evacuated by pump.

The impacts described above would be similar for both the Proposed Action and Alternatives 1 and 2, and they are similar to the expected impacts for the currently permitted mining operation.

<u>3.5.2.2.2 No Action Alternative</u>

Under the No Action Alternative, the West Antelope coal lease application would be rejected and coal removal would not occur on the tract. The impacts to surface water resources described above would continue within the existing mine permit

area as a result of currently approved mining and CBNG development. The surface in portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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, major channels that are disturbed by surface coal mining operations on the West Antelope II LBA tract would be restored. Surface water flow, quality, and sediment discharge would approximate premining conditions. The drainages that are disturbed when the coal is recovered from the tract would be reclaimed to exhibit channel geometry characteristics similar to the premining characteristics. The major channels would be restored in approximately the same location as the natural channel and hydrologic functions and features, including alluvial groundwater-surface water interaction and premining pools and runs, would be restored.

Other WDEQ/LQD permit requirements for the existing Antelope Mine include constructing sediment control structures to manage discharges of surface water from the current 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 West Antelope II LBA tract during the permitting process, if it is leased.

Monitoring requirements for the existing Antelope Mine include a monitoring program to assure that ponds always have adequate space reserved for sediment accumulation and for collection of water quality samples from Antelope Creek at both the Upper (SW-28) and Lower (SW-3A) Stations (Figure 3-13) on a quarterly basis. These requirements would be extended to include the West Antelope II LBA tract when the mine permit is amended to include the tract.

3.5.3 Water Rights

3.5.3.1 Affected Environment

Wyoming SEO administers water rights in Wyoming. Water rights are granted for both groundwater and surface water. Water Records of the SEO were searched for groundwater rights within a three-mile radius of the West Antelope II LBA tract, as required for WDEQ mine permitting. At the time of the search, SEO data indicated there are 980 permitted water wells within three miles of the tract. The majority of these wells (884) are owned by either coal mining companies or CBNG producers. Of the 96 other wells, 51 are permitted for stock watering purposes, 15 are permitted for domestic and/or stock use, 3 for industrial purposes, and 27

for monitoring or miscellaneous use. A listing of the non-coal mine related groundwater rights is presented in Appendix G.

SEO records were searched for surface water rights using the SEO's AREV program. The search was conducted for surface-water rights within one-half mile of the tract and three miles downstream from the tract, as required for WDEQ mine permitting.

At the time of the search, SEO records indicated 260 permitted surface water rights within the search area for the LBA tract. One hundred eighty four of the surface water rights are held by coal mining companies. Of the remaining 76 surface water rights, 71 are permitted for stock watering, 2 for irrigiation, 1 for stock watering or irrigation, and 2 for industrial purposes. A listing of the non-coal mine related surface water rights is presented in Appendix G.

3.5.3.2 Environmental Consequences

3.5.3.2.1 Proposed Action and Alternatives 1 and 2

In November 2007, Wyoming SEO records indicate a total of 980 permitted water wells are located within three miles of the LBA tract. As discussed above, most of these wells are owned by coal mining or CBNG companies. Of the non-coal mine related wells within the search area, approximately 53 percent are permitted for stock watering, 16 percent are permitted for domestic and/or stock use, 28 percent are permitted for monitoring or miscellaneous use, and three percent are permitted for industrial uses.

Some of these privately permitted water wells would likely be impacted (either directly by removal of the well or indirectly by water level drawdown) by approved mining operations occurring at the Antelope and adjacent mines. Additional water wells would likely be affected if the LBA tract is leased and mined. Several 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 coal seam (this excludes wells constructed for monitoring, mine dewatering, or CBNG production). These wells are presented in Table 3-10.

3.5.3.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal would not occur on the tract. The impacts to water rights associated with existing approved mining and CBNG development would continue to occur. The surface of portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

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

Table 3-10. Water Supply Wells Possibly Subject to Drawdown if the West Antelope II LBA Tract is Mined.

SEO Permit Number	Applicant	Use	Yield (gpm)	Well Depth (ft)	Depth to Water (ft)
P95333W	Frances Putnam	Domestic, Stock	6	360	45
P5611P	Robert E. Isenberger	Stock	5	344	280
P23598W	Patricia L. Isenberger	Stock	10	252	100
P5612P	Patricia L. Isenberger-Litton	Stock	1	350	60
P23601P	Patricia L. Isenberger	Stock	7	250	-1
P23595P	Patricia L. Isenberger	Stock	10	525	-4
P18856P	Floyd C. Reno & Son's	Stock	10	300	140
P17459W	Floyd C. Reno & Son's	Stock	20	357	180
P18149P	WY Board of Land Commissioners	Stock	10	362	100
P130523W	Floyd C. Reno & Son's Bill Moore, Jr., / W.I. Moore Ranch Co. Moore	Stock	4	370	190
P94894W	Ray Bell	Stock	5	549	230
P29020W	USDA Forest Service	Stock	5	440	140
P18147P	Floyd C. Reno & Son's Wyoming Board of Land Commissioners	Stock	5	350	110

Note: Based on their reported completion intervals, wells in this table are believed to be completed in the Wyodak coal seam and are within the additional area of five ft or more drawdown caused by mining the West Antelope II LBA tract. Wells impacted by the No Action Alternative are already addressed in the Antelope Mine's WDEQ/LQD mine permit document (ACC 2006a).

3.5.3.3 Regulatory Compliance, Mitigation and Monitoring

In compliance with SMCRA and Wyoming regulations, mine operators are required to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality; this mitigation is thus part of the Proposed Action and Alternatives 1 and 2. The most probable source of replacement water would be one of the aquifers underlying the Anderson and Canyon coal seams. For example, the subcoal Fort Union Formation aquifers are not removed or disturbed by coal mining, so they are not directly impacted by coal mining activity.

If the West Antelope II 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 with water of equivalent quality and quantity if they are determined to be affected by mining.

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 Proposed Action and Alternatives 1 and 2 compared with the area of coal and overburden removal and overburden replacement and associated groundwater drawdowns if the West Antelope II LBA tract is not leased and mined. 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 backfill area in the PRB suggest that there would be an adequate quantity of water in the backfill to replace current use, which is generally for livestock. Water quality in the backfill would generally be expected to meet the Wyoming Class III standards for use as stock water, which was the primary premining use of water from the coal seams.

3.6 Alluvial Valley Floors

3.6.1 Affected Environment

SMCRA prohibits surface coal mining and reclamation operations that would interrupt, discontinue, or preclude farming on AVFs or cause material damage to the quantity or quality of water systems that supply AVFs. These prohibitions do not apply if the premining land use of 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. The prohibitions also apply to AVFs that are downstream of the area of disturbance but might be affected by disruptions of streamflow. If WDEQ determines that an AVF is not significant to agriculture, that AVF 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 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.

Investigations have been conducted by the Antelope Mine to determine the presence of AVFs within the existing Antelope Mine permit area. These AVF studies were conducted as part of the WDEQ/LQD mine permitting process for the purpose of recovering coal in the mine's existing leases. The results of these studies for the existing permit area are as follows:

- Antelope Creek has been investigated for the presence of an AVF (ACC

2005a). The area of the investigation extends more than a mile upstream of the current permit area and includes a portion of the West Antelope II LBA tract. A portion of Antelope Creek within the current permit area has been designated by WDEQ/LQD as "possible subirrigated AVF of minor importance to agriculture". Antelope Mine's approved mining plan avoids disturbing Antelope Creek and an adjacent buffer zone.

- Horse Creek has been investigated for the presence of an AVF (ACC 2005a). WDEQ/LQD has designated 61.2 acres in a narrow band adjacent to the channel and extending about a half mile upstream of the current permit boundary as an AVF designation. ACC's current mining plan would disturb 50.6 acres of that AVF (ACC 2001a). The portions of Horse Creek that have been declared an AVF were determined to be insignificant to farming by WDEQ/LQD (ACC 2001a).

- Spring Creek has been investigated for the presence of an AVF (ACC 2005a). Spring Creek was determined to contain 27.6 acres of AVF, however, historical efforts to employ flood irrigation within the Spring Creek Valley have not been successful (ACC 2006). The portions of Spring Creek that have been declared an AVF were determined to be non-significant to farming by WDEQ/LQD (ACC 2006a).

The general analysis area for the West Antelope II LBA tract includes short reaches of Antelope, Horse, and Spring Creeks which have not yet been formally evaluated for the presence of AVFs. The portions of those creeks that have not been formally evaluated for AVFs are upstream of the areas that have been investigated for the presence of AVFs within the current permit area (Figure 3-14).

As discussed previously, the declared AVF on Antelope Creek will not be disturbed by mining operations at the Antelope Mine. There are stream-laid deposits in portions of Horse Creek and Spring Creek within the general analysis area that are potential AVFs and may be mined and reclaimed in accordance with the WDEQ/LQD regulations.

A site-specific study will be part of the mine permitting process if a lease sale is held and the LBA tract is permitted for mining. Declarations of the presence or absence of AVFs, their significance to agriculture, and the appropriate perimeters will then be made by the WDEQ/LQD. The BLM study area for the West Antelope II LBA tract is undeveloped rangeland; therefore, it is reasonable to assume that mining would be permitted if the WDEQ/LQD determines AVFs are present within the LBA tract that is leased.

3.6.2 Environmental Consequences

3.6.2.1 Proposed Action and Alternatives 1 and 2

As indicated above, the entire West Antelope II general analysis area has not yet

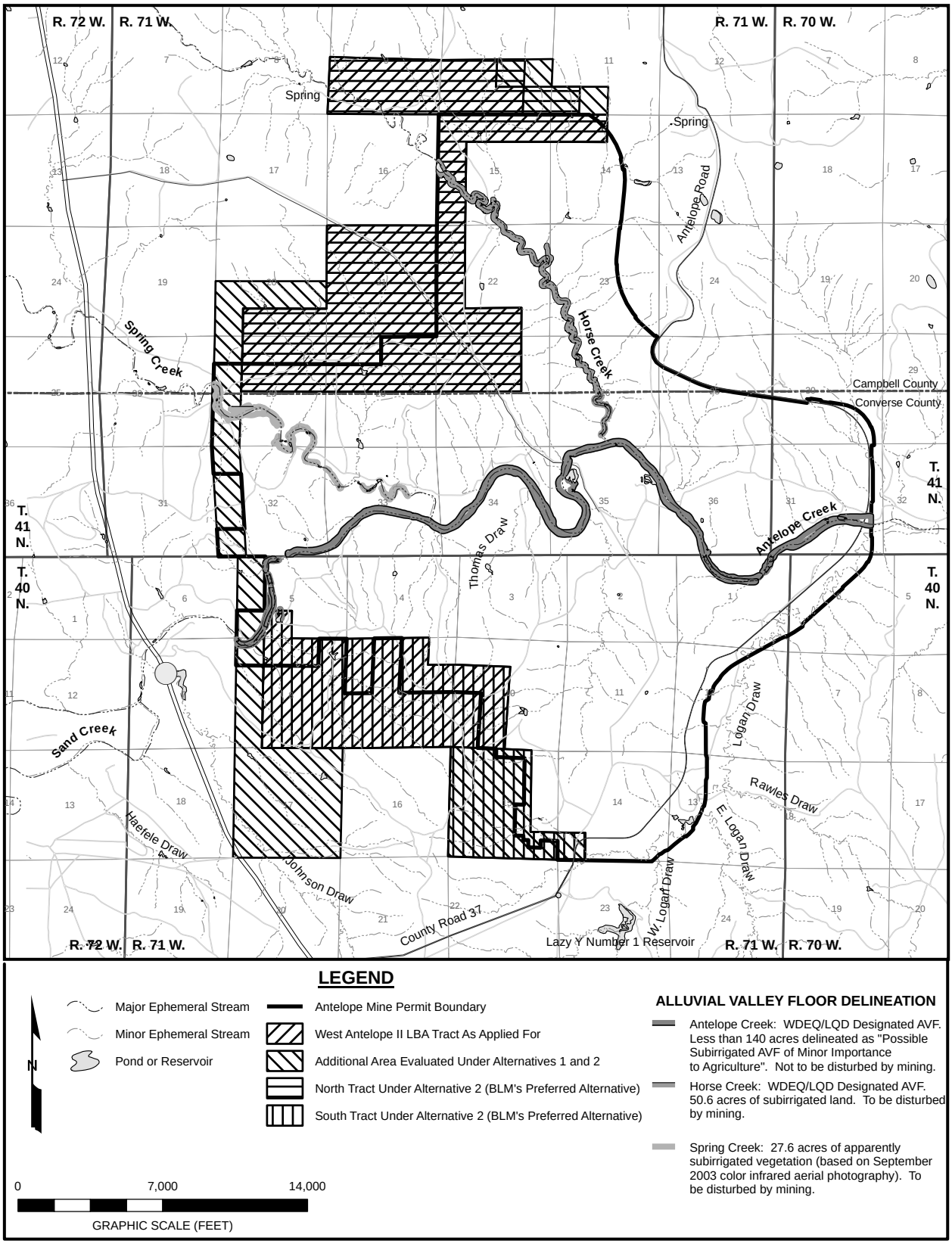


Figure 3-14. Declared Alluvial Valley Floors Within and Adjacent to the West Antelope II Study Area.

been formally evaluated for the presence of AVFs, however, previous investigations have identified AVFs along Antelope Creek, Spring Creek and Horse Creek within and adjacent to the West Antelope II LBA tract.

ACC's approved mining plan avoids disturbing Antelope Creek and an adjacent designated buffer zone. Therefore, any portions of the Antelope Creek valley that are included in the BLM study area for the West Antelope II LBA tract would not be mined, if the tract is leased and ACC acquires the tract.

WDEQ/LQD has determined that the AVFs on Horse Creek and Spring Creek within the current Antelope Mine permit area are not significant to agriculture (ACC 2006a). With the exception of an unsuccessful attempt at flood irrigation on Spring Creek, there is no present or historical record of agricultural use, other than undeveloped rangeland, in this area. Therefore, if WDEQ/LQD determines that an AVF is present in the general analysis area on either Horse Creek or Spring Creek, it would be reasonable to assume that mining would be permitted on that AVF because the lack of agricultural development in this area would preclude a determination of significance to agriculture.

Streamflows in drainages within the West Antelope II 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 water 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 West Antelope II LBA tract.

3.6.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope coal lease application would be rejected and coal removal would not occur on the tract. The impacts to AVFs associated with existing approved mining would continue to occur. The surface of portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 affect AVFs that are determined to be significant to agriculture. Impacts to designated AVFs are generally not permitted if the AVF is determined to be significant to agriculture. If the AVF is determined not to be significant to agriculture, or if the permit to affect the AVF was issued prior to the effective date of SMCRA, the AVF 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 and consolidated cases Rapanos *v.* United

States and Carabell *v.* United States, known as the "Rapanos" decision, June 19, 2006). 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 or two 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 or no field verification.

Several types of wetland systems are present within the general analysis area (Figure 3-15). These wetland systems are limited in size; however, the vegetation in most of 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 along the major drainages. Palustrine wetlands are the most common and abundant wetland on the analysis area and occur primarily along Antelope Creek, Horse Creek and Spring Creek. These wetland areas are supported by the saturated soils along the banks of the drainages with hydrology provided primarily from surface runoff from adjacent uplands and discharged CBNG waters.

In addition to wetlands, the general analysis area may include jurisdictional other waters of the U.S. as defined by 33 CFR 328.3. These other waters of the U.S. are primarily ephemeral stream channels, open water and other stream channels that carry water but do not meet the criteria for classification as wetlands.

Wetland inventories were based on USFWS NWI mapping, 2006-2007 vegetation mapping in the field and wetland inventories completed for the Antelope Mine in areas within or adjacent to the general analysis area. The area of investigation includes the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated under Alternatives 1 and 2) and a ¼-mile disturbance buffer for lands not located within a currently approved mine permit area. Some 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 (9,520.8 acres, of which 2,115.5 acres are within the current Antelope Coal Mine permit area), a total of approximately 42.9 acres of wetlands and other waters of the U.S. have been identified (Figure 3-15). Of this 42.9 acres identified, approximately 31.7 acres are vegetated wetlands and the remaining 11.2 acres are pond or channel other waters of the U.S. The majority of the wetlands are associated with the Antelope Creek, Horse Creek and Spring Creek stream channels. The majority of the channel other waters of the U.S. are associated with the ephemeral stream channels present on the area.

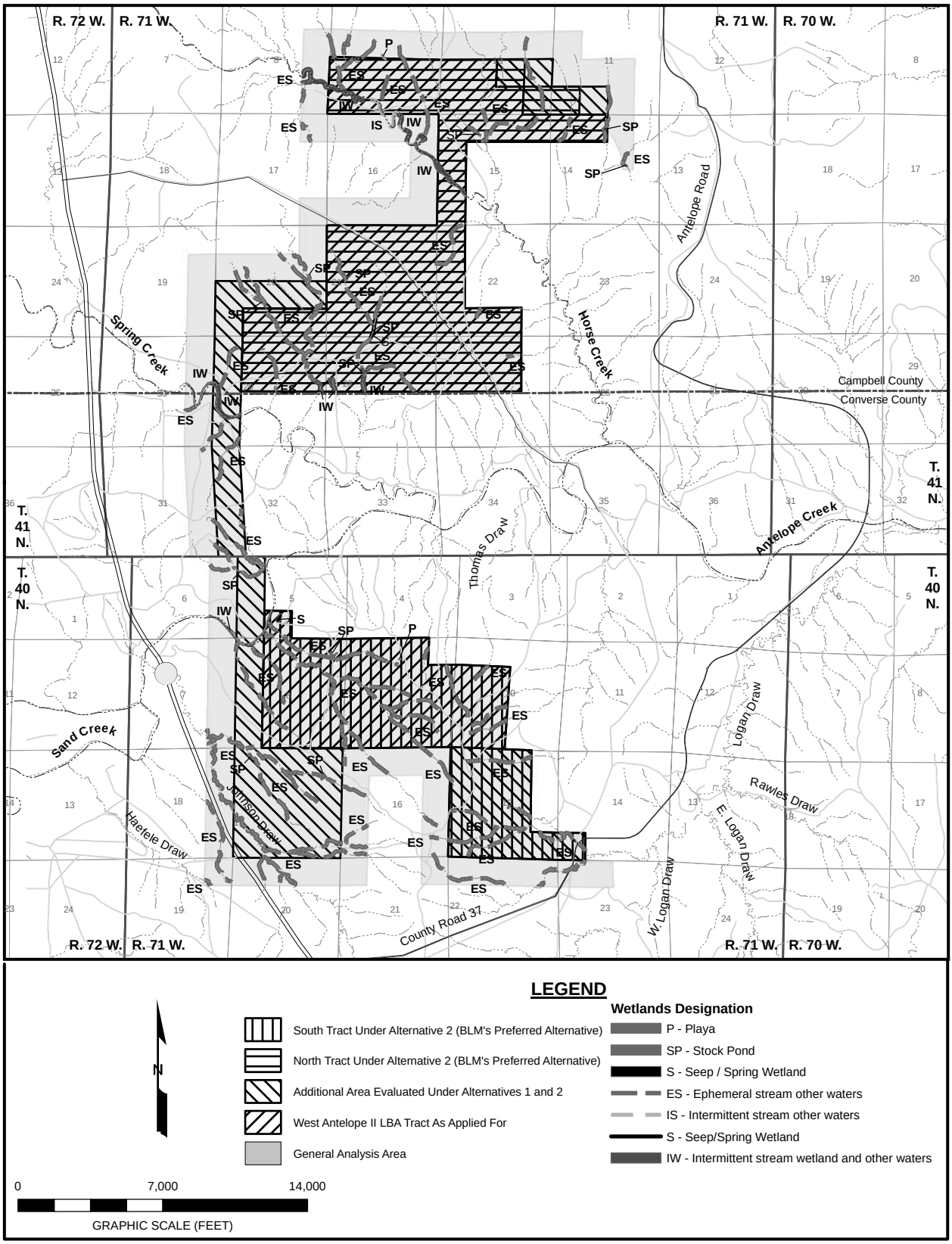


Figure 3-15. Wetlands and Other Waters Within the West Antelope II General Analysis Area.

Non-jurisdictional wetlands or other waters of the U.S. were included in the above acreages and were not identified separately in the study area because only the COE has the authorization to make such determinations. However, two small playas (less than one acre) were observed in the general analysis area (Figure 3-15). A formal wetland inventory would be completed and submitted to the COE for verification as part of the permitting process.

3.7.2 Environmental Consequences

3.7.2.1 Proposed Action and Alternatives 1 and 2

Based on previous surveys approved by the COE, NWI mapping by USFWS, and the vegetation mapping completed in 2006-2007, a maximum of approximately 42.9 acres of wetland and other waters of the U.S. would be disturbed if the LBA tract is leased and subsequently mined under the largest tract configuration (Alternatives 1 or 2).

A formal wetland delineation has been confirmed by the COE for the wetlands and other waters in the 2,116 acres of the wetland analysis area that lie within Antelope Coal Mine's current permit area. Wetland inventories covering the remainder of the wetland analysis area have been conducted but have not yet been submitted to the COE for verification. This wetland inventory would be submitted to the COE for verification as part of the process of obtaining a surface coal mining permit. In Wyoming, once the delineation has been verified, it is made a part of the mine permit document. The reclamation plan is then revised to incorporate the replacement of at least equal types and numbers of jurisdictional wetland acreages.

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 the COE and replacement would be in accordance with the requirements of Section 404 of the Clean Water Act as determined by the COE.

3.7.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal would not occur on the West Antelope II LBA tract. The impacts to wetlands on the existing Antelope Coal Mine leases would occur as currently permitted. The surface portions of the West Antelope II LBA tract within the Antelope Coal Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 and other waters 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 and other waters present. There are special required permitting procedures to assure that after mining there will be no net loss of wetlands. The 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. Mitigation for impacts to non-jurisdictional wetlands located on the tract will be specified during the permitting process as required by the authorized state or federal agency (which may include the WDEQ, the Office of Surface Mining, or the federal surface managing agency, if any federal surface is included in the tract) or the private surface owner. Surface land ownership on the West Antelope II general analysis area is private and federal (see Section 3.11). The federal surface is administered by the USDA-FS. 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 may also require replacement of sites with hydrologic significance. If any playas with hydrologic significance are located on the tract that is leased, WDEQ/LQD would also require their replacement.

Wetland mitigation may begin prior to actual mining of this tract depending on hydrologic resources available. Interim mitigation may be provided through the many sediment control structures (ponds) created during mining, drainage diversions, removal of livestock from riparian areas and repair of damaged wetlands. Actual final mitigation will be at a minimum of one to one for all jurisdictional wetland features as required and dictated by the COE.

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 the COE, which has special required permitting procedures to assure that there will be no net loss of wetlands after reclamation.

3.8 Soils

3.8.1 Affected Environment

The soils analysis area for the West Antelope II EIS includes the general analysis area (approximately 9,521 acres) as well as an additional 481 acres, for a total soils study area of about 10,002 acres. Part of the soils analysis area (approximately 2,116 acres) lies within portions of three previously permitted Antelope Coal Mine areas: Antelope Permit Boundary (236.5 acres), Horse Creek Amendment (949.3 acres), and the West Antelope Amendment (929.7 acres). The entire soils analysis area is included in portions of the Natural Resources Conservation Service (NRCS) Order 3 soil surveys of southern Campbell County, Wyoming, (Westerman and Prink, 2004) and northern Converse County, Wyoming, (Reckner 1986). The permitted portions of the soils analysis area have been previously mapped to the detailed Order 1-2 level as part of the Antelope Coal integrated baseline soil survey - Antelope (Commonwealth Associates 1980), Horse Creek (Sugnet and Associates, 1999), and West Antelope (Western Water Consultants 2004). The detailed soil survey of the remaining portion of the West Antelope II soils analysis area (areas not previously mapped to the Order 1-2 level) was conducted during late 2007 and the spring of 2008. This survey included detailed soils mapping, profile descriptions, and sampling for laboratory characterization of all dominant soils.

All soil surveys were completed to the Order 1-2 or Order 3 level of intensity in accordance with criteria contained in WDEQ/LQD Guideline No. 1, Soils and Overburden (WDEQ 1996), which outlines the required soils information necessary for a coal mining operation. The inventories included soils field sampling, profile descriptions 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.

The soil types and depths on the soils analysis area are similar to soils currently being salvaged and utilized for reclamation at the adjacent Antelope Mine and other nearby mines in the southern PRB. A total of 36 map unit groups are delineated in the West Antelope II soils study area. There are 21 soil consociations, 12 soil complexes, and 3 miscellaneous units (Disturbed Land, Reclaimed Land, and Water).

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 the study area: 1) soils developing predominantly in thin residuum from sandstone or shale on upland ridges, 2) soils developing predominantly in slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands, 3) 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. The major soil series encountered within the study area were grouped according to these categories as follows:

Soils developing predominantly in thin residuum from sandstone or shale on upland ridges (4,417.8 acres, 44.2% of total soils analysis area)

- Samday clay, 0 to 15% slopes (map unit 24)
- Shingle clay loam, 0 to 15% slopes (map unit 26)
- Tassel sandy loam, 0 to 30% slopes (map unit 28)
- Worf sandy loam, 0 to 6% slopes (map unit 37)
- Samday-Shingle-Worf complex, 0 to 15% slopes (map unit 101)
- Shingle-Samday complex, 3 to 30% (map unit 104)
- Wibaux-Rock Outcrop-Shingle complex, 6 to 45% slopes (map unit 106)
- Shingle-Worf-Rock Outcrop complex, 3 to 30% slopes (map unit 108)
- Rock Outcrop-Shingle-Samday-Tassel complex, 3 to 30% slopes (map unit 110)
- Niobrara-Rock Outcrop-Tullock, dry complex, 3 to 30% slopes (map unit 171)
- Ustic Torriorthents, gullied (map unit 401)

Soils developing predominantly in fine-loamy and fine-textured slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands (3,288.5 acres, 32.9% of total)

- Cushman sandy loam, 0 to 10% slopes (map units 7 and 7SL)
- Forkwood loam, 0 to 9% (map unit 11)
- Kim loam, 0 to 3% and 9 to 35% slopes (map units 15 and 15E)
- Razor clay loam, 0 to 6% slopes (map unit 22)
- Renohill clay loam, 0 to 6% slopes (map unit 23)
- Cushman-Shingle complex, 3 to 35% slopes (map unit 25)
- Thedalund clay loam, 0 to 6% slopes (map unit 31 and 32)
- Thedalund-Shingle clay loams, 9 to 30% slopes (map unit 32)
- Ulm clay loam, 0 to 6% slopes (map unit 33)
- Forkwood-Cushman complex, 0 to 15% slopes (map unit 38)
- Zigweid loam to clay loam, 0 to 3% and 3 to 6% slopes (map units 39, 39B)

Soils developing predominantly in coarse-textured alluvium and sandy eolian deposits on rolling uplands (2,180.6 acres, 21.8% of total)

- Terro-Tassel sandy loams, 3 to 15% slopes (map unit 29)
- Orpha loamy sand, 0 to 15% slopes (map unit 34)
- Vonalee fine sandy loam, 0 to 6% slopes (map unit 35)
- Otero sandy loam, 3 to 6% slopes (map unit 36)

- Niobrara-Rock Outcrop-Tullock, dry complex, 3 to 30% slopes (map unit 171)
- Vonalee-Terro fine sandy loams, 2 to 10% slopes (map unit 236)

Drainage soils developing in mixed streamlain alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins (567.5 acres, 5.7% of total)

- Absted-Arvada-Bone complex, 0 to 6% slopes (map unit 1)
- Draknab loamy sand, 0 to 3% slopes (map unit 2)
- Clarkelen sandy loam, 0 to 3% slopes (map units 13 and 13M)
- Haverdad loam, 0 to 9% slopes (map unit 14)
- Typic Fluvaquents complex, very wet (map unit 301)
- Typic Fluvaquents complex (map unit 302)

The soil surveys indicate that the amount of suitable topsoil available for redistribution on all disturbed acres within the soils analysis area during reclamation would have an average depth of about 19 inches (1.6 ft). Areas of unsuitable soils include sites with high salinity, high sodicity, or excessive clay content. The area is expected to have adequate quality and quantity of soil for reclamation. The soil surveys have located hydric soils and/or inclusions of hydric soils which are one component used in identifying wetlands.

3.8.2 Environmental Consequences

3.8.2.1 Proposed Action and Alternatives 1 and 2

Potential impacts to soil resources on the LBA tract after final reclamation under the Proposed Action or Alternatives 1 or 2 are quantified as follows. Under the currently approved mining and reclamation plan, approximately 12,105 acres of soil resources will be disturbed in order to mine the coal in the existing leases at the Antelope Mine (Table 3-1). If the West Antelope II LBA tract is leased, disturbance related to coal mining would directly affect approximately 4,314 additional acres of soil resources on and adjacent to the tract under the Proposed Action, and up to 6,625 additional acres under Alternatives 1 and 2 (Table 3-1). Average topsoil thickness would be about 19 inches (1.6 ft) across the entire reclaimed surface. The types of soils and quantities of suitable soil included in the West Antelope II LBA tract under the Proposed Action and Alternatives 1 and 2 are similar to the soils on the existing leases at the Antelope Mine.

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 replaced topsoil should support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

There most likely would be an increase in the near-surface bulk density of the soil resources on the reclaimed areas. As a result, the average soil infiltration rates would likely 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 West Antelope II 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.

3.8.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts to soils would not occur on the portion of the 4,314 acres (Proposed Action) or up to 6,625 acres (Alternatives 1 and 2) of land that will not be disturbed under the currently approved surface coal mining permit. Soil removal and replacement would occur on the existing Antelope Mine leases as currently permitted. Soils on portions of the West Antelope II area adjacent to the Antelope Mine may be disturbed to recover the coal in the existing leases. As discussed in Section 2.2, a decision to reject the West Antelope II 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 feet 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.

These measures are required by regulation and are therefore considered to be part of the Proposed Action and Alternatives 1 and 2 for the West Antelope II LBA tract.

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 (9,520.8 total acres) is the general analysis area, which includes the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated by BLM under Alternatives 1 and 2) and a ¼-mile buffer, which is the assumed area that would be disturbed in order to recover the coal in the LBA tract. The ¼-mile buffer includes only those lands that are not already approved for disturbance under currently approved coal leases and mine plans. Portions of the vegetation analysis area lie within the current Antelope Mine permit area and were previously mapped and sampled in accordance with the current WDEQ/LQD mine permitting requirements. The balance of this vegetation assessment was completed by Intermountain Resources of Laramie, Wyoming in 2006 and 2007. The vegetation communities in this area were appraised and mapped to provide a baseline assessment.

The vegetation within the analysis area consists of species common to eastern Wyoming and is consistent with vegetation that occurs within the adjacent Antelope Coal Mine permit area. A total of nine vegetation types/map units have been identified and mapped within the West Antelope II LBA vegetation analysis area. Previously disturbed areas were also mapped. The vegetation types include blue grama roughland, blue grama upland, birdsfoot sagebrush upland, grassy bottom, big sagebrush upland, silver sagebrush lowland, greasewood lowland, wetland/water, and treated grazing land ("treated grazing land" is defined in WDEQ/LQD Rules, Chapter 1, section 2 (xi)). The predominant vegetation types, in terms of total acres of occurrence in the vegetation analysis area, are the blue grama upland (41.65 percent), blue grama roughland (20.36 percent), big sagebrush upland (14.10 percent) and birdsfoot sagebrush upland (14.14 percent), which occur primarily on the level uplands and adjacent breaks (Table 3-11).

The blue grama upland vegetation type was the dominant type mapped on the analysis area and is characterized by perennial grasses. Dominant plant species are blue grama, needleandthread, western wheatgrass, Sandberg bluegrass and

other upland grasses of the region. Threadleaf sedge, pricklypear cactus and alkali sacaton are also common on some areas. Annual grasses and forbs were common on this type in 2007 while full shrubs and subshrubs were generally uncommon. This type is generally found on relatively flat to gently sloping areas with loamy and sandy loam soils.

Table 3-11. Vegetation Types Identified and Mapped Within the West Antelope II LBA Tract Vegetation Analysis Area.

Vegetation Type	Acres	Percent of Area
Blue Grama Upland	3,965.38	41.65
Blue Grama Roughland	1,938.35	20.36
Big Sagebrush Upland	1,342.40	14.10
Birdsfoot Sagebrush Upland	1,346.01	14.14
Treated Grazing Land	475.50	4.99
Grassy Bottom	102.57	1.08
Disturbed Land	109.76	1.15
Wetland/Water	42.90	0.45
Silver Sagebrush Lowland	193.00	2.03
Greasewood Lowland	4.88	0.05
Total	**9,520.75**	**100.00**

Source: Intermountain Resources (2006 & 2007)

The blue grama roughland vegetation type total vegetation cover is sparser than on the blue grama upland with the diversity of vascular plant species slightly lower. Common species include most of those found in the more extensive blue grama upland type~~s~~, but in addition, such species as prairie sandreed, scarlet globemallow, birdsfoot sagebrush and broom snakeweed are also common. Full shrubs and subshrubs are present in more abundance than on the blue grama upland type but do not dominate these areas. The blue grama roughland type is generally found on sloping to steeply sloping and erosive topography with shallow to deep soils.

The big sagebrush upland is dominated by big sagebrush and perennial grasses. Other common plant species, besides big sagebrush, are blue grama, needleandthread, pricklypear cactus and western wheatgrass. Annual grasses and forbs were common on this area in 2007. Big sagebrush is obviously the dominant full shrub and fringed sagewort is the most common subshrub. This type is predominantly found on relatively flat to gently sloping areas on moderately deep loamy soils. This type was also mapped in some small gently sloping draws, also with moderately deep loamy soils.

The birdsfoot sagebrush upland type is typically composed of sparsely vegetated uplands which are on relatively flat to gently sloping areas with relatively shallow soils. Soils characteristically are somewhat clayey and slightly alkaline. Dominant plant species include blue grama, birdsfoot sagebrush, threadleaf sedge, needleandthread, Gardner saltbush, wild buckwheat, and western wheatgrass. Full shrubs are uncommon but the subshrubs birdsfoot sagebrush, Gardner saltbush, wild buckwheat and broom snakeweed are common.

Treated grazing land is composed of lands where big sagebrush was removed. This type is found at one locale where big sagebrush was removed by a controlled burn. The treated grazing land type resembles the blue grama upland in terms of vegetation composition with blue grama, western wheatgrass, needleandthread, threadleaf sedge, Sandberg bluegrass and prickly pear cactus being the most common perennial plant species. Annual forbs and grasses were abundant on this area in 2007. Shrubs and subshrubs are generally absent. This type is found on gently rolling plains with moderately deep soils.

The grassy bottom exists in the form of narrow bands that range from approximately ten to 50 ft in width along the edges of Antelope Creek, Spring Creek, Horse Creek and some other associated minor drainages. Although this vegetation type comprises limited acreage, these sites are the most productive within the analysis area. The predominant plants are usually some combination of Kentucky bluegrass, sedges, alkali sacaton, inland saltgrass, yellow sweetclover, western wheatgrass, other wheatgrasses, dandelion, and western yarrow. Full shrubs were generally absent from this type but the subshrub fringed sagewort was common. Soils are usually loamy and moderately deep. Some dense patches of the noxious weed Canada thistle are present within this map unit.

Several areas of disturbed lands are located in the vegetation analysis area. These disturbed lands consist primarily of roads, pipelines and CBNG development. Some of these areas, such as roads and facilities, will remain disturbed into the future. Other disturbances, such as pipelines, will be reclaimed as soon as the work is completed.

Wetlands and open water are found in several locations in the vegetation analysis area, primarily along Horse Creek, Spring Creek and Antelope Creek and qualifying tributaries. The stockponds found within the analysis area are also included in this category. These sites were identified based on COE criteria for wetlands and pond other waters but may or may not be jurisdictional as discussed in Section 3.7. Wetland vegetation consists primarily of cattails, bulrushes, rushes, spikerush, sedges, and horsetails. Typically the open water is surrounded by wetlands or the grassy bottom type. Soils are primarily loams, clay loams and sandy clay loams.

A very small amount of silver sagebrush lowland is present on the vegetation analysis area for the West Antelope II LBA tract. This type is dominated by silver sagebrush, needleandthread, blue grama and western wheatgrass. Annual grasses and forbs were abundant on this type in 2007. Silver sagebrush was the most common full shrub while fringed sagewort was the most common subshrub. This map unit is found on relatively flat to gently sloping areas with typically sandy loam soils.

A minor amount of greasewood lowland (0.05 percent of the total area) was identified in the vegetation analysis area. This type is dominated by greasewood, blue grama, needleleaf sedge, Sandberg bluegrass, and western wheatgrass.

Annual grasses and forbs were abundant on this type in 2007. Greasewood was the most common full shrub while fringed sagewort and winterfat were the most common subshrubs. This type is found on relatively flat to gently sloping terrain with clayey and somewhat alkaline soils.

Previous vegetation inventories and additional inventories completed in 2007 identified approximately 223 plains cottonwood trees and five peachleaf willow trees within the vegetation analysis area. Most of these trees were found along Antelope Creek. Ten trees were found along Spring Creek. These trees were generally found associated with the bottomland grassland type or in the blue grama upland type adjacent to the bottomland grassland type. A few trees were also found in ephemeral drainages as well as adjacent to stockponds and adjacent to stock tanks.

3.9.2 Environmental Consequences

3.9.2.1 Proposed Action and Alternatives 1 and 2

As indicated in Table 3-1, under the currently approved mining and reclamation plan, approximately 12,105 acres of vegetation will be disturbed in order to mine the coal in the existing leases at the Antelope Coal Mine. Under the Proposed Action, mining of the West Antelope II LBA tract as applied for would progressively remove the native vegetation on 4,314 additional acres. Under the Alternatives 1 and 2, mining of the LBA tract would progressively remove the native vegetation on up to 6,625 additional acres.

Short-term impacts associated with the removal of vegetation from the West Antelope II LBA tract would include increased soil erosion and habitat loss for wildlife and livestock. Potential long-term impacts include loss of habitat for some wildlife species as a result of reduced plant species diversity, particularly big sagebrush, on reclaimed lands. However, grassland-dependent wildlife species and livestock would benefit from the increased grass cover and production.

Reclamation, including revegetation of these lands, would occur contemporaneously with mining on adjacent lands, i.e., reclamation would begin after 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, some sediment-control structures, and other mine facilities. Some roads and facilities would not be reclaimed until the end of mining. ACC does not propose to locate any new life-of-mine facilities on the West Antelope II LBA tract under the Proposed Action or Alternatives 1 or 2 because the 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 general analysis area from livestock grazing. This reduction in vegetative production would not seriously affect livestock production in the region,

and long-term productivity on the reclaimed land would return to premining levels within several years following seeding with the approved final seed mixture. Wildlife use of the area would not be significantly 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 area. Initially, the reclaimed lands would be dominated by grassland vegetation, which would be less diverse than the premining vegetation. At least 20 percent of the native vegetation area would be reclaimed to native shrubs at a density of one per square meter or 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. The reclamation standards call for restoration of sagebrush or other native shrubs to at least 20 percent of the reclaimed area. As indicated previously, sagebrush is a component of the big sagebrush upland, birdsfoot sagebrush upland, and silver sagebrush upland vegetation types, which account for approximately 30 percent of the vegetation analysis area. The reduction in sagebrush would result in a long term reduction of habitat for some 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. 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, and the proposed postmining land use (wildlife habitat and rangeland) should be achieved even with the changes in vegetation composition and diversity.

Surface disturbance would occur on the tract under all of the alternatives. 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 Antelope Mine includes steps to control invasion by weedy (invasive nonnative) plant species because WDEQ/LQD requires surface coal mine operators to control and minimize the introduction of noxious weeds until bond release, in accordance with federal and state regulatory requirements. Section 3.9.4 includes a discussion of the steps that the Antelope Mine uses to control noxious weeds. As a result there are few occurrences of noxious weeds in the mine area. The reclamation plan for the West Antelope II LBA tract would also include steps to control invasion from such species.

Wyoming, including the PRB, has been experiencing drought conditions for the past seven or eight years. The climatic record of the western U.S. suggests that

droughts could re-occur periodically during the life of the mine. Droughts tend to hamper revegetation efforts because a lack of sufficient moisture reduces germination and could damage newly established plants. Same-aged vegetation is more susceptible to disease than 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 significant changes in the average overland slope are predicted.

Following reclamation, the LBA tract would be primarily a mixture of upland prairie grasslands with graminoid/forb-dominated areas. An overall reduction in species diversity, especially for the shrub component, would occur. 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.

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 surface landowner.

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

3.9.2.2 No Action Alternative

Under the No Action Alternative (Alternative 3), the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts to vegetation would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. Coal removal and the associated vegetation removal and replacement would occur on the existing Antelope Mine leases as currently permitted. Vegetation on portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 H and I.

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/LQD. 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 or as required by current regulations. Shrubs would be selectively planted in riparian areas and trees would be replaced in a one-to-one ratio.

WDEQ/LQD Rules and Regulations require that:

- Permit applications for surface coal mines include a description of any weeds or other plants listed by the local Weed and Pest Control District as harmful (Chapter 2, Section 2(a)(vi)(C)(2)); and

- Surface coal mine operators control and minimize the introduction of noxious weeds in accordance with federal or state requirements (Chapter 4, Section 2 (d)(xiv)).

Steps to control invasion by weedy (invasive nonnative) plant species using chemical and mechanical methods would be included in the amended mine plan. The mine currently has an active noxious weed control program. The most common and problematic noxious weed in the area is Canada thistle. The mine annually contracts with a weed control expert certified by the state of Wyoming. This contractor completes chemical applications to noxious weed infestations identified by mine personnel and also traverses the remainder of the mine permit area and applies chemical control to any other noxious weed infestations encountered. The Antelope Coal Mine works with the local county weed and pest control agents to control noxious weeds as necessary. The mine also conducts other control programs including mowing, tillage, and reseeding of weedy areas. Detailed wetland mitigation plans would be developed and approved by the 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 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 potential environmental consequences to wildlife in general. The subsequent sections address the potential impacts to specific groups of wildlife species. The balance of this wildlife assessment was completed by Jones & Stokes (formerly Thunderbird Wildlife Consulting), of Gillette, Wyoming in 2006 and 2007.

3.10.1.1 Affected Environment

The BLM study area for the West Antelope II LBA is defined as the original tract, as applied for, plus all lands added by the BLM under Alternatives 1 and 2. The wildlife general analysis area is defined as the BLM study area plus surrounding lands within a one-quarter mile perimeter that could be disturbed by mining the coal within the BLM study area. Coincidentally, the general analysis area for this discussion also represents the extent of the anticipated permit amendment study area for the Antelope Mine, should the mine acquire the tract.

The wildlife general analysis area abuts the existing Antelope Mine permit area. Consequently, portions of the wildlife general analysis area lie within the current Antelope Mine permit area and were previously monitored in accordance with the current WDEQ/LQD mine permitting requirements. Those requirements include surveys that extend 0.5 mile to 2.0 miles beyond the current mine permit area, depending on the species.

Background information on wildlife in the West Antelope II general analysis area and surrounding lands was obtained from several sources, including the South PRB Coal FEIS (BLM 2003a), records from the WGFD, BLM, USFWS, USDA-FS, and personal contact with biologists from those four agencies. Site-specific data for the West Antelope II 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.

Surveys conducted during annual monitoring for existing permitted areas at the Antelope Mine include the permit area and a one-mile perimeter. A two-mile perimeter is used for big game and wildlife baseline studies. Due to the proximity of the proposed lease area to the existing mine permit area, all but the northern third of the West Antelope II general analysis area has been included in multiple

baseline studies and annual wildlife monitoring efforts associated with the Antelope Mine since the early 1980s. Additional acreage within that area was included in annual monitoring since 1994, with yearly coverage over the entire general analysis area beginning in 1998.

The Antelope Mine initiated baseline investigations in 2006 expressly for the West Antelope II LBA tract. As noted above, those surveys included the general analysis area plus a two-mile perimeter. Again, because the proposed LBA tract is adjacent to the existing Antelope Mine, much of the baseline two-mile perimeter had coincidentally been covered during previous annual or baseline monitoring studies for Antelope or the neighboring North Antelope Rochelle Mine over the last 25 years. Annual wildlife surveys associated with unrelated CBNG projects in the same area have also included the northern portions of the baseline two-mile perimeter since 2004. A full description of the extent and timing of coverage during mine-related surveys is provided in Appendix H of this EIS document. Site-specific surveys for the entire leased area and appropriate perimeters would be part of the mine permitting process if the tract is leased.

The West Antelope II LBA tract is dominated by rolling topography, with a few small areas of steeper and more heavily dissected terrain. The area surrounding the expansion is also characterized primarily by broken rolling hills and uplands, along with some prominent ridgelines and more level terrain along the terraces of Antelope and Spring Creeks. Surface mine lands, both active and reclaimed, dominate the landscape east and northeast of the southern portion of the tract. Elevations range from approximately 4,500 to 5,100 feet above sea level.

In an undisturbed condition, the major vegetation types in the general analysis area would provide habitat for many species. Vegetation types occur in a broad mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Predominant wildlife habitat types classified on the LBA tract and adjacent area correspond with the major plant communities defined during the vegetation baseline survey; they consist primarily (approximately 67 percent) of various upland grasslands (Section 3.9, Table 3-11). Included within those grasslands are black-tailed prairie dog (*Cynomys ludovicianus*) colonies, roughlands and coulees, and treated grazing lands. Smaller proportions (less than 1 to approximately 17 percent) of other habitat types are also present, including big sagebrush, birdsfoot sagebrush, grassy bottomland, disturbed land, water, silver sagebrush lowland, and greasewood lowland.

Mesic habitats include riparian corridors with limited trees, and are restricted to narrow bands along primary drainages of Antelope Creek, Spring Creek, and Horse Creek as they pass through or adjacent to the LBA tract. Cheatgrass and crested wheatgrass have invaded some areas, and a growing network of road and well-pad disturbance areas occur in the grassland and sagebrush grassland vegetation areas, especially in the north. A few oil tank batteries and increasing numbers of natural gas pipelines and facilities are also present, with pipeline

disturbance corridors in varying degrees of recovering vegetative cover. No designated critical, crucial, or unique habitats are present.

Antelope Creek and Spring Creek (a primary tributary of Antelope Creek) flow generally west to east across the narrow band of the West Antelope II study area that connects the north and south blocks. Horse Creek, another primary tributary of Antelope Creek, flows north to south through the northern-most extent of the LBA tract. All three drainages are intermittent or ephemeral streams. Limited portions of the drainages may receive recharge from bank storage, making them locally intermittent.

Historically, water was often present in the main creeks as small, shallow, isolated pools within the deeper channels. However, water levels have increased within some drainages over the last year due to the influx of discharged flows associated with CBNG development in the area, and those areas are seldom completely dry anymore. That water appears to be affecting the chemical balance of soils along some portions of Spring Creek, with obvious sodic soils where standing water has accumulated.

Despite this recent influx of water into the general analysis area, many channels are still reduced to isolated, shallow pools in the summer. Numerous named and unnamed ephemeral tributaries of these creeks also drain portions of the LBA tract. Several stock reservoirs are scattered throughout those drainages, and all are constructed with earthen berms or dams. Those water bodies provide short-term habitat for migrating waterfowl, shorebirds, and other aquatic species (birds, fish, herptiles) during spring but are often dry during other seasons.

3.10.1.2 Environmental Consequences

3.10.1.2.1 Proposed Action and Alternatives 1 and 2

If the West Antelope II LBA tract is leased under the Proposed Action, or Alternatives 1 or 2, coal mining operations at the Antelope Mine would be extended by up to 13 years. Impacts to wildlife that would be caused by mining the LBA tract would be addressed as part of the review of the mine permit application by the WGFD, USFWS, and the WDEQ/LQD when the mining and reclamation permit is revised 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 injury and mortalities caused by collisions with mine-related traffic or mortalities due to loss of habitat (especially for species with limited mobility such as fish and some herptiles); restrictions on wildlife movement due to construction of fences, spoil piles, and excavation of pits; and displacement of wildlife from active mining areas. Displaced animals may find 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 latter two situations, the animals may suffer from increased competition with other animals and are less likely to survive and reproduce. If the West Antelope II 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 13 years.

The indirect impacts are longer term than the direct impacts. Results from long-term surveys conducted at the Antelope Mine, and from those completed in both native and reclaimed habitats at other surface mines in the region, demonstrated that some reclaimed habitat types can support levels of species diversity and abundance equal to or greater than their native counterparts. However, wildlife species composition can be quite different between pre- and post-mining habitats, depending on the structure and composition of native habitats prior to disturbance.

After the LBA tract is leased, mined, and reclaimed, alterations in the topography and vegetative communities would likely result in such changes in species composition from pre-mine conditions. Some vegetative communities currently present in the tract, such as low-growth species (e.g., blue grama, and birdsfoot sagebrush) and big sagebrush, are often difficult to reestablish through artificial plantings. Wildlife species associated with pre-mining vegetative communities would be replaced by species that are typically associated with the taller and/or denser vegetation that is often present in reclaimed areas, especially until reclamation matures to its target mix.

Topographic changes would be permanent, and microhabitats may be reduced on reclaimed land due to flatter topography, less diverse vegetative cover, and reduction in sagebrush density. Changes in the composition between pre- and post-mining vegetation and wildlife species may be reduced if special efforts are made to reestablish low-growth and shrub habitat types. In the past, Antelope Mine has addressed low-growth specialized habitat needs with reclamation by creating new prairie dog colonies in reclaimed areas through translocation efforts, thus reestablishing the short-grass community present prior to disturbance. Such efforts have been curtailed by recent regulatory restrictions.

3.10.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II 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 West Antelope II LBA tract. Wildlife habitat on from 4,314 to 6,625 additional acres (under the Proposed Action, or Alternatives 1 and 2) would not be disturbed. Mining operations and associated impacts to wildlife and wildlife habitat would continue as currently permitted on the existing Antelope Mine coal leases but would not be extended onto portions of the LBA tract that will not be affected under the current mining

and reclamation plan. Impacts to wildlife and wildlife habitat associated with CBNG development would continue where those activities overlap with the West Antelope II LBA tract.

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*), though pronghorn are more abundant. White-tailed deer (*Odocoileus virginianus*) are occasionally observed along the cottonwood corridor bordering Antelope Creek. The nearest elk (*Cervis elaphus*) population is the Rochelle Hills Herd, approximately 13 miles east of the study area; elk are rarely recorded within the general analysis area.

Pronghorn are the most common big game species in the general analysis area. However, pronghorn density within two miles of the LBA tract has consistently been lower than that of a larger multi-mine survey area over time. The differences are probably due primarily to the vegetative characteristics of the general analysis area. The majority of the West Antelope II LBA tract is comprised of grassland habitats, which are not preferred by wintering pronghorn (Sundstrom et al. 1973). The same is true for the current Antelope Mine annual wildlife monitoring survey area (current permit boundary plus a one-mile perimeter), which regularly supports fewer wintering pronghorn than other portions of the multi-mine survey block. Similarly, only small groups of pronghorn are regularly present in reclaimed habitats, which are currently dominated by grass species with only a modest shrub component. The home range for pronghorn can vary between 400 to 5,600 acres depending on several factors, including season, habitat quantity and quality, population characteristics, and local livestock occurrence. In northeast Wyoming, daily movement typically does not exceed six miles. Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of specific plants and not local weather conditions (Fitzgerald et al. 1994).

The WGFD has classified the general analysis area as primarily 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. Within the LBA as-applied-for area, the SE ¼ of Section 10, T.40N., R.71W. encompasses severe winter relief habitat for antelope, as classified by the WGFD. Severe winter relief habitat is defined as "a documented survival range which may or may not be considered a crucial range area…it may lack habitat characteristics which would make it attractive or capable of supporting major portions of the population during normal years but is used by and allows at least a significant portion of the population to survive the occasional extremely severe winter" (TWS Wyoming Chapter 1990). The Cheyenne River Pronghorn Herd Unit encompasses the entire general analysis area. The WGFD estimated the 2006 post-season pronghorn

population to be approximately 39,621 animals; the herd objective is 38,000 (WGFD 2006).

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 not abundant in the general analysis area, with most individuals recorded in eroded draws, riparian corridors, and reclaimed lands in that vicinity. 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 indicates that mule deer are not very migratory in the vicinity of the West Antelope II LBA tract. The WGFD has classified the general analysis area as yearlong mule deer range, with the extreme southeastern portion as winter/yearlong. The entire area is located within the Thunder Basin Herd Unit. The WGFD estimated the 2006 post-season mule deer population to be approximately 22,036 animals, whereas the herd objective was 20,000 (WGFD 2006). No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the West Antelope II LBA tract.

White-tailed deer and elk are generally managed separately by the WGFD. White-tailed deer prefer riparian habitats, whereas elk are typically observed in and near rough breaks and pine stands. Those habitat types are not common within the general analysis area, which accounts for the rare sightings of white-tailed deer and elk in that region. The WGFD classifies the entire area as out of the normal white-tailed deer and elk use range, with the exception of a narrow corridor along Antelope Creek which is classified as yearlong range. The majority of white-tailed deer sightings were confined to the Antelope Creek riparian corridor. Elk observations were limited to rare records in the extreme southeastern corner of the winter big game survey perimeter.

3.10.2.2 Environmental Consequences

3.10.2.2.1 Proposed Action and Alternatives 1 and 2

Under the Proposed Action, and Alternatives 1 and 2, big game would be displaced from portions of the West Antelope II 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, and this species is not as prevalent in the general analysis area as elsewhere within the region. Mule deer would not be substantially impacted, given their infrequent use of these lands and the availability of suitable habitat in adjacent areas. The WGFD does not consider the general analysis area to be within either white-tailed deer or elk use range, and sightings of those species in that vicinity are uncommon or rare, respectively.

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 next to and within active mining operations, suggesting that some animals may become habituated to such disturbances.

Big game animals are highly mobile and can potentially move to undisturbed areas. But if the tract is leased, once surface disturbance begins, big game movement would be restricted on or through the tract due to the construction of fences, spoil piles, and pits related to mining. During winter storms or other stressful weather events, 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 long-term effects on 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 previously described in Section 3.10.1.2.2.

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. These include predators and furbearers such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), swift fox (*Vulpes velox*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), weasels (*Mustela* spp.), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents [including mice, rats, voles, gophers, ground squirrels, chipmunks, and black-tailed prairie dogs (*Cynomys ludovicianas*)) and lagomorphs [jackrabbits (*Lepus* spp.) and cottontails (*Sylvilagus* spp.)]. These prey species are cyclically common, widespread throughout the region, and are important for raptors and other predators. Porcupines (*Erethizon dorsatum*) and bats [such as hoary (*Lasiurus cinereus*), big brown (*Eptesicus fuscus*), and Townsend's big-eared (*Corynorhinus townsenii*)] have not been documented in the general analysis area, and have limited potential habitat in the vicinity.

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 2004a).

The black-tailed prairie dog is a BLM Sensitive Species and a USDA-Forest Service Sensitive species (see Appendix H).

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 short-grass 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 through the 1920s; large-scale control efforts conducted from approximately 1918 until 1972 when an Executive Order was issued banning the use of compound 1080 (a predacide and rodenticide); and the introduction of sylvatic plague into North American ecosystems in 1908 (USFWS 2000b).

Currently, this species is primarily found in isolated populations in the eastern half of Wyoming (Clark and Stromberg 1987). Prairie dogs are considered a common resident in eastern Wyoming, utilizing short-grass and mid-grass habitats (Cerovski et al. 2004). The USFWS recently estimated that about 125,000 acres of occupied black-tailed prairie dog habitat exists in Wyoming (USFWS 2004b). Prairie dogs construct extensive burrow systems in fine- to medium-textured upland soil types. Many other wildlife species, such as the black-footed ferret (*Mustela nigripes*), swift fox, mountain plover (*Montanus charadrius*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*) may be dependent on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000b).

According to USDA-FS observations on the TBNG, the largest concentrations of prairie dog colonies in the vicinity of the surface coal mines are found east of the coal burnline, which is east and beyond the area of surface coal mining (Tim Byer, personal communication 9/11/2003). The large prairie dog complexes in the area east of the coal burnline have been drastically impacted by outbreaks of plague in recent years. The colonies west of the burnline, including those within and near the West Antelope II LBA tract, are generally smaller and less densely concentrated. Nevertheless, some of those colonies have also been impacted by plague within the last three years (refer to Antelope Mine Annual Wildlife Reports, on file with WDEQ/LQD).

Surveys have been conducted to locate prairie dog colonies on and within two miles of the LBA tract as applied for under the Proposed Action and Alternatives 1 and 2 (BLM study area). The two-mile perimeter encompasses the general analysis area. Sixteen prairie dog colonies were found within this survey area, with 4 colonies (approximately 188 acres) within the LBA general analysis area (Figures 3-16 and 3-17). Additional discussion of prairie dog colonies identified in the vicinity of the West Antelope II area is included in the Biological Assessment (Appendix I) of this EIS.

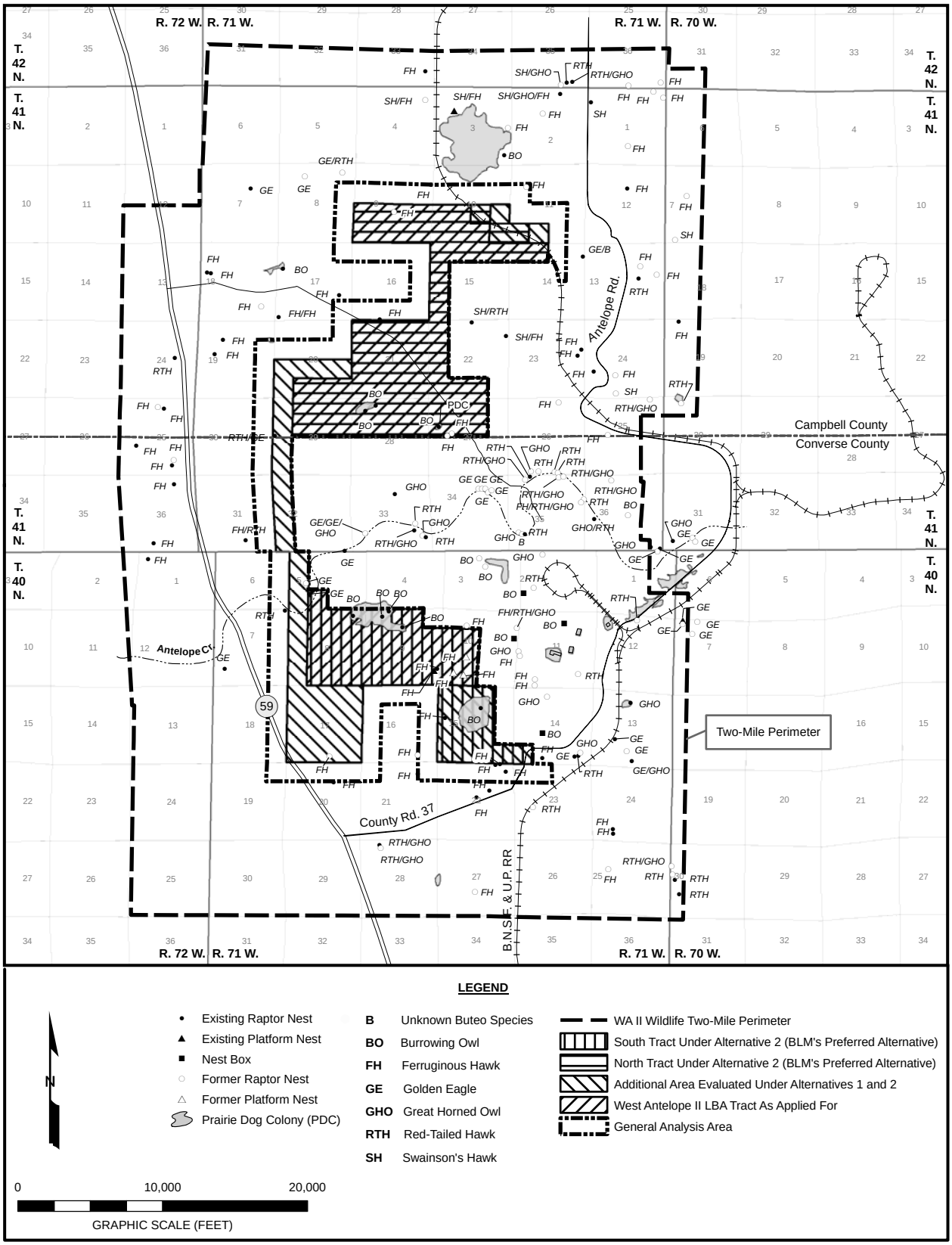


Figure 3-16. Raptor Nest Sites and Prairie Dog Colonies Within the West Antelope II Wildlife Two-Mile Perimeter Area.

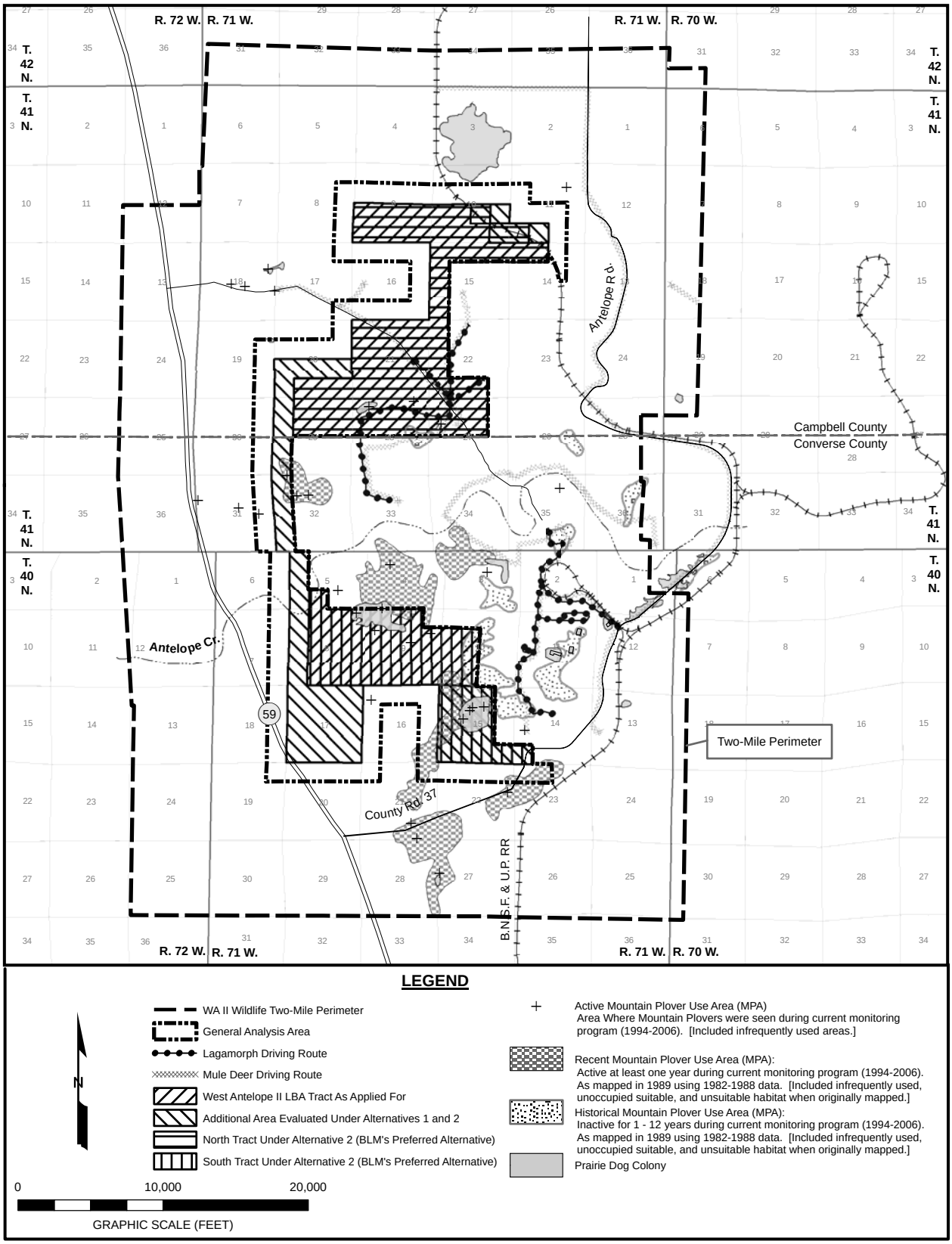


Figure 3-17. Wildlife Features and Survey Routes Within the West Antelope II Wildlife Two-Mile Perimeter Area.

3.10.3.2 Environmental Consequences

3.10.3.2.1 Proposed Action and Alternatives 1 and 2

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 would retreat into burrows when disturbed. Therefore, local populations of such prey species 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 objectives to encourage recolonization of reclamation by small mammal communities are being achieved (Shelley 1992). That study evaluated sites at five separate mines.

All or portions of four prairie dog colonies occur in the general analysis area and would be affected by leasing and mining the area described in the Proposed Action, or Alternatives 1 or 2. However, 74 percent of the total acreage (12 additional colonies) within the two-mile perimeter would be either only partially disturbed or not disturbed at all by mining under those options. Refer to the Biological Assessment (Appendix I) of this EIS for further discussion of impacts to prairie dog colonies in the general analysis area.

3.10.3.2.2 No Action Alternative

Impacts to small mammals under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.4 Raptors

3.10.4.1 Affected Environment

The raptor species known or expected to occur in suitable habitats in the general analysis area include the golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawks (*Buteo lagopus*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), great horned owl (*Bubo virginianus*), burrowing owl, and short-eared owl (*Asio flammeus*). Many of these species are USDA-FS and BLM Sensitive Species (see Appendix H).

The bald eagle (*Haliaeetus leucocephalus*) is a migrant and common winter resident of the Wyoming Powder River Basin region. On July 9, 2007, the USFWS published a Federal Register notice (72 FR 37346) announcing that the bald eagle would be removed from the list of threatened and endangered species under the

Endangered Species Act of 1973, as amended (16 U.S.C 1531 *et* seq.) on August 8, 2007. However, the protections provided to the bald eagle under the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668, and the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, will remain in place. The bald eagle is now recognized as a Sensitive Species and is further discussed in the Sensitive Species Evaluation (Appendix H) of this EIS.

Raptors that commonly nest in the general analysis area are the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, American kestrel, great horned owl, and burrowing owl. No nest sites have been documented in the general analysis area for northern harriers or short-eared owls, though occasional sightings of recently fledged young indicate that such activities do occur there for one or both of those species. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species are adapted to nesting on the ground, creek banks, buttes, or rock outcrops. Rough-legged hawks are winter residents in northeast Wyoming, and breed in the arctic regions.

Figure 3-16 shows the locations of raptor nests identified within the West Antelope II general analysis area. The two-mile wildlife perimeter is also shown. Since 1982, raptors have been monitored every year within this two-mile perimeter. Specific details regarding those nests, including their historical use by nesting raptors, will be provided in a future wildlife baseline report for that area. Previous information is available in the annual wildlife reports for the Antelope Mine. Over time, natural forces have destroyed many nests, while others have been relocated for mitigation or have been removed by mining activities. In some cases, nests have been created to mitigate other nest sites that were impacted by operations at the Antelope Mine.

During surveys completed in 2006 by Thunderbird-Jones & Stokes (J&S, formerly Thunderbird Wildlife Consulting), a total of six raptor species (golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, great horned owl, and burrowing owl) nested within the West Antelope II wildlife two-mile perimeter area (see Figure 3-16). Five of those six species have regularly nested within this area since annual monitoring began in 1982. Swainson's hawks began nesting in the area more recently, with the first nest documented within the survey area in 1998. Based on sightings of young, it is likely that at least one pair of American kestrels nested in one of the many small cavities present in the snags along Antelope Creek. Eighty-three raptor nests were intact within the entire wildlife two-mile perimeter area during the 2006 breeding season; one nest was removed prior to mining in the autumn.

In 2006, thirteen intact nests were on the LBA tract as applied for, including 1 golden eagle nest, 5 ferruginous hawk nests (four territories), and 7 burrowing owl nest sites (four territories). One ferruginous hawk nest was removed during autumn, 2006, due to encroaching mine operations. Three additional raptor nests were present on lands added under Alternatives 1 and 2: a ferruginous hawk nest in one of the above territories, one burrowing owl nest site, and one nest used

historically by red-tailed hawks and golden eagles (used solely by golden eagles since at least 1997). The remaining 67 intact nests were within two miles of the LBA tract. Only 5 of the 16 intact nests encompassed by the West Antelope II LBA tract or added lands were active during 2006: four on the tract itself and one on lands included with Alternative 1 and Alternative 2.

3.10.4.2 Environmental Consequences

3.10.4.2.1 Proposed Action and Alternatives 1 and 2

Mining the LBA tract would not impact overall regional raptor populations, however, individual birds or pairs may be impacted. Mining activity could cause raptors to abandon nests proximate to disturbance, particularly if mining encroaches on active nests during a given breeding season. USFWS recommends a one-mile buffer around all ferruginous hawk nests. In 2006, 11 ferruginous hawk nests in four territories were present within the West Antelope II general analysis area, with 5 nests in the BLM study area itself (LBA tract as applied for under the Proposed Action plus additional lands added by BLM under Alternative 1 and 2). A sixth nest was removed after that breeding season. Ferruginous hawks have actively nested (laid eggs) at only one of those sites in recent years, and that nest was last active in 2003.

For the last 15 years, monitoring data has indicated that the majority of nests within the general analysis area (the tract as applied for plus the additional area evaluated under Alternative 1 and 2, plus a one-quarter mile buffer) have served as alternate nesting sites for other active nests elsewhere within raptors' respective territories beyond that area. Nests of most other raptor species (including all of the others present on the LBA tract) are typically buffered by a one-quarter- or one-half-mile radius.

USFWS and WDEQ/LQD approval would be required before mining would occur within buffer zones for active raptor nests. The Antelope Mine annually monitors territorial occupancy and nest productivity on and around their existing leases. Several raptor pairs from multiple species have successfully nested within 200-1,000 feet of active mining at Antelope, including golden eagles, red-tailed hawks, and great horned owls. All five species represented on the LBA tract have successfully nested near active mining and construction areas throughout the PRB of northeast Wyoming. Those efforts have succeeded due to a combination of two things: 1) raptors becoming acclimated to the gradual encroachment of mine operations, and 2) successfully implemented progressive mitigation techniques to maintain viable raptor territories and protect nest productivity. Details documenting raptor nesting efforts and success near mine operations are available in the Antelope Mine Annual Wildlife Reports, on file with the WDEQ/LQD in Cheyenne, Wyoming.

Mining within or near raptor territories would impact availability of foraging habitat for nesting birds. However, increased acreage of reclamation within the

permit area would offset new habitat loss as mining progresses. Equipment yards associated with mining provide additional habitat for prey species such as cottontails, and several raptor pairs voluntarily nest near those areas. As at other surface mines throughout the region, raptor nesting efforts at Antelope Mine have typically been influenced primarily by natural factors such as prey abundance and availability of nesting substrates. Due to the lack of woody vegetation, raptors that nest in trees or on cliffs are not as abundant as those that either nest on the ground or are adaptable to nesting on mine facilities or other man-made structures (platform nests, etc.). During mining, new nesting habitat can be created through enhancement efforts like nest platforms, nest boxes, and tree plantings.

3.10.4.2.2 No Action Alternative

Impacts to raptor species under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.5 Upland Game Birds

3.10.5.1 Affected Environment

Four upland game bird species have historically been documented within the West Antelope II general analysis area. These species are the mourning dove (*Zenaida macroura*), wild turkey (*Meleagris gallopavo*), gray (or Hungarian) partridge (*Perdix perdix*), and Greater sage-grouse (*Centrocercus urophasianus)*. However, the mourning dove is the most prevalent upland game bird in the general analysis area, and the only species known to occur with any regularity.

The mourning dove is a relatively common breeder in Campbell and Converse Counties. Doves are often seen in the area during migration, with fewer observations during the nesting season. Most sightings occurred near sites with water sources and trees, though they have occasionally been recorded in sagebrush or greasewood stands.

Wild turkeys have been seen infrequently over time, with spans of several years between observations. All observations occurred during spring, when males were gobbling. This species has been recorded along Antelope Creek, generally east of the LBA tract. However, they have also been seen on the tract itself, or along the creek channel west of the tract.

The gray partridge is an introduced species, and has also been occasionally documented in the general analysis area. Individual birds were observed in the vicinity of the study area in December 1984 and again in March 1985. No other sightings were recorded until December 1999, when snow tracks were seen within the current Antelope permit area, approximately one mile northeast of the southern block of the LBA tract, as applied for. No gray partridge have been observed in the general analysis area since then.

The Greater sage-grouse, hereafter referred to as sage-grouse, is a species of concern throughout the West, and is considered a "landscape species" which means that large expanses of unfragmented land are required in order to provide all the habitat components for their annual life cycle. Relying on sagebrush for food, cover, and shelter, sage-grouse require sagebrush habitat year-round and for every phase of their life cycle.

Sage-grouse breeding occurs on strutting grounds (leks) during late March and April. Leks are generally established in open areas surrounded by Wyoming big sagebrush which is used for escape and protection from predators. Generally, sage-grouse exhibit high fidelity to lek sites and return to the same liks year after year for breeding. Leks are considered to be the center of year-round activity for resident sage-grouse populations. On average, the majority of sage-grouse hens nest within 4 miles (6.2 km) of the lek. New spring plant growth, residual cover, and understory are important habitat components for nesting sage-grouse hens.

Areas near the nest are used for several weeks by hens for brood rearing. The habitats used during the first few weeks after hatching must provide good cover to conceal the chicks and must provide essential nutritional requirements during this period of rapid development. Brood-rearing habitats that have a wide diversity of plant species tend to provide a variety of insects that are important chick foods.

Summer habitat consists of sagebrush mixed with areas of wet meadows, riparian, or irrigated agricultural fields. As summer progresses and forbs mature and dry up, sage-grouse broods move to more mesic wet meadows where succulent plants and insects are still available. This can be especially important in drier years and during long drought periods. As fall nears, sage-grouse form flocks as brood groups break up. As fall progresses, sage-grouse move toward their winter ranges.

During winter, sage-grouse feed almost exclusively on sagebrush leaves and buds. Suitable winter habitat requires sagebrush above snow. It is crucial that sagebrush be exposed at least 10 to 12 inches above snow level as this provides food and cover for wintering sage-grouse. Population and habitat analyses suggest that wintering habitat can be as limiting as breeding habitats. These seasonal movements are related to severity of winter weather, topography, and vegetative cover.

Since 1999, the USFWS has received eight petitions requesting that Greater sage-grouse be listed as threatened or endangered. Three of the petitions requested that Greater sage-grouse be listed as endangered across its entire range. On January 12, 2005, following a 12-month status review on the species, the USFWS concluded that listing was not warranted at that time. On December 4, 2007, U.S. District Court, District of Idaho, ruled that the USFWS 12-month petition finding on sage-grouse was in error and remanded the case back to the Service for further reconsideration. On February 26, 2008, the USFWS announced the initiation of another status review for the Greater sage-grouse.

USFWS has indicated the need for continued efforts to conserve sage-grouse and sagebrush habitat on a long-term basis, and has encouraged continued development and implementation of conservation strategies throughout the species' range. The sage-grouse is also a USDA-FS Region 2 Sensitive species and Management Indicator Species (see Appendix H).

In 2007, the Governor of Wyoming commissioned a Statewide Sage-grouse Implementation Team. On March 17, 2008, the team preliminarily identified and mapped recommended sage-grouse core breeding areas in Wyoming in an effort to better understand what types of habitat grouse prefer and what areas should be protected. The West Antelope II general analysis area is not located within the mapped core breeding areas.

On September 11, 2003, the Wyoming Game and Fish Commission announced that the 2003 hunting season for sage-grouse in Johnson, Sheridan, and Campbell Counties would be closed, following the deaths of 11 sage-grouse in northeastern Wyoming from West Nile Virus in August and early September of that year. According to a press release, the commission took this action because the incidence of infection was much higher in northeastern Wyoming than the rest of the state and the area is on the fringe of sage-grouse range with marginal, fragmented habitat (WGFD September 11, 2003 press release). Recent lek, or strutting ground, count data indicate that Wyoming's sage-grouse populations increased slightly from 2004 through 2007. Lower incidences of West Nile Virus mortalities were also documented in those years, primarily the result of cooler temperatures that reduced mosquito populations. Sage-grouse hunting seasons were consequently reopened in 2004 (Christiansen 2004).

The Antelope Mine has conducted annual searches for sage-grouse leks within the existing permit area and one-mile perimeter as part of its wildlife monitoring program since 1982. Baseline inventories that encompassed a two-mile perimeter around the permit area were conducted in the late 1970s, 1998, and 2003. Most of the surveys conducted since the early 1980s have included the eastern two-thirds of the West Antelope II general analysis area and its two-mile perimeter, with more complete coverage (up to 80%) in recent years. The entire general analysis area and most of its two-mile perimeter were surveyed in spring 2003 as part of annual monitoring or baseline studies for the Antelope Mine and its West Antelope expansion, respectively. Those surveys included the limited sagebrush stands in the general analysis area. At least 80% of the LBA general analysis area has been surveyed annually since then as part of annual monitoring efforts for the Antelope Mine. 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 updated list, giving further impetus to ongoing annual survey efforts.

The sage-grouse is a year-round resident throughout much of the PRB, but is rare in the vicinity of the West Antelope II general analysis area and the adjacent

Antelope Mine. Sage-grouse require vast expanses of sagebrush-steppe communities with extensive mosaics of sagebrush of varying densities and heights. There are no large expanses of contiguous sagebrush in the West Antelope II general analysis area. The lack of use of that region by sage-grouse has been well documented from the late 1970s through 2006. The most recent evidence of sage-grouse in the vicinity occurred in early July 2006, when grouse droppings and feathers were seen in a sage draw approximately 1.5 miles southeast of the general analysis area. The prevalence of sign in that area indicated that multiple grouse had recently foraged in that drainage. The last grouse sighting prior to that occurred in a draw approximately 1.25 miles southwest of the general analysis area in the early 1990s.

As discussed in Section 3.9, sagebrush is a component of the Wyoming big sagebrush upland, birdsfoot sagebrush upland, and silver sagebrush upland vegetation types, which account for approximately 30 percent of the general analysis area. Potential sage-grouse habitat is limited to relatively small scattered sagebrush stands with no large expanses of contiguous sagebrush within several miles of the area. Consequently, few sage-grouse have ever been documented in the area, and no grouse leks, nests, or broods have ever been discovered on or within 2.0 miles of the West Antelope II general analysis area. Due to the ephemeral nature of the drainages in that area, little potential brood-rearing habitat is present. The nearest known sage-grouse lek is the Steckley Road Complex, approximately three miles away in T40N R70W, SE NW Section 29. A thorough history of sage-grouse survey efforts and observations within two miles of the LBA tract is presented in Appendix H of this EIS document.

3.10.5.2 Environmental Consequences

3.10.5.2.1 Proposed Action and Alternatives 1 and 2

Leasing and mining the West Antelope II LBA tract would affect some potential habitat for mourning doves, wild turkeys, and gray partridge. A portion of the best habitat (cottonwood corridor) along Antelope Creek is within the 100-foot non-disturbance zone on either side of the channel. Even though the corridor is protected by a 100-foot non-disturbance zone, as mining moves adjacent to the corridor the habitat will likely be less attractive and less accessible to upland game birds and other wildlife. While woody corridors are not abundant in the general analysis area, they also are not unique to the LBA tract. Similar habitat is present immediately west of the tract, where mining is not projected to occur in the near future. Additionally, sightings of turkeys and partridge are infrequent in the area, and doves are not restricted to treed habitats.

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 estimated that sage-grouse populations in western North America declined at an overall rate of 2.0 percent per year from 1965 to 2003 (Connelly et al. 2004). 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 West Antelope II LBA tract is within the Northeast Wyoming Local Sage-Grouse Working Group (NWLSWG) Area. It includes portions of the WGFD Sheridan and Casper regions and the USDA-Forest Service Thunder Basin National Grassland. Sage-grouse monitoring has occurred within the NWLSWG Area 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 3-18).

Population trends within the NWLSWG Area appear to be mirroring statewide trends in Wyoming, although the average number of males per lek in the NWLSWG Area, including in the Thunder Basin National Grassland, has typically been lower than those observed statewide (Figure 3-19). 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.

The causes of the range-wide decline in sage-grouse population levels are not fully 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 (Braun 1998, Wisdom et al. 2002, 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 and related to specific periods of activity. In some cases, mineral development may result in positive effects, which may include increased forb production, habitat diversity, and additional water sources. Some 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

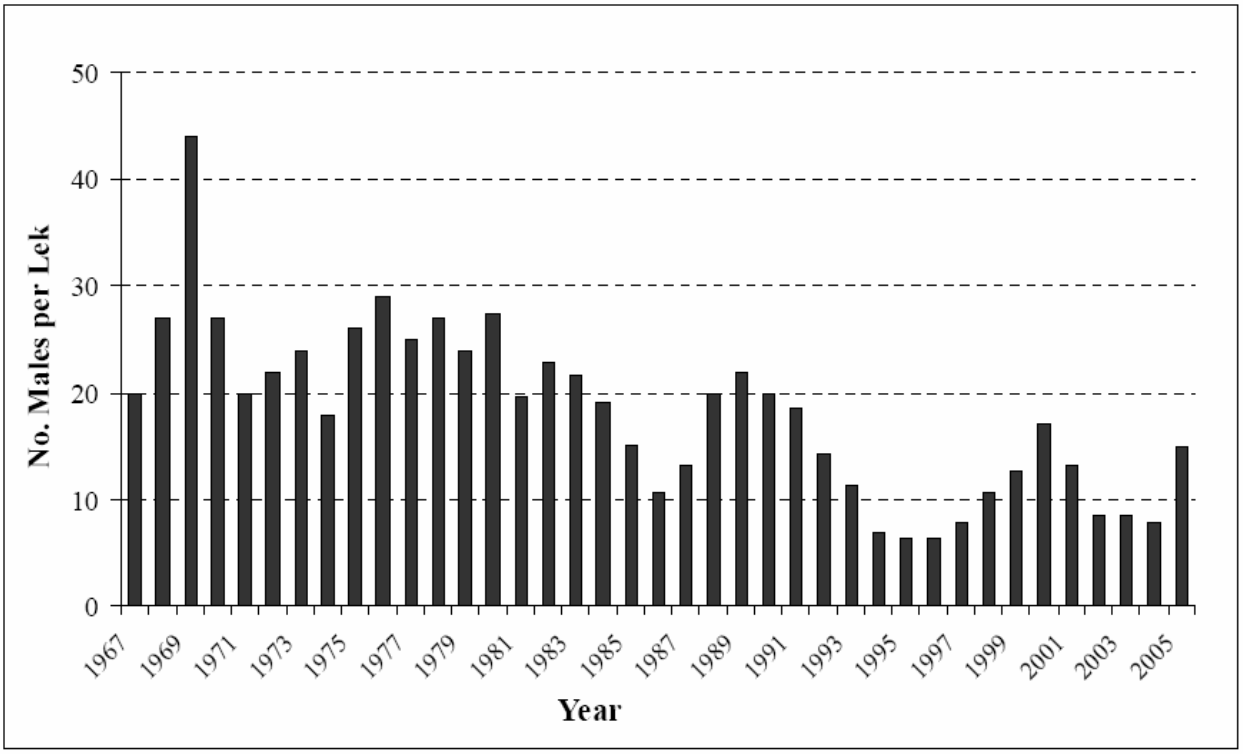


Figure 3-18. Average Male Sage-Grouse Lek Attendance Within the Northeast Wyoming Local Working Group Area (1967-2005).

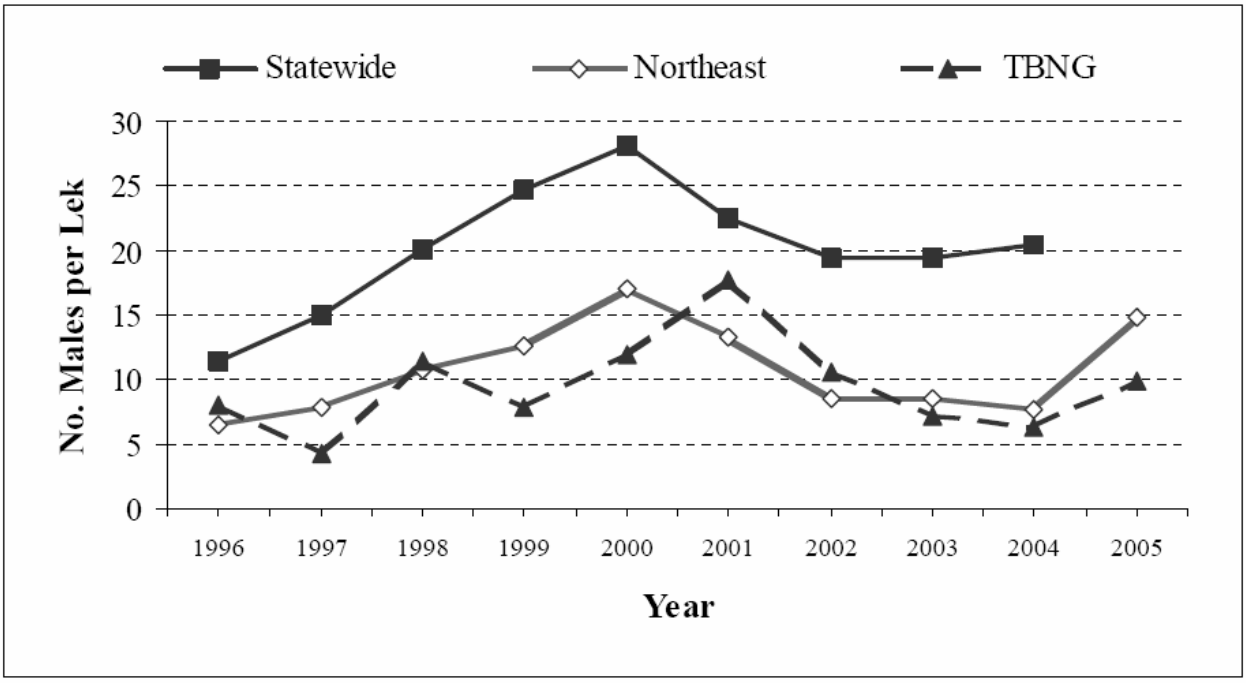


Figure 3-19. Average Male Sage-grouse Lek Attendance Statewide, Within the Northeast Wyoming Local Sage-Grouse Working Group Area, and Within the Thunder Basin National Grasslands (1996-2005).

habitat may also affect sage-grouse populations (Naugle et al. 2006). When mining occurs in potential sage-grouse habitat, 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 was present before mining. Should the BLM study area be leased, mined, and reclaimed, alterations in the topography and vegetative communities would likely result in such changes in species composition from pre-mine conditions. Some vegetative communities currently present in the tract, such as low-growth species (e.g., blue grama, and birdsfoot sagebrush) and big sagebrush, are often difficult to reestablish through artificial plantings. Until sagebrush returns to its premining density levels, there would be a reduction in potential habitat for wildlife species associated with this habitat in the West Antelope II general analysis area. However, given the limited presence of sage stands in the area, it is not likely that many sagebrush obligates would be affected.

If mining activities disturbed a lek, sage-grouse would have to use an alternative 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.

Baseline (1978-1979, 1998, 2003) and annual monitoring studies (1982-2006) have repeatedly demonstrated that sage-grouse do not inhabit the Antelope Mine area, although some small areas with marginal potential habitat are present. As described previously, those surveys encompassed most of the West Antelope II general analysis area and its two-mile perimeter for much of that period. No sage-grouse leks, nests, or broods were observed in that region during any survey year. Given the limited sightings of sage-grouse observations in the area, and the minimal quantity and marginal quality of potential sage-grouse habitat, implementation of the Proposed Action or either Alternative 1 or 2 is not likely to negatively impact any existing or potential sage-grouse leks, and will not impact prevalent sage-grouse habitats (expanses of sagebrush). Refer to Appendix H of this EIS document for more details regarding sage-grouse in the general analysis 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, above.

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. 2001). The *Migratory Bird Species of Management Concern in Wyoming* replaced the *Migratory Birds of High Federal Interest* (MBHFI) list. The Antelope Mine has conducted annual surveys for avian species of concern since at least 1994, incorporating new lists and survey protocols as they are issued. Surveys occur in spring and summer to document migrating and breeding birds, and include the permit area and one-half-mile perimeter.

Results from surveys for migratory birds at the Antelope Mine are available in baseline and annual wildlife reports, on file with the WDEQ/LQD in Cheyenne, Wyoming. Those reports include a tabulation of the regional status, expected occurrence, historical observations, and breeding records for each species on the current list of avian species of concern for a given report year, as well as two or more preceding years. Additional information for each species observed within the given year is provided in the text of those reports.

Non-raptor avian species that have been documented within the Powder River Basin and are included on both the *Coal Mine list of Migratory Bird Species of Management Concern* and at least one more list of special status species include the mountain plover (*Charadrius montanus*), long-billed curlew (*Numenius americanus*), yellow-billed cuckoo (*Coccyzus americanus*), sage thrasher (*Oreoscoptes montanus*), loggerhead shrike (*Lanius ludovicianus*), Baird's sparrow (*Ammodramus bairdii*), sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and Greater sage-grouse. Of those species, the mountain plover, long-billed curlew, loggerhead shrike, Brewer's sparrow, and sage-grouse have been recorded within the general analysis area for the West Antelope II LBA tract; only the mountain plover, loggerhead shrike, and Brewer's sparrow are known or suspected to nest in that vicinity.

Raptor species that have been documented in the Powder River Basin and are on the *Coal Mine list of Migratory Bird Species of Management Concern* and on at least one other list of special status species include the bald eagle, ferruginous hawk, burrowing owl, and short-eared owl. Each of those species has been documented in the general analysis area, with all but the bald eagle known or suspected to nest there. Those species are discussed at length in Appendix H of this EIS.

In sum, nineteen of the 40 species on the current list have historically been observed at least once within the general analysis area. Species that have been recorded nesting in the area include the mountain plover, ferruginous hawk, Swainson's hawk, burrowing owl, and loggerhead shrike. Species that are presumed to nest in the area, based on their presence and behavior during the breeding season, include the McCown's longspur (*Calcarius mccownii*), Brewer's sparrow (*Spizella breweri*), lark bunting (*Calamospiza melanocorys*), chestnut-collared longspur (*Calcarius ornatus*), vesper sparrow (*Pooecetes gramineus*), and lark sparrow (*Chondestes grammacus*). Based on habitat requirements and

infrequent sightings, long-billed curlews, short-eared owls, upland sandpipers (*Bartramia longicauda*), and grasshopper sparrows (*Ammodramus savannarum*) could potentially nest in the area, but have not been documented doing so. Most observations of those species were limited to spring, so they were presumed to be migrants. The remaining four species historically documented in the area have been restricted to specific seasons (bald eagle-winter), rarely observed (sage-grouse), or recorded only once each (red-headed woodpecker [*Melanerpes erthrocephalus*] and barn owl [*Tyto alba*]). The ferruginous hawk, burrowing owl, loggerhead shrike, both longspurs, Brewer's sparrow, long-billed curlew, and Greater sage-grouse are all discussed in detail in Appendix H of this EIS document.

The mountain plover 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 history of mountain plovers at the Antelope Mine and surrounding area is well documented. Mountain plovers were first recorded in the general analysis area during baseline studies for the mine in 1978 and 1979. Annual monitoring for this species began in 1982 and continued through 2006, and coincidentally included much of the West Antelope II general analysis area. Because mountain plovers are known to nest in the general analysis area, the Antelope Mine specifically addressed this species in its Avian Monitoring and Mitigation Plan, which was approved by USFWS. The mine also incorporated species-specific protective measures into its state mining permit, providing additional guidance and mitigation options regarding mountain plovers. Further details regarding the occurrence of this species within and near the LBA tract are provided in Appendix H of this EIS document.

The bald eagle, a USDA-FS and BLM Sensitive Species, is seasonally common and is most frequently observed during the winter months. Bald eagles are relatively common winter residents and migrants in northeastern Wyoming's PRB, but only rarely nest in that region. No bald eagle nests or winter roosts have been documented within one mile of the West Antelope II general analysis area during either baseline or annual monitoring studies since they began in 1978 and 1982, respectively.

The general analysis area includes only limited bald eagle nesting and roosting potential habitat in the form of scattered, decaying cottonwoods along Antelope Creek and isolated trees or small (five trees or less) stands of cottonwoods along Antelope or Spring Creeks, and their primary tributary draws. In general, the area does not contain consistent yearly, concentrated prey or carrion sources (e.g.,

fisheries, large groups of big game, waterfowl, sheep, etc.) that would be expected to attract bald eagles. This species is typically seen infrequently in the general vicinity of the West Antelope II LBA tract, and only during winter. Additional information about the observed occurrence of the bald eagle on the LBA tract can be found in the Sensitive Species Evaluation (Appendix H) of this EIS document.

Swainson's hawks have nested in the general vicinity of the Antelope Mine for the last few years. However, it wasn't until 1998 that this species nested within the raptor survey area for the LBA tract. Since then, five separate territories have been identified, though only one or two have been active within a given year. Because of the limited number of trees in the area and the fact that Swainson's hawks return to the region relatively late (mid-April) in the spring after most other raptor species have initiated nesting, few Swainson's hawks nests have been established in the area.

Burrowing owls were first recorded nesting in the Antelope Mine two-mile perimeter wildlife survey area in 1991, and owls have nested in that general vicinity during 14 of the last 16 years. All known burrowing owl nest sites throughout the entire West Antelope II general analysis area were in prairie dog burrows, and are therefore considered intact. Four additional artificial nest boxes have been constructed in the two-mile perimeter wildlife survey area for mitigation purposes since 1994, but no owls have ever been observed at or near them. Five pairs of burrowing owls have nested in the general analysis area, with all five pairs within the BLM study area itself (LBA tract as applied for plus added lands). Four of the five pairs have been active at least once in the last five years.

Lark buntings and vesper sparrows have been recorded in the general analysis area during each of the last 13 years (1994-2006). Lark buntings generally return to the area from migration in early May, while vesper sparrows are typically present in April. Results from general surveys and breeding bird point counts over time indicate that the lark bunting is the most abundant breeding bird of management concern in the area. The vesper sparrow is also quite common in most years. Both species are typically observed in all habitats in the general analysis area throughout spring and summer, and are presumed to nest in the vicinity.

Lark sparrows have also been recorded with some regularity in the general analysis area over the years. Lark sparrows inhabit a wide variety of habitats (Rising 1997), but were most often observed in relatively rugged terrain. It may be that some features associated with this species' breeding habitat, such as open areas of low scrub or scattered trees (Harrison 1984, Peterson 1990), are more prevalent in the breaks, thus the higher number of sightings there. Grasshopper sparrows have occasionally been recorded in the general analysis area, but most sightings have been in the relatively mature stands of reclaimed grassland associated with the Antelope Mine, approximately one mile east of the LBA tract. In the Great Plains region, including the PRB, grasshopper sparrows are typically associated with taller grassland vegetation, such as that found in mature

reclamation areas (Vickery 1996).

Short-eared owls and upland sandpipers have occasionally been recorded in the general analysis area. Most observations of these species consisted of migrants and non-breeding adults. Although potential nesting habitat is present, neither species has been known to nest in the area. The barn owl and red-headed woodpecker each were recorded in the general analysis area once since wildlife surveys were initiated in 1978. A single adult barn owl was seen perched on the bank of a draw near Antelope Creek in NW¼ Section 34, T.41N., R.71W., approximately 1.0 mile from the West Antelope II LBA tract, during lagomorph surveys in fall 2001. The first and only sighting of a red-headed woodpecker occurred in the cottonwood corridor along Antelope Creek in NE¼ SW¼ Section 33, T.41N., R.71W. during breeding bird surveys for the West Antelope baseline studies in mid-June, 2003. That observation occurred approximately 1.25 miles from the nearest edge of the LBA tract.

The remaining 21 migratory bird species of management concern have never been recorded in the general analysis area. Suitable habitat that would support these species like coniferous woodlands, large expanses of native prairie, lush riparian corridors, and large persistent bodies of water are scarce if not absent in the general analysis area.

Under natural conditions, the West Antelope II LBA tract provides extremely limited and marginal habitat for waterfowl and shorebirds. The natural aquatic habitat, prior to CBNG development in the general analysis area, was mainly available during spring migration as ponds (primarily stock reservoirs) and ephemeral streams. Many of these water features generally were reduced to small, isolated pools or were completely dry during summer. However, the recent development of CBNG resources on and upstream of the general analysis area has enhanced the water resources available in the area in the last two years, resulting in somewhat improved habitat for waterfowl and shorebirds. Waterfowl and shorebird observations have primarily consisted of relatively low numbers of common species, often restricted to spring migration. Few broods have been recorded in the area during baseline or annual monitoring studies due to limited and unreliable water resources in the area. Avian species typically associated with aquatic habitats in the general analysis area include, but are not limited to, the mallard duck (*Anas platyrhynchos*), killdeer (*Charadrius vociferus*), and red-winged blackbird (*Agelaius phoeniceus*).

3.10.6.2 Environmental Consequences

3.10.6.2.1 Proposed Action and Alternatives 1 and 2

Of the 19 Migratory Bird Species of Management Concern in Wyoming that have historically been observed in the general analysis area at least once, 11 species are classified as Level I (those identified as needing conservation action). Six of those 11 species are known or presumed to nest in and near the West Antelope II

general analysis area: the mountain plover, McCown's longspur, ferruginous hawk, burrowing owl, Brewer's sparrow, and Swainson's hawk. The first three species have regularly nested in the area over the last two decades of annual monitoring. In contrast, the latter three species nested less frequently, in part due to more limited nesting habitat (prairie dog colonies, small stands of sagebrush, isolated mature trees, respectively) present within the general analysis area. Bald eagles are seasonally present, and have been observed perched or foraging in the area in many years during winter. No bald eagle nests have ever been documented within several miles of the LBA general analysis. Other Level I species historically recorded in the area included the Greater sage-grouse, long-billed curlew, short-eared owl, and upland sandpiper. None of those species have ever been documented to display breeding behaviors or nest in the general analysis area.

When the West Antelope II tract is mined, current existing habitat within and near the tract for these 11 Level I species would be destroyed during mining. The habitat loss would be relatively short-term for some grassland species, but would last much longer for shrub-dependent species and other species requiring more specialized habitats. The current reclamation plan and practices for the Antelope Mine are designed to provide a mosaic of upland grass and sagebrush habitats that would potentially host most of these species.

Natural regrowth of some habitats (e.g., birdsfoot sagebrush) and recolonization of others (prairie dog colonies) would contribute to those reclamation efforts. Trees within the general analysis area are limited to two isolated stretches along Spring Creek and Antelope Creek. No trees would be removed from the Antelope Creek corridor due to the required buffer zone along that channel. Approximately 15 trees would be removed from the Spring Creek drainage. Some of the latter trees will be placed as snags in reclamation; all of those trees will be replaced with new trees along the drainage during reclamation.

Prairie dog translocations are no longer authorized in the area, but natural recolonization would also enhance reclamation efforts for those species with more specialized habitat needs, such as mountain plovers and burrowing owls. Both species nest in prairie dog colonies within the general analysis area. Periodic breeding bird surveys at other surface mines with similar habitats in the region since the mid-1980s have demonstrated that species richness and abundance in reclaimed habitats are equal to or greater than in their native counterparts, though species composition may not be the same due to differences between pre- and post-mining vegetation. Antelope Mine survey methods and results are available in annual wildlife monitoring reports on file with the WDEQ/LQD in Sheridan, Wyoming.

Specific impacts to and mitigation measures for avian species of management concern such as mountain plovers, bald eagles, sage-grouse, ferruginous hawks, and others are included in the preceding discussions or in Appendix H of this EIS document. In addition to those efforts, the availability of existing suitable habitat

beyond the general analysis area may provide off-site options for displaced species and individuals, provided that those areas are not already at carrying capacity for the various species.

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; such ponds are readily used by these species at other coal mines in the region. Antelope Creek would not be physically disturbed, but active mining on one or both sides could inhibit use by aquatic avian species. Any diverted creek channels would not provide the same habitat as the natural stream channel, though natural stream flow and the presence of CBNG discharge water in some areas would not be affected.

The current reclamation plan for the Antelope Mine requires that any portion of a stream channel affected by currently permitted mining be reclaimed to restore its pre-mining functions and aquatic habitats (special provisions are in place for Horse Creek and Spring Creek AVF areas). If the West Antelope II tract is leased and mined, these reclamation efforts would be extended onto the portion of the stream affected by mining the new tract. Replacement of all impacted jurisdictional wetlands would be required in accordance with Section 404 of the CWA (Section 3.7). If the replaced wetlands on the tract do not duplicate the exact function and/or landscape features of the pre-mine wetlands, waterfowl and shorebirds could potentially be positively 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, above.

3.10.7 Amphibians, Reptiles, and Aquatic Species

3.10.7.1 Affected Environment

Wildlife surveys completed specifically for the applicant and other mines in the area, 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 of these species are locally common inhabitants of the area, depending on the quantity and quality of aquatic habitats present.

Under natural conditions, aquatic habitat in the general analysis area is limited by the intermittent and ephemeral nature of surface waters. The lack of deep-water habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic species. As discussed above, water discharged from CBNG wells has enhanced the water supply within some drainages in the general analysis area, including Spring Creek, which has increased potential habitat for some aquatic species. However, those enhanced areas are still

relatively limited and/or isolated in nature, and no perennial drainages are present in the general analysis area.

Baseline aquatic studies were completed for the Antelope Mine during the original baseline surveys and covered Antelope Creek at, and downstream from, the confluence with Spring Creek (Commonwealth Associates 1980). Several common fish species were found on the upper Antelope Creek sampling station (located at the Spring Creek confluence, east of the LBA tract) during those efforts: the plains minnow (*Hybognathus placitus*), green sunfish (*Lepomis cyanellus*), and plains killifish (*Fundulus zebrinus*). Those species are either tolerant of intermittency or are adapted to shallow, sandy bottom streams. Horse Creek, which crosses the northern extent of the general analysis area, was sampled in June 1998 during baseline studies; the green sunfish was the only fish species caught (PRES 1999). Spring Creek has not historically exhibited flow persistent enough to warrant aquatic sampling. Specific sampling was also not conducted during the West Antelope baseline, but no fish were observed in that tract during incidental observations during other wildlife surveys along Antelope and Spring Creeks.

Few reptiles and amphibians have been recorded during wildlife surveys conducted in the general analysis area over the years. The relatively low quantity and quality of aquatic habitat in the area reduces its potential to attract these species, particularly amphibians and turtles. The boreal chorus frog (*Pseudacris triseriata*) has been the most common herptile observed in the area during baseline and annual monitoring surveys over the last two decades. These frogs have been heard in all three primary creeks in the area during spring. Other less common species recorded on or near the general analysis area over time included the Woodhouse's toad (*Bufo woodhousei*), northern leopard frog (*Rana pipiens*), and tiger salamander (*Ambystoma tigrinum*). Prairie rattlesnakes (*Crotalus viridis*) have been observed in a prairie dog colony approximately one mile northeast of the southern portion of the tract. Other dry land species, such as the eastern shorthorned lizard (*Phrynosoma douglassi*) and bullsnake (*Pituophis melanoleucas*), are likely to occur in the general analysis area. Many of these fish, amphibian, and aquatic species are also USDA-FS Sensitive species (see Appendix H).

3.10.7.2 Environmental Consequences

3.10.7.2.1 Proposed Action and Alternatives 1 and 2

Mining activities in the general analysis area would remove intermittent and ephemeral habitat for amphibians, reptiles, and other aquatic species in portions of Spring Creek and Horse Creek during active mining; Antelope Creek would not be physically disturbed. Under natural conditions, habitat for aquatic species is limited on the West Antelope II LBA tract as applied for, and few observations of those species have been recorded in the general analysis area over time. Additionally, primary channels and surface water flow affected during mining would be restored during reclamation. Aquatic species recorded in native and reclaimed channels at other mines in the PRB have been similar to those recorded

at the Antelope Mine.

Under jurisdiction of Antelope Mine's current WDEQ/LQD mine permit, portions of Horse Creek and Spring Creek have been, or will be, disturbed or diverted in order to recover coal from existing coal leases (Section 3.5.2.1). Antelope Creek will not be physically disturbed under the current WDEQ/LQD mine permit and would not be disturbed by mining operations in the general analysis area. Reclamation of the stream channel and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions would restore aquatic resources of those creeks.

3.10.7.2.2 No Action Alternative

Impacts to reptiles, amphibians, and other aquatic species under the No Action Alternative would be similar to the impacts described in Section 3.10.1.2.2, above.

3.10.8 Threatened, Endangered, Proposed, Candidate Species, BLM Sensitive Species, and USDA-FS Region 2 Sensitive Species and Management Indicator Species

Refer to Appendices H and I.

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;
- development of a Monitoring and Mitigation Plan for raptors and other migratory bird species of management concern that must be approved by the USFWS, including the following provisions:
    - creation of raptor nests and nesting habitat through enhancement efforts (nest platforms, tree plantings) to mitigate other nest sites impacted by mining operations;
    - relocation of active and inactive raptor nests that would be impacted by mining in accordance with the approved raptor monitoring and mitigation plan;
    - obtaining permits for removal and mitigation of golden eagle and other raptor species' nests;
    - buffer zones for protection of raptor nests;

  - restriction of mine-related disturbances from encroaching within stipulated buffers of active raptor nests from egg-laying until fledging to prevent nest abandonment and injury to eggs or young;
  - reestablishment of the ground cover necessary to attract and sustain a suitable raptor prey base after mining; and
  - required use of raptor-safe construction for overhead power lines;

- development of a Migratory Bird Species of Management Concern for Coal Mines in Wyoming Monitoring and Mitigation Plan, which must be approved by USFWS;
- 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 for sagebrush obligates and their young;
- restoration of short-grass habitat for species that nest and forage in those habitat types;
- 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 stream channels and restoration of surface water flow quantity and quality after mining to approximate pre-mining conditions.

Antelope Mine's current mine permit requires reconstruction of bed form features such as pools and runs in the stream channels of Spring Creek and Horse Creek. Those efforts should help restore the channels' natural form and function, as well as provide habitat. Restoration will be achieved by salvaging sufficient material from channel terrace alluvium to reconstruct naturally-occurring features. Current reclamation, as well as future reclamation of those creeks by the Antelope Mine, would incorporate alluvium salvaged from the original channels. Similar measures would be incorporated in the amended mining and reclamation plans, if the LBA tract was leased and permitted for mining.

Baseline wildlife surveys were conducted for the Antelope Mine before mining operations began. Annual wildlife monitoring has been ongoing since the early 1980s. These surveys are required by state and federal regulations. The wildlife monitoring surveys cover the lands within the approved mine permit area and a surrounding perimeter that varies in size according to the species being considered. As a result, a majority of the West Antelope II general analysis area has been encompassed during the required monitoring efforts for the Antelope Mine.

The required annual wildlife monitoring program currently consists of the following:

- early spring surveys for new and/or occupied raptor territories and/or nests, upland game bird lek locations, T&E species, and migratory birds on and around the existing leases;
- late spring surveys for migratory birds and raptor production at occupied nests, opportunistic observations of all wildlife species, and T&E species;
- summer surveys for raptor production at occupied nests, migratory birds, and lagomorph density.

Surface coal mines in the PRB were required to conduct seasonal surveys for big game species and brood surveys for upland game birds annually from 1994-1999. At the end of that period, the WGFD reviewed monitoring data and requirements for those species on mine properties. WGFD biologists concluded that the monitoring had demonstrated a lack of impacts to big game on existing mine sites, and that the brood surveys were not providing meaningful data. Additionally, no severe mine-related big game mortalities had occurred and no long-lasting impacts to big game had been documented on existing mine sites. The WGFD therefore recommended in late 1999 that big game monitoring and upland game bird brood surveys 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 West Antelope II general analysis area.

Although big game surveys are no longer required, the Antelope Mine voluntarily elected to continue winter aerial and ground counts in alternate years to enhance previous annual data for those species. Numerous other mines in the PRB also conduct these voluntary surveys on the same schedule as Antelope Mine.

The Antelope Mine operates under a current USFWS approved Monitoring and Mitigation Plan for raptors and other migratory bird species of management concern. The plan would be amended to include the West Antelope II LBA tract if it is leased and permitted for mining. The amended plan would be subject to review and approval by the USFWS before the amended mining plan is approved.

If the current *Coal Mine List of Migratory Bird Species of Management Concern in Wyoming* is updated, or if additional species are documented nesting or using the area regularly, the current Monitoring and Mitigation Plan would be amended to incorporate and protect those birds and their habitats.

3.10.10 Residual Impacts

Although the West Antelope II LBA tract would be reclaimed in accordance with the requirements of SMCRA and Wyoming statutes, there would still 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 for bond release may also limit replacement of habitat for some species such as the mountain plover, which occupy somewhat specialized, low-growth form habitats. Those species may repopulate reclaimed areas, but populations may not attain pre-mining levels without special variances to accommodate those specific needs. For example, every effort would be made to preserve source populations of prairie dogs in the vicinity of development, as these animals can be valuable in restoring similar structural characteristics of pre-mine grassland species through regular clipping and harvesting of vegetation.

Limited riparian and sagebrush-grassland habitat is present in the general analysis area. Areas that currently support sagebrush would be altered to a grassland community, perhaps for decades, during the interim between sage plantings and maturity in reclamation. Such habitat transformations would likely result in a change in wildlife species composition until pre-mining habitats had been fully reestablished. Because state and federal regulations require reclamation of specific habitats, minimal residual impacts to T&E, Candidate, or Proposed plant and animal species are expected to occur.

3.11 Land Use and Recreation

3.11.1 Affected Environment

Within the West Antelope II LBA tract as applied for, surface ownership consists entirely of private lands. Federal land administered by the USDA-FS is included within the area added under Alternatives 1 and 2. The present land use of the general analysis area is primarily livestock grazing and wildlife habitat. Gas production and recreation are secondary land uses. Surface ownership for the West Antelope II LBA tract is shown in Table 3-12 and Figure 3-20.

Table 3-12. Distribution of Surface Ownership Within the West Antelope II LBA Tract as Applied for Under the Proposed Action and Additional Lands Added Under Alternatives 1 and 2.

	Federal Ownership		**Private Ownership**	
LBA Tract Configuration	**(Acres)**	**(Percent)** [1]	**(Acres)**	**(Percent)** [1]
Tract As Applied For	0	0	4108.6	65.1
Additional Lands Added Under Alternatives 1 and 2	237.2	3.8	1963.4	31.1
Total	**237.2**	**3.8**	**6072.0**	**96.2**

[1] Based on total acres (Proposed Action plus Alternatives 1 and 2).

As indicated in Table 3-12, approximately 240 acres of federal surface administered by the USDA-FS is included in the West Antelope LBA tract under

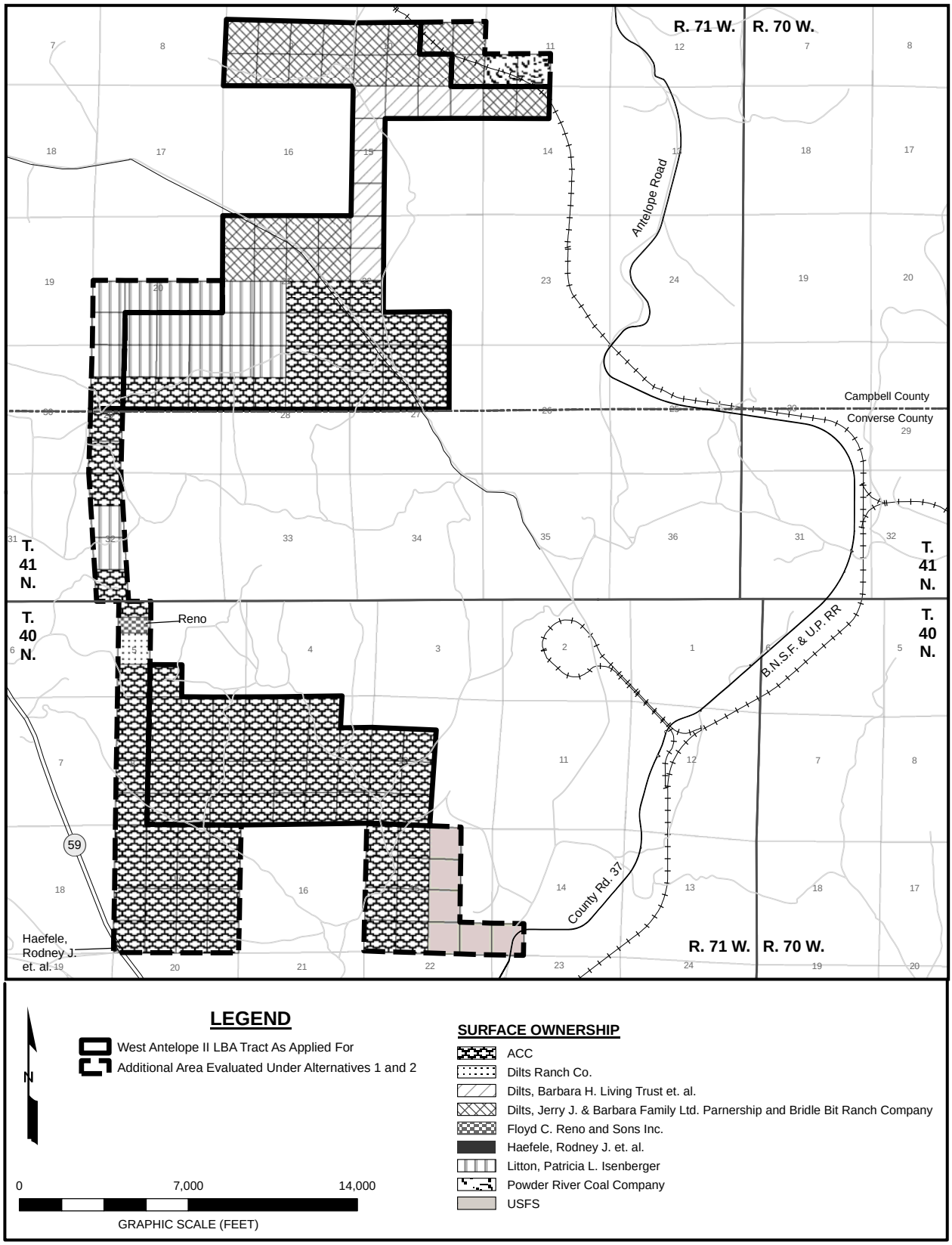


Figure 3-20. Surface Ownership Within the West Antelope II LBA Tract.

Alternatives 1 and 2. This federal land is within Grazing Allotment #213, currently held by Thunder Basin Grazing Association.

Areas of disturbance within and near the general analysis area include roads, oil and gas wells and associated production facilities, surface mine-related facilities, and activities associated with ranching. State Highway 59 is located west of the West Antelope II LBA tract as applied for. Highway 59 crosses the southwestern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2. County roads that traverse and provide public and private access within and near the general analysis area include County Road 37 (Antelope Coal Mine Road) in Converse County and County Road 4 (Antelope Road) in Campbell County. County Road 37 crosses the southeastern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2. The BNSF & UP railroad ROW crosses the northern block of the West Antelope II LBA tract (Figure 3-20). As discussed in Section 1.5 and Appendix B, the lands within the railroad ROW are considered to be unsuitable for mining under coal mining unsuitability Criterion 2 (43 CFR 3461.5 (c)(2)). The lands within the public road ROWs are considered to be unsuitable for mining under coal mining unsuitability Criterion 3 (43 CFR 3461.5 (c)(3)).

The oil and gas estate within the West Antelope II LBA tract is federally and privately owned (Figure 3-21); the majority (approximately 95 percent) is federally owned. Not all of the federally owned oil and gas estate is leased. The current (April 2007) federal oil and gas lessees for the LBA tract (Proposed Action and Alternatives 1 and 2) are listed in Table 3-13.

According to WOGCC records (WOGCC 2007c), two conventional oil wells were permitted and drilled on lands included in the BLM study area for the West Antelope II LBA tract (the tract as applied for and additional area evaluated under Alternatives 1 and 2, Figure 3-21). Both are permanently abandoned.

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.There are 40 permitted CBNG wells on lands included in the BLM study area for the West Antelope II LBA tract (the tract as applied for and the additional area evaluated under Alternatives 1 and 2, Figure 3-21) (WOGCC 2007c). The status of these 40 well permits as of April 2007 was as follows: 20 producing, 3 flowing, 7 shut-in, 1 permanently abandoned, 1 denied or cancelled, 1 notice of intent to abandon, and 7 expired permits. CBNG wells capable of production on or in sections adjacent to the West Antelope II LBA tract are listed in Appendix E.

Additional information on the conventional oil and gas and CBNG development in the West Antelope II 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

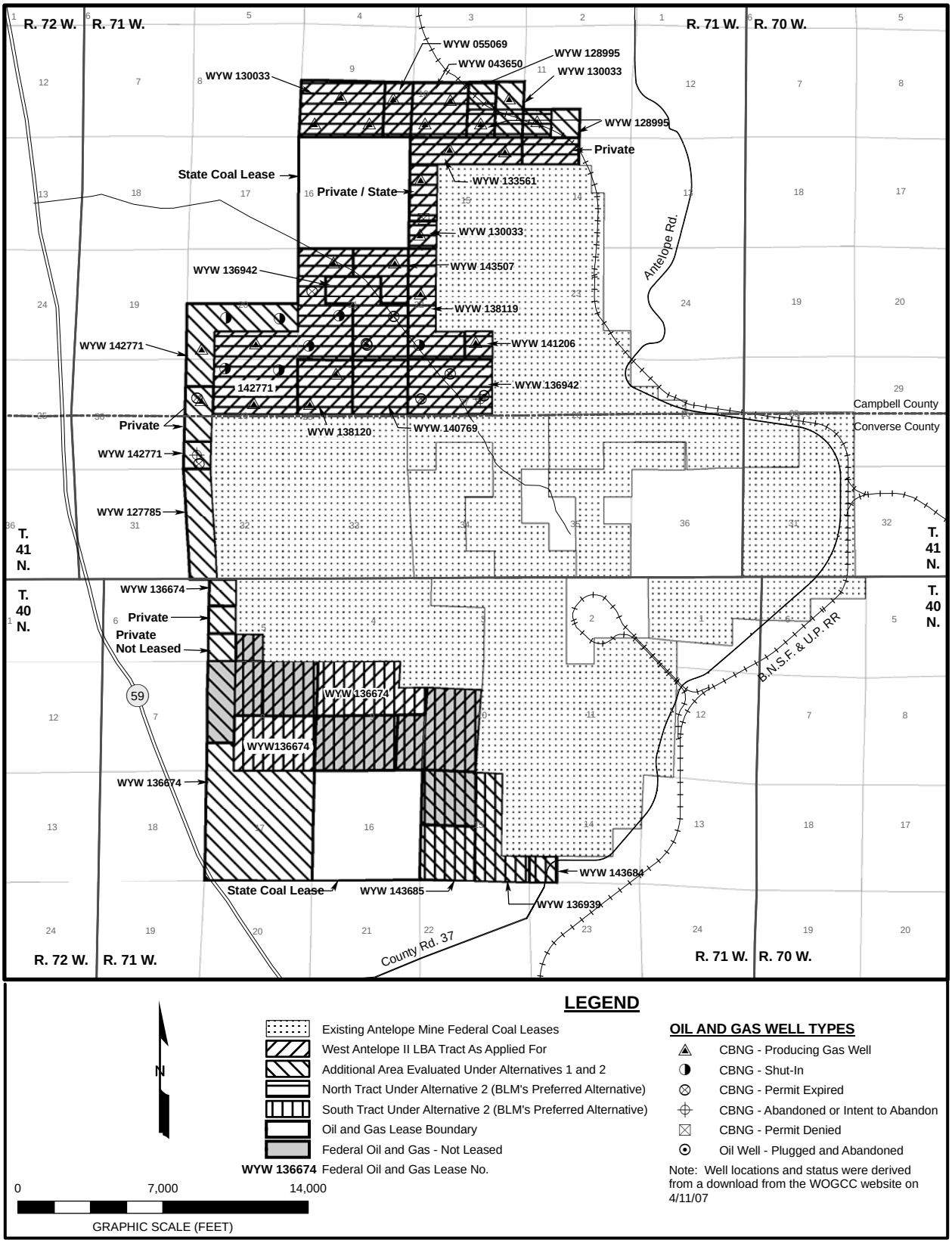


Figure 3-21. Oil and Gas Ownership on the West Antelope II LBA Tract.

Table 3-13. Current Federal Oil and Gas Leases on the West Antelope II LBA Tract.

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

Lease Number	Location	Lessees of Record
	T.40N., R.71W.	
WYW 136674	Section 5; Lots 8, 9 Section 8; Lots 9-11, 13-16 Section 9; Lots 2-8 Section 17; Lots 1-16	Antelope Coal Co.
WYW 136939	Section 15; Lots 2, 7,10, 15, 16	Liberty Petroleum Corp.
WYW 143684	Section 14; Lot 13	Bill Barrett Prod. Co.
WYW 143685	Section 15; Lots 11-14	Petro Atlas Corp.
	T.41N., R.71W.	
WYW 043650	Section 10; Lots 11-14	ABO Petro Corp. Cienaga LLC Hay Canyon LLC Marico Expl. Inc. Myco Industries Inc. Sharbro Oil LTD Co. Tulipan LLC Willian G. Helis Est. Yates Drilling Do. Yates Petroleum Corp.
WYW 055069	Section 9; Lots 9, 16	Key Production Co. Inc. Lance O&G Co. Inc. Nance Petroleum Corp. Pathfinder Energy Wellstar Corp. Williams Prod. RMT Co.
WYW 127785	Section 32; Lots 4, 5, 12, 13	Fred L. Engle
WYW 128995	Section 10; Lots 10, 15 Section 11; Lots 13, 14	ABO Petro Corp. Lance O&G Co. Inc. Myco Industries Inc. Williams Prod. RMT Co. Yates Drilling Do. Yates Petroleum Corp.

Table 3-13. Current Federal Oil and Gas Leases on the West Antelope II LBA Tract - Continued.

Lease Number	Location	Lessees of Record
WYW 130033	Section 9; Lots 10-15 Section 10; Lots 9, 16 Section 15; Lot 13	ABO Petro Corp. Lance O&G Co. Inc. Myco Industries Inc. Sharbro Oil LTD Co. Williams Prod. RMT Co. Yates Drilling Do. Yates Petroleum Corp.
WYW 133561	Section 15; Lots 1-4	Barbara Starr Shillington
WYW 136942	Section 21; Lots 6, 7, 9, 10, 15, 16 Section 27; Lots 6-11	Gregor Klurfeld
WYW 138119	Section 22; Lots 7, 8, 14-16	Bowers O&G Inc. Spring Creek Ranch
WYW 138120	Section 28; Lots 3-6	Bowers O&G Inc. Spring Creek Ranch
WYW 140769	Section 28; Lots 1, 2, 7, 8	Lance O&G Co. Inc. Williams Prod. RMT Co.
WYW 141206	Section 22, Lot 2	Williams Prod. RMT. Co.
WYW 142771	Section 20; Lots 9-16 Section 21; Lots 3-5, 11-14 Section 29; Lots 1-4, 6-8, 13	Lance O&G Co. Inc. Williams Prod. RMT Co.
WYW 143507	Section 21; Lots 1, 2, 8	ABO Petro Corp. Myco Industries Inc. Yates Drilling Do. Yates Petroleum Corp.

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.

Coal mining is a dominant land use to the north and east of the LBA tract. The Jacobs Ranch, Black Thunder, School Creek, North Antelope/Rochelle, and Antelope Mines form a group of contiguous surface coal mines located in Campbell and Converse Counties (Figure 1-1). Coal production from these mines increased by 65 percent between 1998 and 2006 (from approximately 155 million tons in 1998 to approximately 255 million tons in 2006). Of the 17 leases issued in the PRB since decertification of the federal coal region, 14 have been issued within this group of five mines (Table 1-1). The West Antelope II LBA tract being evaluated in this EIS is one of five currently pending lease applications in this group of mines (Table 1-2).

Campbell County does not have a county-wide land use plan, but is currently developing a comprehensive land use plan jointly with the City of Gillette (City of Gillette 1978 and Campbell County 2005). 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. In August 1978, the Converse County Planning Commission completed a land use plan covering agriculture, recreation and minerals industries management (Converse County 1978). The Antelope Coal Field lies approximately 55 miles north of Douglas in an area zoned primarily for agricultural use, and secondarily for mineral extraction.

Big game hunting is the principal recreational land use within the general analysis area, with pronghorn, mule deer, and white-tailed deer 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., USDA-FS 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 are no BLM-administered public surface lands included in the West Antelope II LBA tract. About 240 acres of USDA-FS administered lands (TBNG) are included in the area added to the south block of the tract under Alternatives 1 and 2 (Figure 3-20). Approximately 100 acres of the TBNG land within the area added under Alternatives 1 and 2 are within the current Antelope Mine permit boundary and thus may be inaccessible to the public.

Specific information pertaining to WGFD big game herd management objectives within and near the general analysis area is contained in the 2006 Big Game Job Completion Reports for the Casper and Sheridan Regions (WGFD 2006). The

WGFD classifies most of the general analysis area as yearlong habitat for pronghorn. A small portion of the south tract is classified as severe winter range. No crucial or critical pronghorn habitat is recognized by the WGFD in this area. The general analysis area is within pronghorn Hunt Area 27, which is contained in the Cheyenne River Herd Unit. In post-season 2006, the population of the Cheyenne River Herd Unit was estimated to be approximately 39,621 animals; the WGFD population objective is 38,000.

Between 1995 and 2000, the Cheyenne River Herd Unit population was fairly stable at about 15 percent below the objective population. Pronghorn populations in this herd unit dropped in 2001, primarily because of lower productivity and survival caused by climatic factors. Population recovery began in the following years, with an increase of approximately 2,000 additional pronghorn each year between 2002 and 2005. The estimated population decreased slightly in 2006. Hunt Area 27 contains mostly privately owned surface lands with poor hunter access to limited publicly owned lands; therefore, the number of pronghorn 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.

The WGFD has classified the general analysis area as winter-yearlong, yearlong, and "OUT" mule deer use range (the OUT areas do not contain enough animals to be important habitat, or the habitat is of limited importance to a species). Crucial or critical mule deer habitat does not occur on or within several miles of the general analysis area. The general analysis area is located within mule deer Hunt Area 10, part of the Thunder Basin Mule Deer Herd Unit. The Thunder Basin Herd Unit encompasses 3,642 square miles; of this, 71 percent is privately owned. Hunt Area 10, however, contains substantial blocks of public land. According to WGFD, there has been an increase in the number of landowners leasing to outfitters, which is increasing hunting pressure on public lands. In 2006, measures taken to address landowner and sportsmen concerns about low deer numbers in Hunt Area 10 included switching to general license, antlered only hunting and reducing the length of the hunting season. The 2006 post-season objective for this mule deer herd was 20,000. The 2006 post-season population was estimated at 22,036, an increase of 4,230 animals since 2005. Because of drought-related forage conditions, WGFD believes the herd should be reduced to below the objective population; however, limited sales and use of certain types of licenses and limited hunting on private land may hamper the ability to reduce the population through hunting.

White-tailed deer are now managed separately by WGFD. The herd occupying Hunt Area 10 is part of the Central White-tailed Deer 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 Antelope Creek, as OUT white-tailed deer use range. The narrow corridor along Antelope Creek is classified as yearlong range. There is no population model for this herd.

The Rochelle Hills Elk Herd resides in the Rochelle Hills located approximately 13 miles east of the general analysis area. The general analysis area is within Elk Hunt Area 113 of the Rochelle Hills Herd Unit. Elk Hunt Area 113 contains crucial winter, parturition, winter-yearlong, yearlong, OUT, and undecided/unknown use ranges. In post-season 2006, the population of the Rochelle Hills Elk Herd was estimated to be approximately 650 animals; the WGFD population objective is 400. The herd favors the ponderosa pine/juniper woodlands, savanna, and steeper terrain habitat offered by the Rochelle Hills. However, recent data indicate the population is larger than previously expected, with this herd also occupying the public lands found in TBNG located within Hunt Area 113. 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.

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 has enhanced the water supply within some drainages in the general analysis area, including Spring Creek, which has increased potential habitat for some aquatic species. Those enhanced areas are still relatively limited and/or isolated in nature, and no perennial drainages are present in the general analysis area.

3.11.2 Environmental Consequences

3.11.2.1 Proposed Action and Alternatives 1 and 2

The major adverse environmental consequences of leasing and mining the West Antelope II LBA tract with respect to land use would be the loss of livestock grazing and wildlife habitat (particularly big game) and curtailment of oil and gas development during coal mining and surface 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. Under Alternatives 1 and 2, access to approximately 240 acres of federal grazing leases would be suspended during mining operations. This federal land is within Grazing Allotment #213, currently held by Thunder Basin Grazing Association. Access for recreational and other (i.e., ranching, oil and gas development) activities would be restricted during mining operations. Estimated disturbance areas for the West Antelope II LBA tract and the tract configuration for Alternatives 1 and 2 are presented in Table 3-1.

Sections 3.3.2 and 3.11.1 and Appendix E 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 1 and 2. Well location information, federal oil and gas ownership, and federal oil and gas lessee information are presented in Figure 3-21 and Table 3-13. 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 allowed development of both resources on portions of the LBA tract. Producing CBNG wells are present on the West Antelope II LBA tract. In the PRB, royalties have been and would be lost to both the state and federal governments 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.

As discussed above, BLM is evaluating including up to approximately 240 acres of USDA-FS-administered federal surface under Alternatives 1 or 2. Access to those lands would be limited if they are leased and mined. Approximately 100 of those acres are within the current Antelope Mine permit area and access to the public is currently limited on those lands as a result. 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 West Antelope II LBA tract, including the federal surface discussed above, would be eliminated during mining and reclamation. Pronghorn, white-tail deer, and mule deer occur on and adjacent to the LBA tract, as do 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 (USDA-FS).

3.11.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would

not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. Currently approved mining operations would continue on the existing Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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. 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, 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 used here. The Plains designation within the Early, Middle, and Late Archaic periods has been omitted.

- 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. Ceramic technology also appears with the Late Prehistoric Period. 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 the 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).

The Dry Land Farming movement of the late 19th and early 20th centuries had a profound effect on the settlement of the PRB during the years around World War I. Although the principles of dry land farming were sound, success still required a certain amount of precipitation each year. Wyoming encouraged dry land settlement of its semi-arid lands through a Board of Immigration created in 1911. Newspapers extolled the virtues of dry land farming, and railroads conducted well-organized advertising campaigns on a nationwide basis to settle the regions through which they passed.

The most intensive period of homesteading activity in the Eastern PRB occurred in the late 1910s and early 1920s. Promotional efforts by the state and the railroads,

the prosperous war years for agriculture in 1917 and 1918, and the Stock Raising Act of 1916 with its increased acreage (but lack of mineral rights) all contributed to this boom period. A large amount of land filings consisted of existing farms and ranches expanding their holdings in an optimistic economic climate. However, an equally large number of homesteaders had been misled by promotional advertising and were not adequately prepared for the experiences that awaited them in the PRB. It soon became apparent to the would-be dry land farmer that he could not make a living by raising only crops. Some were initially successful in growing wheat, oats, barley and other small grains, along with hay, alfalfa, sweet clover and other grasses for the increased number of cattle.

A drought in 1919 was followed by a severe winter. The spring of 1920 saw market prices fall. Those homesteaders who were not ruined by the turn in events often became small livestock ranchers and limited their farming to the growing of forage crops and family garden plots. Some were able to obtain cheap land as it was foreclosed or sold for taxes. During the 1920s the size of homesteads in Wyoming nearly doubled and the number of homesteads decreased, indicating the shift to livestock raising (LeCompte and Anderson 1982).

With serious drought beginning in 1932, several Federal actions were taken. In April of 1932, Weston, Campbell and Converse counties were eligible for a drought relief program. The Northeast Wyoming Land Utilization Project began repurchasing the sub-marginal homestead lands and making the additional acres of government land available for lease. This helped the small operator to expand the usable grazing land. Cropland taken out of production could be reclaimed and then added to the grazing lease program. Grazing associations were formed to regulate the grazing permits. In1934, the Agricultural Adjustment Administration began studying portions of Converse, Campbell, Weston, Niobrara and Crook counties. In all, 2 million acres were included in the Thunder Basin Project (LA-WY-1) to alter land use and to relocate settlers onto viable farmland. Nationally, the program hoped to shift land use from farms to forest, parks, wildlife refuges or grazing districts. In marginal areas cash crops were to be replaced by forage crops, the kind and intensity of grazing would be changed and the size of operating units would be expanded (USDA-FS n.d.). Land purchase work on the Thunder Basin Project began late 1934 and the purchasing of units started in 1935.

During the development program to rehabilitate the range, impounding dams were erected, wells were repaired, springs developed, and homestead fences were obliterated while division fences were constructed for the new community pastures. Farmsteads were obliterated and the range reseeded. Remaining homesteaders and ranchers often purchased or scavenged materials from the repurchased farmsteads. Pits were dug on some homesteads and machinery and demolished buildings buried (many of these were dug up during the World War II scrap drives). Ironically, the rehabilitation project utilized a labor pool of former farmers who had spent years building what the government paid them to destroy. Their efforts were so successful that almost no trace remains of many homesteads.

While counties lost much of their population base as a result of the Resettlement Administration relocation program, they were strengthened financially: schools were closed, maintenance of rural roads was restricted to main arteries, and delinquent taxes were paid. The remaining subsidized ranches were significantly larger and provided a stabilizing effect on the local economies. Three grazing associations were formed: the Thunder Basin Grazing Association, the Spring Creek Association, and the Inyan Kara Grazing Association. These associations provided responsible management of the common rangeland.

Class III Cultural Resources Survey

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 which cannot be avoided by project development and are recommended as eligible for the NRHP 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. If the West Antelope II LBA tract is leased, full consultation with the SHPO would 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, as well as with surface mining operations, have been conducted in the general area. The entire West Antelope II

general analysis area has been surveyed for cultural resources at a Class III level. Approximately 1,140 acres within the anticipated permit amendment study area (Figure 3-1) were surveyed in October 2008. Agency archaeologist are reviewing the results of that inventory, and site evaluations and assessment of potential effects and mitigation needs will be detailed in the Conditions of Approval accompanying the Record of Decision. Of the seven cultural sites documented by the recorder within the 1,140 acres, four were recommended as eligible for the NRHP.

Eighty-two cultural sites have been documented within the portion of the West Antelope II general analysis area that was surveyed prior to October 2008 (Table 3-14). Of these 82 sites, 48 are prehistoric activity areas ranging from open camps to cairns and other rock alignments, 22 are historic (homestead remains, trash scatters, etc), nine are multi-component (containing both historic and prehistoric components), and three are cairns of undetermined age and cultural affilitation.

Eight prehistoric sites (including one multiple component site) have been determined NRHP *eligible* under Criterion D, which applies to sites that have yielded, or may be likely to yield, information important in prehistory or history. These sites will require the implementation of approved mitigation plans prior to any disturbance, as their loss would be considered an adverse effect to cultural resources. Sites 48CA2892, 48CA4342, 48CA4343, 48CA4998, 48CA5800, 48CO0480, 48CO2832, and 48CO2834 will require planned avoidance unless an approved mitigation plan is implemented.

There are two prehistoric sites with undetermined or unresolved NRHP status within the West Antelope II survey area. Unresolved sites are treated under the law as if they were NRHP eligible, that is, disturbance is to be avoided until they have been evaluated for the NRHP. Site 48CA4718 is recommended eligible by the recording organization but has not been evaluated by any agency. Site 48CA3929 is recommended not eligible by the recorder, but is considered unevaluated by the SHPO. SHPO requested that additional testing be conducted at these sites because further information is required before a final evaluation can be made. Additionally, BLM has recommended that site 48CA3929 be submitted to Native American consultation to determine eligibility.

Three prehistoric sites (48CO2934, 48CO2996, and 48CO2997) were evaluated by the recorder as *not eligible* in the field. There is no SHPO concurrence, but BLM has concurred with the evaluation of not eligible. All three fail to meet criterion D due to minimal artifact assemblages and lack of soils deposition. However, rock alignments and stone circles are often of religious or spiritual importance and Native American consultation will need to be carried out on these sites. Two additional sites (48CA1547, 48CA3064) have been evaluated as not eligible under criterion D but will also require Native American consultation to determine whether these sites might be eligible under criterion A.

Table 3-14. Cultural Sites in the West Antelope II General Analysis Area.

Site Number	NRHP Status	Author(s) / Organization	Report / Project Name	Site Type
48CA0884	NE/D	Archaeological Services	Jumping Creek Fed-1 well	P
48CA0885	NE/D	Archaeological Services	Jumping Creek Fed-1 well	P
48CA1547	NE [1]	GCM Services	Fiddleback Ranch Land Exchange	H
		GCM Services	Horse Creek Archaeological Study	
		High Plains Consultants	Boundary Fed 1	
48CA2892	E (D)	GCM Services	Horse Creek Archaeological Study	P
		GCM Services	Antelope Coal Mine Drill Holes	
48CA2973	NE	GCM Services	Fiddleback Ranch Land Exchange	M
		Greer Services	Kane Fed. Proj. Dilts Lease CBM	
48CA3064	NE [1]	GCM Services	Horse Creek Archaeological Study	U
48CA3097	NE	GCM Services	Horse Creek Archaeological Study	P
48CA3574	NE	GCM Services	West Antelope II & Off Lease Drill	H
		GCM Services	Tract L Addendum	
		Quality Services	Rochelle Hills POD CBM	
		ACR Consultants, Inc.	Antelope Federal POD CBM	
		Pronghorn Archaeological Services	East Litton CBM POD	
48CA3925	NE	GCM Services	West Antelope LBA Area	H
48CA3926	NE	GCM Services	West Antelope LBA Area	H
48CA3927	NE	GCM Services	West Antelope LBA Area	H
48CA3928	NE	GCM Services	West Antelope LBA Area	H
48CA3929	UND [1]	GCM Services	West Antelope LBA Area	P
48CA3930	NE	GCM Services	West Antelope LBA Area	P
48CA3972	NE	GCM Services	West Antelope LBA Area	P
48CA4342	E (D)	Greer Services	Kane Fed. Proj. Dilts Lease CBM	P
48CA4343	E (D)	Greer Services	Kane Fed. Proj. Dilts Lease CBM	P
48CA4718	UND	WAS	Antelope II POD	P
		GCM Services	West Antelope II & Off Lease Drill	
48CA4719	NE	GCM Services	West Antelope II & Off Lease Drill	H
		Western Land Services	Antelope II POD	
48CA4720	NE	GCM Services	West Antelope II & Off Lease Drill	H
		Western Land Services	Antelope II POD	
48CA4783	NE	Western Land Services	Antelope II POD	H
48CA4998	E (D)	Quality Services	Rochelle Hills POD CBM	P
48CA4999	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5000	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5001	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5002	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5003	NE	Quality Services	Rochelle Hills POD CBM	M

Table 3-14. Cultural Sites in the West Antelope II General Analysis Area (Continued).

Site Number	NRHP Status	Author(s) / Organization	Report / Project Name	Site Type
48CA5011	NE	Quality Services	Rochelle Hills POD CBM	H
48CA5012	NE	GCM Services Quality Services	Tract L Addendum Rochelle Hills POD CBM	H
48CA5013	NE	GCM Services Quality Services	Tract L Addendum Rochelle Hills POD CBM	H
48CA5296	NE	ACR Consultants, Inc.	Tuit Draw POD	H
48CA5799	NE	GCM Services	West Antelope II & Off Lease Drill	U
48CA5800	E (D)	GCM Services	West Antelope II & Off Lease Drill	M
48CO0047	NE (CON)	OWSA	No Associated Report	P
48CO0144	NE	OWSA GCM Services	Antelope Coal Lease - Final Report West Antelope II & Off Lease Drill	H
48CO0154	NE (CON)	OWSA	Antelope Coal Lease - Final Report	P
48CO0158	NE/D	OWSA GCM Services	Antelope Coal Lease - Final Report West Antelope II & Off Lease Drill	M
48CO0159	NE (CON)	OWSA	Antelope Creek Lease Area	P
48CO0480	E (D)	WCRM	Antelope Mine Testing and Mitigation	P
48CO1709	NE	TRC/Mariah & Associates	WDOT Linear Survey	H
48CO1710	NE	TRC/Mariah & Associates	WDOT Linear Survey	H
48CO1716	NE	USFS	Antelope Creek Land Exchange	P
48CO1717	NE	USFS	Antelope Creek Land Exchange	P
48CO1718	NE	USFS	Antelope Creek Land Exchange	P
48CO1719	NE	USFS	Antelope Creek Land Exchange	P
48CO1720	NE	USFS	Antelope Creek Land Exchange	M
48CO1721	NE	USFS	Antelope Creek Land Exchange	M
48CO1722	NE	USFS	Antelope Creek Land Exchange	P
48CO1723	NE	USFS	Antelope Creek Land Exchange	M
48CO1724	NE (CON)	USFS GCM Services	Antelope Creek Land Exchange West Antelope Drilling Additions	P
48CO1725	NE	USFS	Antelope Creek Land Exchange	P
48CO2248	NE	AEC	Antelope Mines Fuel Pipeline	M
48CO2613	NE	AEC	Rochelle Hills CS#1 Well, Access	P
48CO2718	NE	GCM Services	West Antelope LBA Area	P
48CO2830	NE	GCM Services	West Antelope Drilling Additions	H
48CO2831	NE	GCM Services	West Antelope Drilling Additions	P
48CO2832	E (D)	GCM Services	West Antelope Drilling Additions	P

Table 3-14. Cultural Sites in the West Antelope II General Analysis Area.

Site Number	NRHP Status	Author(s) / Organization	Report / Project Name	Site Type
48CO2833	NE	GCM Services	West Antelope Drilling Additions	P
		GCM Services	West Antelope Site Evaluations	
48CO2834	E (D)	GCM Services	West Antelope Drilling Additions	P
		GCM Services	West Antelope Site Evaluations	
48CO2835	NE	GCM Services	West Antelope Drilling Additions	P
48CO2836	NE	GCM Services	West Antelope Drilling Additions	P
48CO2837	NE	GCM Services	West Antelope Drilling Additions	P
48CO2838	NE	GCM Services	West Antelope Drilling Additions	P
48CO2859	NE	Quality Services	Rochelle Hills POD CBM	H
48CO2860	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2861	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2862	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2863	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2864	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2867	NE	Quality Services	Rochelle Hills POD CBM	M
48CO2868	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2869	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2886	NE	Quality Services	Rochelle Hills POD CBM	P
48CO2919	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2920	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2921	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2922	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2923	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2924	NE	GCM Services	West Antelope II & Off Lease Drill	P
48CO2934	NE [1]	GCM Services	CA/CO Joint Pipeline Corridor	P
48CO2996	NE [1]	GCM Services	West Antelope EIS Additions	P
48CO2997	NE [1]	GCM Services	West Antelope EIS Additions	U

Site Type: P=Prehistoric; H=Historic; M=Multi-component; U=Unknown (i.e., rock cairn)

WCRM=Western Cultural Resource Management; OWSA=Office of the Wyoming State Archaeologist; USFS=United States Forest Service; AEC=Archaeological Energy Consulting; WAS=Western Archaeological Services
NRHP Status: E(D)=Eligible for the NRHP under Criterion D; NE=Not Eligible; NE(CON)=Not Eligible by Consultant; NE/D=Not Eligible/Destroyed; UND=Undetermined NRHP Status (No SHPO review or inusfficient information).

[1] Site requires Native American consultation

Four prehistoric sites (48CO0047, 48CO0154, 48CO0159, 48CO1724) were reported as *not eligible* by the recorder, with no other concurrence. Three of these sites (48CO0047, 48CO0154, and 48CO0159) were reported prior to 1980 and, according to BLM policy, must be reassessed. Site 48CO1724 was recorded in 1991, but because no other information is available it should be reexamined prior to final disposition. Available information for these four sites indicates that they will not be eligible for the NRHP under current standards.

The remaining 63 sites have been determined *not eligible* for the NRHP. No further protection is afforded these sites, as recordation has exhausted their archaeological potential. There is a standing stipulation that, should previously unknown cultural resources be discovered during any surface disturbing activity, all activity in that vicinity shall be halted until a qualified archaeologist can evaluate the find.

3.12.2 Environmental Consequences

3.12.2.1 Proposed Action and Alternatives 1 and 2

Data recovery plans are required for all sites recommended eligible to the National Register following testing and consultation with 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 a mining plan. 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 cultural sites may be destroyed without further work.

The eligible sites on the West Antelope II 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. Unintended or uninformed impacts related to increased off-road traffic during mine related activities are the most frequents impacts to cultural resources.

3.12.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. Currently approved mining operations would continue on the existing Antelope Mine leases. Cultural resources on the portions of the West Antelope II LBA tract adjacent to the

Antelope 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 West Antelope II 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, 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. They are also being provided with more specific information about the known cultural sites on the tract in this analysis. Their help is being requested in identifying potentially significant religious or cultural sites in the general analysis area before a leasing decision is made on the West Antelope II LBA tract.

Native American tribes were consulted at a general level in 1995-1996 as part of an update to the BLM Buffalo RMP update (BLM 2001a) 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 mining, 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.

Mining activities are monitored during topsoil stripping operations. If a lease is issued for the West Antelope II 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.

Cultural sites are permanently destroyed by surface coal mining operations but, as a result of the intensive pedestrian inventories, site evaluations and excavation and analysis of prehistoric cultural resources discussed above, there is a more informed understanding of what types of resources exist in the region and a better understanding of local prehistory.

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. Existing surface mines form a nearly continuous band on the east side of Highway 59 from Gillette south for about 50 miles. 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 general analysis area is fairly low because of the industrial nature of the adjacent existing mining operations and oil and gas development.

The VRM system is the basic tool used by BLM to inventory and manage visual resources on public lands. Prior to 1986, the five VRM classes defined below were used to describe increasing levels of change within the characteristic landscape. The number of VRM classes was reduced from five to four in 1986 (BLM 2007), but the new resource management class objectives remain very similar to the original objectives of VRM Classes I through IV.

The pre-1986 VRM Classes are summarized as follows:

Class I: Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.

Class II: Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.

Class III: Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.

Class IV: Activity attracts attention and is a dominant feature of the landscape in terms of scale.

Class V: This classification is applied 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.

The 2001 Buffalo RMP revision (BLM 2001a) covers the Campbell County portion of the West Antelope II general analysis area. It retained and carried forward the VRM inventory from the 1985 Buffalo RMP (BLM 1985a). Visual classifications for the Converse County portion of the West Antelope II LBA tract (the south block of the lease application area) were included in the Platte River Resource Area RMP (BLM1985b). The Proposed Resource Management Plan and Final Environmental Impact Statement for the Casper Field Office, which was released June 8, 2007 and will replace the 1985 Platte River RMP when it is completed, includes an updated VRM inventory (BLM 2007).

At this time, the lands included in the general analysis area in both Campbell and Converse Counties continue to be managed in accordance with the VRM classes established in 1981 and the predominant VRM class is Class IV. Portions of the general analysis area adjacent to State Highway 59 in Converse County are currently classified as Class III, but the amount of Class III land would be reduced by adoption of the preferred alternative (BLM 2007) for the Casper Field Office RMP. Use of the post-1986 VRM classes in the Casper Field Office RMP will not affect the general analysis area VRM classification because the general analysis area does not include any lands that were classified as VRM Class V in the 1985 Platte River RMP.

Approximately 240 acres of the surface of the general analysis area is part of the TBNG, which is administered by the USDA-FS. The USDA-FS has established visual quality objectives for the TBNG. In the general analysis area, facilities and landscape modifications may be visible but should be reasonably mitigated to blend and harmonize with natural features according to the revised Land and Resource Management Plan for the Thunder Basin National Grassland (USDA-FS 2001).

Currently, mine facilities and mining operations at the Antelope Mine are visible from various public-use roads in the general analysis area, including Antelope Road (County Road 37) and State Highway 59.

3.13.2 Environmental Consequences

3.13.2.1 Proposed Action and Alternatives 1 and 2

If the West Antelope II LBA tract is leased and mined, mining operations on the LBA tract would be visible from State Highway 59, which is approximately 0.75 to 2.5 miles west of the tract. The portions of the general analysis area that would be disturbed under the Proposed Action or Alternatives 1 or 2 would be considered as VRM Class IV prior to reclamation. After reclamation of the LBA tract and adjoining mines, the VRM Class IV conditions would be restored and the reclaimed land would resemble the surrounding undisturbed terrain. No visual resources that are unique to this area have been identified on or near the West Antelope II LBA tract.

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

3.13.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively. The current VRM Class designations would not change for those lands. Currently approved mining operations would continue on the existing Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 access 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 3-22 presents noise levels associated with some commonly heard sounds.

No site-specific noise level data are available for the general analysis area. However, in 2004, Matheson Mining Consultants, Inc. conducted a noise survey at the two occupied locations closest to the existing Antelope operations. Measurements were taken at the Don Jacobs residence located directly west of the mine on State Highway 59 and at the Dyno Nobel West Region office located northeast of the mine on County Road 37. The maximum daily time weighted (L_{eq}) noise reading at the Don Jacobs residence was 51 dBA which is comparable to that of a normal office, 50 feet in the distance. The maximum measured L_{eq} at Dyno Nobel was 52.6 dB(A) which is equivalent to the noise level of an average office environment.

3.14.2 Environmental Consequences

3.14.2.1 Proposed Action and Alternatives 1 and 2

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, no rail car loading would take place on the LBA tract. The Noise Control Act of 1972 indicates that a

24-hour equivalent level of less than 70 dBA prevents hearing loss and that a level below 55 dBA, in general, does not constitute an adverse impact.

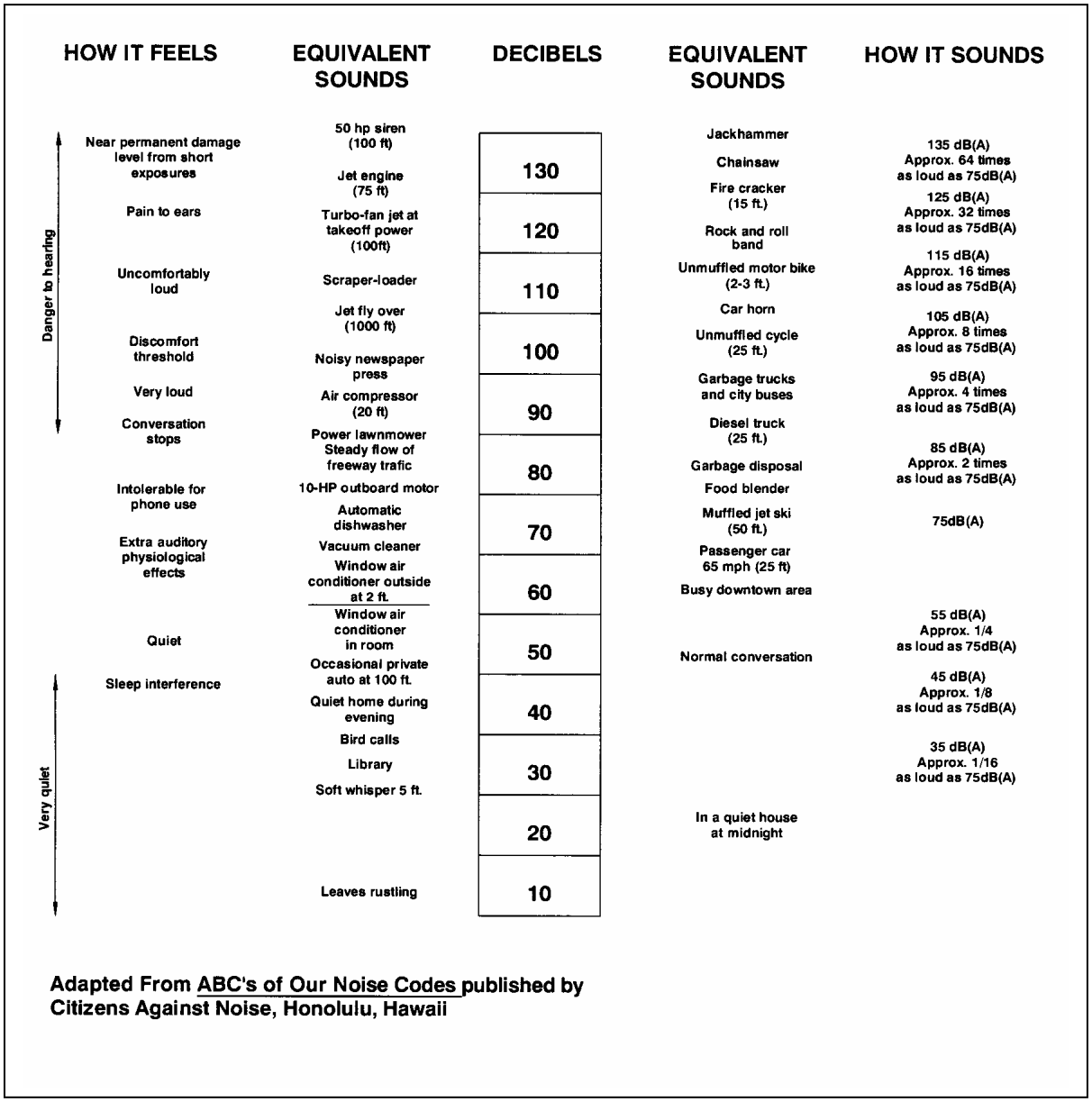


Figure 3-22. Relationship Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

Because of the remoteness of the LBA tract and because mining is already ongoing in the area, noise would have few off-site impacts. MMA (2005) conducted a very conservative noise modeling analysis of the existing West Antelope North (WAN) pit which showed that, at a distance of 16,000 feet, maximum noise levels would not exceed 54 dBA, which is equivalent to the sound level expected in a suburban, residential town. The nearest occupied residence (the Don Jacobs residence) is approximately 2,800 feet west of the westernmost extent of the West Antelope II LBA tract. If the tract is leased and mined, mining operations could be approximately 2,000 feet closer to this residence than the current lease would

allow (Figure 3-9). The minimum distance from current lease areas to the next nearest residence, located due west of the north part of the LBA tract, is approximately 16,300 feet. If the West Antelope II LBA tract is leased and mined, mining operations could be approximately 1,900 feet closer to this residence.

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 West Antelope II coal lease application would be rejected and coal removal and the associated noise impacts would not occur on the LBA tract. Currently approved mining operations and associated noise impacts would continue on the existing Antelope leases.

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 West Antelope II LBA tract include State Highway 59, County Road 37 (Antelope Coal Mine Road) in Converse County, County Road 4 (Antelope Road) in Campbell County, several unimproved local roads and accesses (unnamed two-track trails), the BNSF & UP railroad, oil and gas pipelines, utility/power lines, telephone lines, and associated ROWs. Figure 3-23 depicts the current transportation facilities, excluding the oil and gas pipelines, within and near the general analysis area. Figure 3-24 depicts the oil and gas pipelines within and near the general analysis area.

Highway 59, a paved two-lane road located west of the West Antelope II LBA tract, is the major north-south public transportation corridor within the PRB. Access to the LBA tract is on Douglas Road and Antelope Coal Mine Road from the west (from Highway 59) or Antelope Road / Antelope Coal Mine Road from the northeast. The county roads provide public and private access within the general analysis area. The unimproved local roads and accesses in the area are primarily

for private use. As shown in Figure 3-23, State Highway 59, County Road 37, and County Road 4 do not cross the West Antelope LBA tract under the Proposed Action. However, State Highway 59 does cross the southwestern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2, and County Road 37 crosses the southeastern corner of the portion of the BLM study area that includes the south block of the tract under Alternatives 1 and 2.

The BNSF & UP Gillette-Douglas rail spur runs north-south along the eastern edge of the PRB, roughly parallel to and east of 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. 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 completed an EIS and gave final approval to the expansion project in 2002. After the EIS was successfully appealed, the STB issued a final SEIS on the expansion project December 30, 2005, which addressed four issues that were remanded back to the STB as a result of the appeal, and granted final approval to construct the rail line on February 15, 2006. The SEIS was also appealed, but was upheld by the US Court of Appeals for the Eighth Circuit in December 2006. In early September, 2007, Canadian Pacific Railway Ltd announced it is in the process of buying DM&E. If it is constructed as proposed, the DM&E rail line would potentially be in a position to haul coal produced by the Antelope Mine.

3.15.2 Environmental Consequences

3.15.2.1 Proposed Action and Alternatives 1 and 2

Essentially all of the coal mined on the LBA tract would be transported by rail. Since the West Antelope II LBA tract would be an extension of the existing Antelope Mine operations, the existing rail facilities and infrastructure would be used to recover the coal within the tract, if it is leased. As discussed in Section 4.1, BNSF & UP have upgraded and will continue to upgrade their rail capacities to handle the increasing coal volume projected from the PRB, with or without the leasing of the West Antelope II LBA tract. The construction of the proposed DM&E Railroad expansion into this area is not dependent on leasing the LBA tract.

As discussed above, State Highway 59 crosses the southwestern corner of the BLM study area for the south block of the tract under Alternatives 1 and 2. County Road 37 crosses the southeastern corner of the BLM study area for the south block of the tract under Alternatives 1 and 2. As discussed in Chapters 1 and 2, lands within 100 feet of the outside line of the ROW of a public road are considered unsuitable for mining under Criterion 3 of the coal unsuitability criteria (43 CFR 3461(c)). Although the lands underlying the ROWs for these

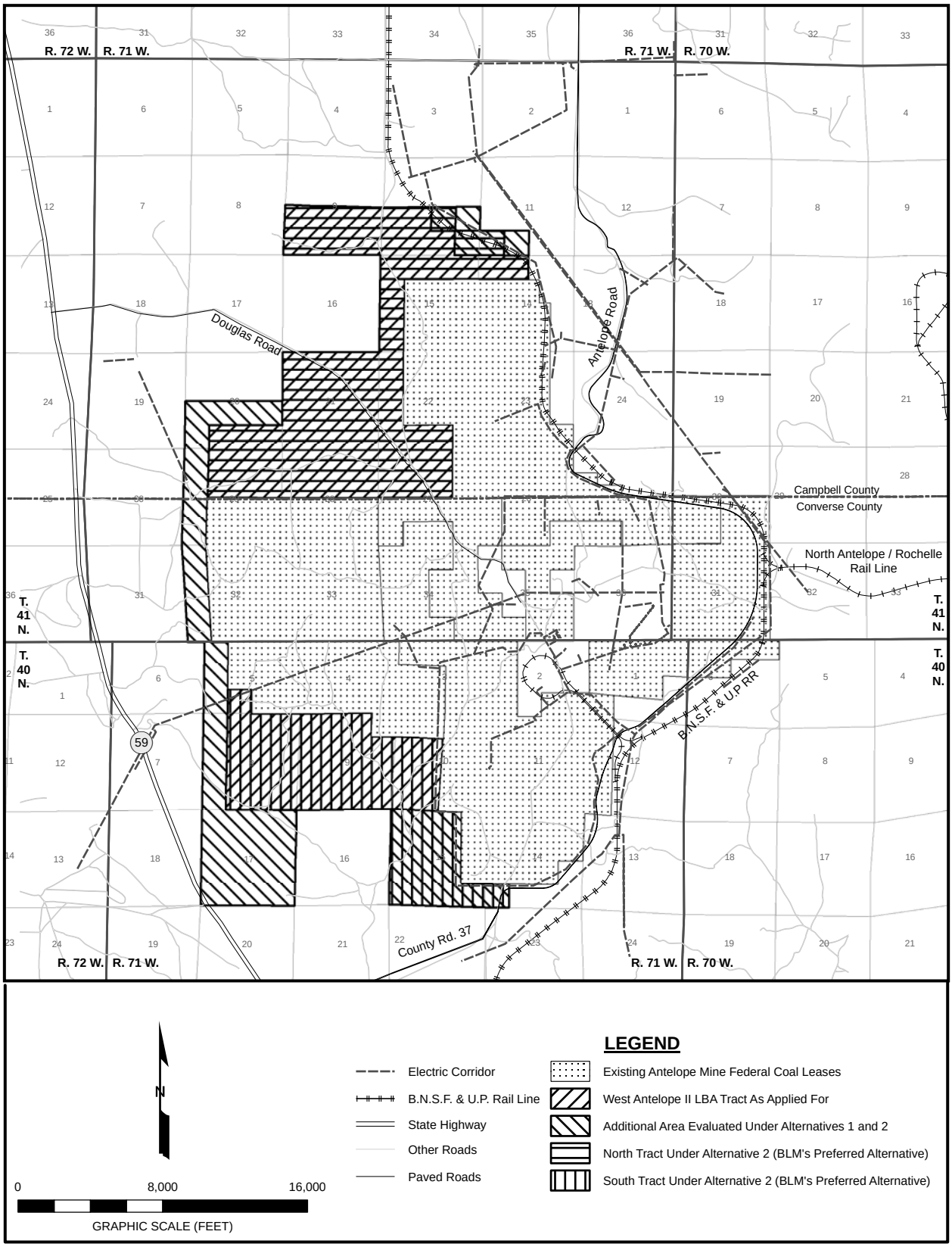


Figure 3-23. Transportation Facilities Within and Adjacent to the West Antelope II LBA Tract.

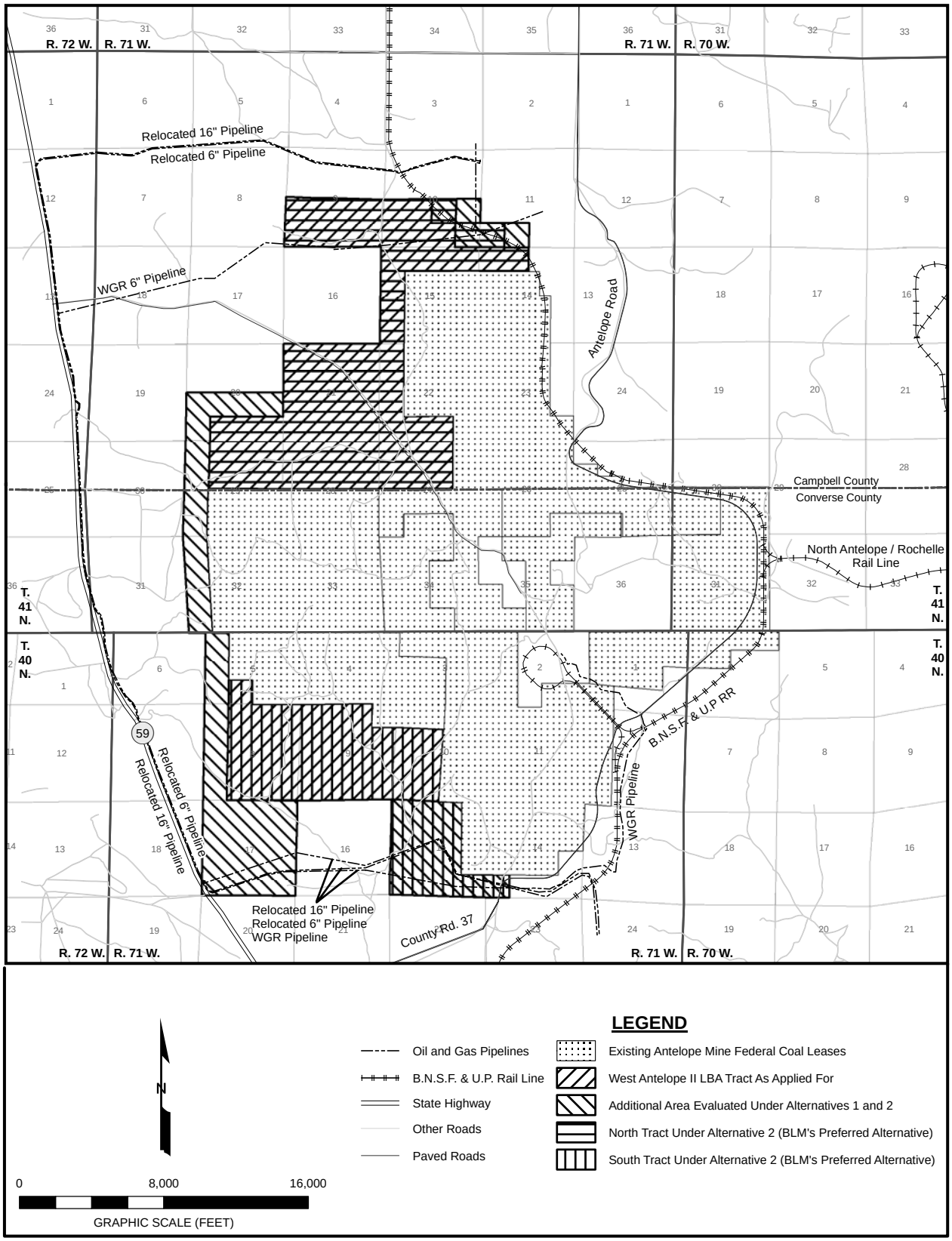


Figure 3-24. Oil and Gas Pipelines Within and Adjacent to the West Antelope II LBA Tract.

public roads would be considered unsuitable, they could be included in the West Antelope II LBA tract to allow recovery of economically mineable coal outside of the ROW and buffer zone. A stipulation stating that no mining activity may be conducted in the portion of the lease within the public road ROW and buffer zone will be attached if a lease is issued for this tract. The exclusion from mining by lease stipulation honors the finding of unsuitability under Unsuitability Criterion 3.

If the tract is leased and mined, pipelines and utility/power transmission lines that currently cross the LBA tract would have to be removed and relocated if they are currently active. 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.

3.15.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, respectively.

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 Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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

3.15.4.1 Coal Loss During Transport

With the opening of the Powder River Basin in Wyoming in the late 1970s, U.S. coal shipments have grown dramatically from 4.8 million carloads back then to 8.4 million carloads in 2006 as the railroads deliver low sulfur coal to help electric utilities achieve Clean Air Standards (FRA 2008). The largest rail coal movements are from the Powder River Basin to generating power plants in Illinois, Missouri, and Texas (FRA 2008).

Shifting and blowing coal dust and coal chunks coming off freshly loaded moving railroad cars can accumulate along railroad tracks, railroad rights-of-way, and on adjacent lands. Coal dust can wash into drainages where large deposits of lost coal can accumulate. Accumulated coal dust has been linked to train derailments and can also spontaneously combust and cause wildfires.

Coal can be lost from rail cars through leakage from the rail car discharge doors, spillage over the rail car sides, and can be blown from rail car tops during transit. In testing conducted by Union Pacific Railroad, Burlington Northern Sante Fe Railroad, and the National Coal Transportation Association, the average loss of coal from an individual rail car's rapid discharge doors was about 19 pounds per 216 miles, or 0.09 pounds per mile (NCTA 2007). The same testing indicated that an average of 225 pounds of coal was lost from the top of a coal car through either top spillage or being blown off during a 567 mile test trip, which equated to about 0.40 pounds per mile (NCTA 2007).

The derailment of two trains in the PRB in 2005 resulted from track instability problems caused by a buildup of coal dust and other particles on the rail bed in combination with high concentrations of moisture (UPR 2005). BNSF railway officials toured the PRB rail infrastructure in June, 2007. According to a BNSF official, when coal dust is blown off rail cars, it gets lodged in the rail bed, allowing moisture to intrude. The moisture then degrades the structural stability of the rail bed and leaves the rail more vulnerable to buckling under stress (Gillette News-Record 2007a). NCTA (2007) testing results suggested that rail car bottom spillage may have more of a negative impact on rail ballast stability than loss from the top of rail cars since the leakage is directly above and near the ballast. NCTA (2007) testing also showed that after the rapid discharge doors were adjusted, there was a 32 percent decrease in bottom spillage of coal.

Accumulating coal dust and deposition has become a concern in Converse County. The majority of coal mined in the PBR travels through Converse County on railroads. Coal dust blows off the freshly loaded coal cars on their way from the PRB mine load-outs to Bill and through Converse County (Casper Star Tribune 2007a). The Converse County Board of Commissioners is concerned with the coal dust piles that have accumulated in the county from coal being transported by rail.

Spontaneous combustion of accumulated coal dust can cause rangeland fires. Smoldering coal dust within a railroad right-of-way can ignite a wildfire and quickly spread to surrounding private lands if the fire is not immediately controlled. The Douglas Volunteer Fire Department Chief, Rick Andrews, estimates that coal fires account for at least 50 percent of the department's average summer call volume (Casper Star Tribune 2007a). Coal fires along the railroad tracks are an ongoing problem for the Douglas Volunteer Fire Department (Casper Star Tribune 2007a). Often water only temporarily puts down the flames; some fires repeatedly ignite over the course of several hours or days (Casper Star Tribune 2007a). While the county's rural fire district is compensated for some of

the costs involved in putting out fires caused by transported coal, the compensation doesn't come close to the actual costs, according to the Douglas Volunteer Fire Department Chief (Casper Star Tribune 2007a).

BLM was invited by a Converse county private land owner to examine and survey the coal deposition that has occurred from coal trains traveling through his land. On July 7, 2008, BLM personnel met with the private landowner and toured his rangeland that was adjacent to the railroad right-of-way, about 26 miles north of Douglas, Wyoming. BLM surveyed various coal accumulations in Box Creek; one area was found to have a coal accumulation of 1.8 feet thick (BLM 2008b). Water runoff washed lost coal from the trains into drainages; the amount of coal deposition varied along the tracks (BLM 2008b).

BNSF is working with the utility companies and the mines in trying to encourage larger chunks of crushed coal to be delivered (3-inch versus 2-inch) in an effort to reduce the amount of small particles that are created in the crushing process (Gillette News-Record 2007a). Another possibility that may help lessen blowing coal dust from trains is the use of surfactant applied to the tops of loaded coal cars (Gillette News-Record 2007a). When applied to coal, surfactant can stabilize and adhere coal dust to larger coal chunks. Some tests have shown that coal dust on railroad tracks can be reduced by up to 95 percent with surfactant use (Gillette News-Record 2007a). In order for a surfactant to be used, it would need to meet utility companies' burning specifications (Gillette News-Record 2007a).

A collaborative effort between the NCTA, PRB mines, and the BNSF and UP railroads has resulted in an improved design for a coal loading chute that distributes coal more evenly and produces a lower profile load (UPR 2006). Preliminary results have demonstrated that this new design may result in a 30 to 60 percent reduction in coal dust blowing off the top of cars during the early portion of the route (UPR 2006).

Converse County Commissioners have formally expressed concerns to BLM in regard to fire, health, and safety issues associated with blowing coal dust from trains. The Commissioners have stated that the health and well-being of Converse County citizens downwind of the railroad tracks continue to be jeopardized due to lack of coal dust mitigation in the coal mining permit process (BLM 2008c). The Converse County Commissioners have urged that coal dust mitigation be applied as a standard condition of approval upfront in the mining permit (BLM 2008c).

BLM does not authorize mining permits nor regulate mining operations with the issuance of a BLM coal lease. WDEQ is the agency that permits mining operations and has authority to enforce mining regulations. In Wyoming, WDEQ has entered into a cooperative agreement with the Secretary of the Interior to regulate surface coal mining operations. Mitigation and other requirements are developed as part of the mining and reclamation permit. These must be approved by WDEQ before mining operations can occur on leased federal coal lands.

Other agencies that may be stakeholders in this issue include the Federal Railroad Administration, which implements U.S. Department of Transportation environmental policies related to U.S. railroads, and the National Coal Transportation Association whose mission includes facilitating the resolution of coal transportation issues in order to serve the needs of the general public and industry (NCTA 2008).

3.16 Hazardous and Solid Waste

3.16.1 Affected Environment

Potential sources of hazardous or solid waste on the West Antelope II 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 West Antelope II LBA tract. Wastes produced by current mining activities at the Antelope Mine are handled according to the procedures described in Section 2.1.2.

3.16.2 Environmental Consequences

3.16.2.1 Proposed Action and Alternatives 1 and 2

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 West Antelope II 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 Antelope Mine.

3.16.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and coal removal and the associated disturbance and impacts would not occur on from 4,314 up to 6,625 acres that would be disturbed under the Proposed Action or Alternatives 1 and 2, 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 Antelope Mine leases. Portions of the West Antelope II LBA tract adjacent to the Antelope Mine would be disturbed to recover the coal in the existing leases.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 lease action and associated mining includes Converse and Campbell counties and the communities of Douglas, Gillette and Wright. These three communities are home to more than 95 percent of the mine's current workforce, as well as most of the mining services, retail and business and consumer service establishments in the area. Gillette and Douglas are also the county seats for the respective counties.

The Antelope Mine presently has a workforce of 430 employees. The current workforce represents an increase of about 180 employees following the acquisition of additional reserves in the West Antelope lease. The mine has also completed significant capital investments in mining equipment and rail loadout facilities to boost its production. The expansion in reserves associated with the West Antelope II LBA tract under the Proposed Action would sustain current rates of production [about 36 mmtpy) while extending the life of mine by approximately 11 years. The additional reserves associated with Alternatives 1 and 2 would add up to two more years to the life-of-mine beyond that associated with the Proposed Action. Assuming an increase in annual production to 42 mmtpy, the corresponding life-of-mine estimates are nine additional years under the Proposed Action and up to 11 additional years under Alternatives 1 and 2.

No major change in direct employment is anticipated at the Antelope Mine in conjunction with the Proposed Action or Alternatives 1 and 2 assuming annual production of 36 mmtpy, though as many as 25 additional workers may be needed at times during the life-of-mine as mining progresses to different locations. Raising annual production to 42 mmtpy could increase the incremental workforce needs to as many 40 workers, or 470 total employees, at times.

Residency patterns of new employees would be expected to mirror that of the mine's current workforce. Nearly 70 percent of the current workforce lives in or near Douglas, approximately 50 miles south of the mine. About 26 percent of the mine's workforce live in Campbell County; 90 workers (20 percent) in Gillette (about 65 miles north) and 25 workers (6 percent) in Wright (about 20 miles north). Company-sponsored bus service to and from the mine operates several times daily for employees living in Gillette and Douglas.

In 2006 the Antelope Mine had a total payroll, including benefits and incentives, of $36.7 million. In addition, the mine made outlays of $286 million for non-labor operating expenses, capital investments, and permits, licenses, fees and taxes. Approximately 20 percent of the latter sum was spent with vendors and suppliers in Wyoming or paid directly to state and local governments. The total also includes $62.7 million in Federal Mineral Royalties, reclamation and black lung taxes, a considerable portion of which returns to Wyoming.

3.17.1 Local Economy

3.17.1.1 Affected Environment

Coal production reported to the Wyoming State Inspector of Mines showed Wyoming's coal mines set a new annual production record of 444.9 million tons in 2006, an increase of 41 million tons (10.2 percent) over the 403.9 million tons produced in 2005; itself a record. PRB coal production (from Campbell and Converse Counties, 13 active mines) represented nearly 97 percent of the statewide coal production in 2006 and accounted for all of the gains in statewide production from 2005 to 2006 (Wyoming Department of Employment 2007a).

Energy resource development has been the primary stimulus behind a significant economic expansion across the state in recent years. Statewide total covered employment[2] stood at 254,302 in the first quarter of 2006, more than 10 percent higher than the corresponding total of 230,429 jobs in 2003. Nearly one-of-three new jobs created in the state during the 3-year period was in the mining industry, with most of that increase concentrated in support industries for oil and gas development. During the same period, statewide coal mining employment increased by 762 jobs to 5,567 jobs, a 16 percent net increase (Wyoming Department of Employment 2007b) and total employment grew by 513 jobs (12 percent) in Converse County and 4,422 jobs (22 percent) in Campbell County.

Local job growth occurred across most industries, but was concentrated in mining, construction, transportation, and local government (Wyoming Department of Employment 2007b). Mining, including the oil and gas industry, accounts for 30 percent of the total employment and 45 percent of the total payroll in Campbell County and 15 percent of employment and 25 percent of the total payroll in Converse County. Coal mining is the major constituent portion of the region's mining industry, unlike in many other areas of Wyoming, where oil and gas development is the primary constituent.

Labor market conditions in the region reflect recent economic expansion driven principally by energy resource development. Unemployment in both counties has

[2] Covered employment refers to those full- and part-time, private and government wage/salary workers covered under the state's unemployment insurance program. About 97% of non-agricultural workers are included. Exclusions include insurance and real estate agents on commission; most railroad workers; self-employed; unpaid volunteers or family workers; members of the military; and many agricultural workers.

declined since 2003. Average unemployment rates for 2006 were 3.4 percent in Converse County and 2.1 percent in Campbell County, even as the local labor force has grown due to immigration and the attraction of additional residents into the labor force (U.S. Bureau of Labor Statistics 2007).

Recent estimates of the state's Gross State Product (GSP)[3] highlight the significance of the minerals industry to the statewide economy. Estimates of the 2004 GSP indicate the mining industry, including oil and gas and support activities, accounted for 21.3 percent of the state's total GSP of $24.1 billion. The contribution of mining was nearly twice that of government, the next largest sector, and more than three times the contribution of the real estate industry, the next largest private sector. Coal mining and mining of other minerals accounted for 8.3 percent of the Wyoming GSP (Wyoming Department of Administration and Information 2007).

Wyoming, Converse and Campbell county governments, school districts, and local towns receive revenue from a variety of taxes and royalties on the production of federal coal. These include lease bonus bids, ad valorem taxes, severance taxes, royalty payments, sales and use taxes on equipment and other taxable purchases, and portions of required contributions to the federal AML program and Black Lung Disability Trust Fund. Lease bonus bids are paid for the right to enter into lease agreements for federal coal.

In 1994, the University of Wyoming estimated the total fiscal benefit to the State of Wyoming for coal produced in the PRB at $1.10 per ton (Borden et al. 1994). 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 valorem 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 (BLM 2006b).

Revenues to the federal government from the leasing and production of federal coal include retention of one-half of the lease bonus bids and federal mineral royalties. Bonus bids are paid in five annual installments, with half returned to the state. 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). The successful bonus bids for these six sales ranged from 30 cents per ton to 97 cents per ton and totaled $1.69 billion, including $146.3 million for the West Antelope tract (BLM 2006b).

Annual bonus bid payments from the six lease sales currently total $338.2 million. Three years remain on the payments from those sales, with an annual bonus bid payment of $169.1 million to the State of Wyoming derived directly from federal coal in the PRB. Three coal sales have been held in Wyoming in the first

[3] GSP is a measure of the total market value of goods and services produced by the labor, capital and property in the state, after netting out the value of intermediate outputs imported to the state.

four months of 2008, two of which were successful. The sales for the Eagle Butte West and South Maysdorf tracts yielded bonus bids within the range of the 2004 and 2005 sales (BLM 2008). Successful sales generate additional coal lease bonus bid disbursements. The coal lease bonus bid disbursements to the State of Wyoming are allocated to fund capital construction of schools, capital construction projects for cities, towns and counties, the state's highway fund, and community colleges.

Federal mineral royalties (FMR) are collected by the federal government at the time that produced coal is sold, with a royalty rate equal to 12.5 percent of the sale price. Following a deduction for administrative expenses (approximately one percent), 50 percent of the FMR are disbursed to the State of Wyoming. Total FMR disbursements to the state in fiscal year 2006, derived from all mineral production, not solely coal, was $1.07 billion (Wyoming CREG 2007). In 2006, the Antelope Mine paid $39.3 million in FMR.

In addition to the FMR, coal mines pay 31.5 cents per ton of surface coal produced to fund abandoned mine land (AML) reclamation programs. Collectively about 83 percent of the funds are returned to states and tribes with AML problems. Actual annual appropriations vary depending on Congressional authorizations and overall AML program priorities. Additional sources of revenue include federal income tax and annual rentals paid to the government. The Antelope Mine payments to the federal mining reclamation program exceeded $11.8 million in 2006.

Sales and use taxes are levied by the state and by local governments. Approximately 70 percent of the revenues generated from the statewide 4.0 percent levy are retained by the state, the remainder being distributed to the counties, cities and towns according to statutory formula. In addition, Converse and Campbell county governments each impose a 1.0 percent general purpose local option tax and Campbell County imposes a 0.25 percent specific county option tax. Sales and tax revenues are vital for local governments. Statewide total sales and use tax revenues totaled $810.4 million in 2006. A direct accounting of sales and use taxes paid by coal mining firms is not available, however, it is likely substantial given the operating budgets of the mines. An internal analysis of the mine's outlays yielded an estimated $3.5 million paid in sales and use taxes by the Antelope Mine in 2006.

Local governments and school districts also rely heavily on ad valorem/ property taxes levied on the real property and value of production. Due to the location and configuration of the mine and actual mining areas, Converse and Campbell county governments as well as Converse County School District #1 and Campbell County School District #1 all benefit from operations of the Antelope Mine. The permanent facilities are primarily located in Converse County. Most of the active mining areas are presently located in Campbell County, but production has also occurred from reserves located in Converse County over time.

Rising production and market values for oil and gas, and the increases in coal production tonnages have given rise to dramatic increases in the ad valorem tax bases of producing counties, particularly Campbell County. In 2005, Campbell County had an ad valorem tax base of $3.66 billion; more than 22 percent of the aggregate statewide assessed value on all real property and mineral production. Converse County had an assessed value of $432 million that same year, 14th among Wyoming's 23 counties. The coal mining industry accounted for 59 percent of Campbell County's total assessed value and 23.5 percent of that in Converse County – see Table 3-15. The Antelope Mine accounted for a majority share of the coal-related value in Converse County and a substantial amount in Campbell County. The mine is a major taxpayer in both counties.

Table 3-15. Contribution of Coal Mining to the 2005 Assessed Valuation of Converse and Campbell Counties.

	(1) Total Assessed Value	(2) Coal Mining (Real Property)	(3) State Assessed Minerals - Coal	(4) Coal-related Share of the Total [(2) + (3)]/(1)
Campbell County	$ 3,660,527,493	$ 163,424,869	$ 1,995,307,606	59.0%
Converse County	$ 432,232,521	$ 16,355,912	$ 85,208,985	23.5%

Sources: Wyoming Department of Revenue 2006 and Wyoming State Board of Equalization 2007.

3.17.1.2 Environmental Consequences

3.17.1.2.1 Proposed Action and Alternatives 1 and 2

The federal and state revenues that would be generated by the leasing and mining of the West Antelope II LBA tract would depend on which alternative is selected and the eventual sales price of produced coal. For this analysis the average sales price of coal is assumed to be $9.01 per ton, equal to the forecasted price in 2009 by the State of Wyoming's Consensus Revenue Estimating Group (CREG) to estimate the state's revenues from mineral severance and federal mineral royalty revenues over the next five years (Wyoming CREG 2006 and 2007). CREG assumes further increases of approximately 2 percent per year from 2009 through 2012. Consequently, the $9.01 may be conservative.

The projected federal and state revenues for the West Antelope II LBA tract presented in Table 3-16 are based on the coal production tonnages shown in Table 3-1 and potential bonus bids on the leased recoverable coal ranging from $0.30 to $0.97 per ton. Note that the projected revenues are based on the total tons of recoverable coal and hence are insensitive to changes in future annual production rates. If the West Antelope II LBA tract is leased and mined under the Proposed Action, the potential additional federal revenues would range from approximately $511 to $637million. Under Alternatives 1 and 2, potential additional federal revenues range from approximately $514 million to $766 million.

If the LBA tract is leased and mined under the Proposed Action, the potential incremental state and local revenues beyond those associated with No Action

range from $686 to $813 million. Under Alternatives 1 and 2, potential additional state revenues range from about $690 to $977 million.

The base of economic activity provided by wages and local purchases would continue for to up to 13 additional years, depending on the alternative and production rates.

Table 3-16. Projected Major Revenue Impacts from Leasing the West Antelope II LBA Tract Under the Proposed Action or Alternatives 1 and 2.[1]

Item	No Action Alternative (Existing Mine)	Proposed Action	Alternatives 1 and 2
State and Local Revenues	$ 657.3 mm	+ $ 686.4 to $ 813.0 mm	+ $ 690.2 to $ 976.8 mm
Federal Revenues	$ 473.7 mm	+ $ 510.6 to 637.1 mm	+ $ 513.5 to $ 765.5 mm
Increased Mine Life	0 yrs	11 yrs (36 mmtpy) 9 yrs (42 mmtpy)	11 to 13 yrs (36 mmtpy) 9 to 11 yrs (42 mmtpy)
Additional Employees	0	Up to 25 (36 mmtpy) Up to 40 (42 mmtpy)	Up to 25 (36 mmtpy) Up to 40 (42 mmtpy)

[1] Includes severance taxes, federal mineral royalties, and payments to the Abandoned Mined Lands and Black Lung Disability funds. State and local revenues include allowances for sales and use taxes on direct purchases by the mine and ad valorem/property taxes on real property and production. Revenues assume an average sales price of $9.01 per ton for coal.

3.17.1.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the LBA tract under the Proposed Action (377.8 million tons of recoverable coal) or Alternatives 1 and 2 (up to 453.9 million tons) would not be mined and the economic and fiscal 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 Antelope Mine leases, but would cease between nine and 13 years earlier than under the Proposed Action or Alternatives 1 and 2. Job losses, both those directly associated with the mine, as well as those secondary jobs supported by the mine, would occur following the cessation of operations.

As discussed in Section 2.2, a decision to reject the West Antelope II 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

Converse County had an estimated population of 12,866 in July 2006, an increase of 762 residents (6.3 percent) over its population of 12,104 in 2000. Statewide

population grew by 4.2 percent during the same period – see Table 3-17. Douglas, the county seat and largest community in Converse County, had an estimated population of 5,581 in July 2005, compared to 5,288 residents in 2000.

Table 3-17. Population Change, 2000 to 2006.

Year	Campbell County	Converse County	Total Study Area
2000	33,698	12,104	45,802
2003	36,381	12,326	48,707
2006	38,934	12,866	51,800
Change, 2000 - 06	5,236	762	5,998
Percent Change	15.5%	6.3%	13.1%

Source: U.S. Census Bureau (2006b).

Campbell County's population climbed from 33,698 in 2000 to an estimated 38,934 in July 2006. This represents a 15.5 percent growth rate since 2000 making Campbell County the second fastest growing county in the state. Campbell County's population ranks it as the third most populous of Wyoming's 23 counties and Gillette's 2005 population of 22,685 is the fourth largest city in the state, following Cheyenne, Casper, and Laramie (U.S. Census Bureau 2007).

Based on the residency patterns of the mine's employees and the concentration of mine service companies in the Gillette area, the majority of the mine's current population likely reside in and are assimilated into the Douglas and Gillette communities.

In comparison to the statewide population, the median age of Campbell County residents was substantially lower, while that of Converse County residents was higher. However, both counties had relatively fewer minority residents, a higher percentage of residents under 18, and had larger average household sizes – see Table 3-18.

Table 3-18. Demographic Characteristics, 2000.

Characteristic	Wyoming	Campbell County	Converse County
Median Age	36.2	32.2	37.5
Percent Residents < 18 Years Old	26.1	31.0	28.5
Average Household Size (persons)	2.48	2.73	2.55
Percent Minority Residents	7.9	3.9	5.3

Source: PRB Coal Review Task1C Report (BLM 2005b)

3.17.2.2 Environmental Consequences

3.17.2.2.1 Proposed Action and Alternatives 1 and 2

As indicated by Table 3-16, leasing and subsequently mining the LBA tract would extend the life of the Antelope Mine, and current employment at the mine, by up to 13 years. Relatively little change in employment is expected at the mine under the Proposed Action or Alternatives 1 and 2 (up to 40 additional jobs, depending

on the annual production rates as discussed above). Consequently, leasing and mining of the LBA tract would not result in any noticeable incremental change in the study area population. Demands on public facilities and service would also see little change.

3.17.2.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Currently approved mining operations and associated employment levels would continue on the existing Antelope Mine leases. Without additional reserves, operations at the Antelope Mine would cease in about 2018, resulting in economic dislocations of the mine's workforce, their households, and others supported indirectly by the mine's operations. The net result would likely include population out-migration, with associated adverse impacts on local communities.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 substantially in recent times, with new technologies and higher capacity equipment major contributors to these changes. Local coal mining employment grew rapidly during the 1970s as more mines opened and production climbed. 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 (BLM 2005b). Since 1998, direct employment in Powder River coal mines climbed as total annual production climbed by more than 45 percent (Wyoming Department of Employment 2007b).

In 2006, the mining sector, which includes oil and gas workers, accounted for almost 28 percent of all employment in the two-county study area, nearly four times the statewide percentage. Approximately 4,800 people were directly employed by surface coal mines or coal contractors in Converse and Campbell counties, representing about 17 percent of total employment labor force (Wyoming Department of Employment 2007a).

3.17.3.2 Environmental Consequences

3.17.3.2.1 Proposed Action and Alternatives 1 and 2

Leasing and subsequently mining the West Antelope II LBA tract would extend the life of the Antelope Mine by nine to 13 years, depending on annual production rates. As discussed above, limited increases in anticipated employment at the mine would occur under the Proposed Action and Alternatives 1 and 2. Consequently leasing the West Antelope II tract would also have limited effect on secondary employment in the region. Thus, there would be little net effect on the local labor market. The economic stability of the region would benefit by having the current Antelope Mine workforce living in the community and employed at the mine for up to 13 additional years.

3.17.3.2.2 No Action Alternative

Under the No Action Alternative, the coal included in the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Mine life and existing employment levels would not be extended, though currently approved mining operations and associated employment would continue on the existing Antelope Mine leases. However, production would be completed and the direct jobs provided by the mine and those supported indirectly by its operations and the consumer expenditures of its workforce would be lost sooner than if leasing were to occur.

As discussed in Section 2.2, a decision to reject the West Antelope II 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

The 2000 census tallied 5,669 housing units in Converse County, of which 82.8 percent were occupied; 74 percent of which were owner-occupied and 26 percent renter-occupied. Of the 975 vacant units (17 percent), 316 were owned for seasonal or occasional use with 656 available for sale or rent, or otherwise vacant. The census counted 13,288 housing units in Campbell County, of which 12,207 (92 percent) were occupied; 74 percent by owners. Of the 1,081 vacant units, 215 were held for seasonal or occasional use and 866 were for sale, rent or vacant for other reasons (U.S. Census Bureau 2000).

Population growth since 2000 has prompted new housing construction in the region. Net additions to the number of housing units from 2000 through 2005 total 797 in Campbell County and 183 units in Converse County (Table 3-19). Building permits for 219 new units were issued by the City of Gillette in 2006. Construction has not kept pace with demand. As a consequence, vacancy rates

are near record lows and housing prices have climbed. In the second half of 2006, vacancy rates of rental units were 0.4 percent (6 units) in Campbell County and 1.4 percent (9 units) in Converse County (Wyoming Housing Database Partnership 2007).

Table 3-19. Total Housing Stock in 2000 and 2005.

Year	Campbell County	Converse County
2000	13,288	5,669
2005	14,085	5,852
Change	797	183

Source: U.S. Census Bureau (2006a)

A recent housing survey in Gillette yielded a vacancy rate of 0.2 percent for rental properties with many complexes having waiting lists of more than 50 people and wait times of up to nine months. That survey also estimated a vacancy rate of less than 10 percent among 11 mobile home parks (City of Gillette 2007).

In the fourth quarter of 2006, average housing rental costs in Campbell County were $697 for a two-bedroom, unfurnished apartment, $283 for a single-wide mobile home lot and $975 for a two or three-bedroom single family home. In Converse County, the equivalent rates substantially lower; $515 for an apartment, $152 for a mobile home lot and $545 for a single family home (Wyoming Department of Administration and Information 2007).

The average selling price of homes in Converse County in 2005, based on 195 sales, was $147,560, nearly 29 percent higher than the preceding year. In Campbell County the average sales price, based on 458 sales, was $185,874. That average represents a 7 percent increase over that in 2004 and fifth highest among Wyoming counties (Wyoming Housing Database Partnership 2007).

In addition to permanent housing, there is a substantial inventory of temporary or transient housing in the study area. Such housing includes hotels or motels, campgrounds, and possibly mobile home parks. Given the tight housing market in Gillette, some such units are reportedly being used for longer-term occupancy by workers and families waiting for traditional housing to become available (Langston 2005).

There are 17 motels in Gillette with 1,346 guest rooms and a 27-room motel in Wright. Gillette has two year-round commercial campgrounds with 150 hookups for RVs plus tent areas (Gillette Convention and Visitor's Bureau 2004). There are 7 motels with a total of 364 rooms in Douglas, along with three commercial campgrounds with 119 trailer/RV spaces (Wyoming Travel and Tourism Division 2007).

3.17.4.2 Environmental Consequences

3.17.4.2.1 Proposed Action and Alternatives 1 and 2

As discussed above, limited change in direct employment at the Antelope Mine is anticipated in conjunction with the leasing and mining of the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2. Consequently, no substantial population influx and additional demand on housing resources is expected. Furthermore, any new employees would most likely be attracted to the Douglas area, the principal community of residence for employees at the Antelope Mine. Housing is relatively more available and affordable in the Douglas area.

3.17.4.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Housing markets would not be affected by any additional employment at the Antelope Mine. Currently approved mining operations and associated employment levels would continue on the existing mine leases. When the existing leases are mined out, mining operations would cease, likely triggering population out-migration from the area and adversely affecting housing markets.

As discussed in Section 2.2, a decision to reject the West Antelope II 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 address growing demands for public services. Current facilities and services are generally adequate for the current population, although several service providers are engaged in expansion plans to accommodate future growth and improve service delivery.

Converse County School District #1 and Campbell County School District #1 are the districts most directly affected by the Antelope mine's operations. Following steady declines between 1996 and 2003, enrollment in the Converse County School District #1 has stabilized at about 1,580 over the past three years. Total enrollment in Campbell County School District #1 declined by more than 500 students between 1998 and 2004, but then climbed by nearly 140 students in 2005 in response to economic and population growth in the county. In terms of enrollment, it is the third largest district in Wyoming (Wyoming Department of Education 2007).

Converse County School District #1 operates eight schools; six elementary, one junior high, and one high school. Campbell County School District #1 facilities include 15 elementary schools, two junior high schools, and two high schools (one with two campuses in Gillette). Converse County School District #1's facilities are adequate in terms of capacity for its present enrollment, however it has initiated planning and design for a new elementary school to accommodate recent and expected enrollment and is planning for the construction of new warehouse and transportation support facilities, access road improvements for schools, and systems maintenance and upgrades (Converse County School District #1 2007). The Campbell County School District is involved in a major five-year plan to replace several schools, modernize others and complete major systems maintenance and upgrades. The complete plan is budgeted at over $57 million. Plans for the next two years include completion of a new elementary school and additions to a high school (Wyoming School Facilities Commission 2007).

The Converse County and Campbell County Sheriff's departments provide police protection throughout their respective counties. In addition to general law enforcement, the Sheriff's staff provides court security, detention facilities, and animal control. For the 2004 fiscal year, the Campbell County Sheriff 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). The Converse County Sheriff includes 12 patrol deputies, plus additional staff in the communications and detention divisions.

Fire suppression 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. Fire suppression in rural Converse County is provided by the Converse County Rural Fire Control Association. The Douglas Volunteer Fire Department covers the city of Douglas. The Antelope Mine maintains equipment and trained staff to fight fires on mine property.

The primary medical care facilities serving the region are the Memorial Hospital of Converse County, a 25-bed acute care hospital located in Douglas, and the Campbell County Memorial Hospital, a 90-bed acute care hospital, located in Gillette. The Campbell County Memorial Hospital operates the Wright Clinic, a satellite clinic, located approximately 18 miles from the Antelope Mine. The clinic is staffed 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). Emergency medical transport in Converse County is provided by an ambulance service operated by the Memorial Hospital of Converse County. The service

presently maintains and operates three ambulances with a paid staff. Response is augmented by the Douglas Volunteer Fire Department (Leon 2007).

The principal water and wastewater utilities are operated by the City of Douglas, City of Gillette and by the Wright Water and Sewer District. The City of Douglas has three water sources. The Little Boxelder Spring is a high-quality gravity-fed source located some 18 miles west of Douglas. This source provides up to 2 million gallons per day and meets the water demands in the fall and winter. The second water source is a 1.5 million gpd Sheep Mountain Well. This well came into service in the fall of 1994 and supplements the city water supply during peak demand and allows for reduced usage of the more costly treated water. The water treatment plant treats up to 2.5 million gpd of North Platte River water during the summer and is used primarily during heavy irrigation periods. It was not designed to service the community in winter, but can be brought on-line under emergency circumstances.

Douglas has multiple water storage facilities with a combined capacity of about 6 million gallons. The current water system is designed to accommodate a population of 10,000 people (Sweeney 2004). However, as a result of drought, the city implemented watering restrictions during summer months of the last four years. The construction of a new water treatment plant, scheduled for completion in 2008, may ease the need for water restrictions, but continued drought conditions could also result in a continuation of these restrictions (Fitzhugh 2007).

The City of Gillette water system has ample capacity for its service area during most of the year, however, the system operates close to capacity during the peak demand months of June, July and August. In the short term, the city intends to add several wells to the system to augment water supply during peak months. The city is also conducting a Level II Water Study to identify longer term solutions to its water supply problems. The City implemented voluntary conservation measures during the summer of 2007 and is considering changes in the water rate structure to reduce peak period consumption. The Level II study is likely to identify well field, transmission, pumping station and treatment additions to the current system. If approved by the city and if funding is secured, these improvements are anticipated to come on line during the next three to five years (Petersen 2007).

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.

3.17.5.2 Environmental Consequences

3.17.5.2.1 Proposed Action and Alternatives 1 and 2

As discussed above, employment at the mine would not increase substantially under the Proposed Action and Alternatives 1 and 2. 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 would be satisfied by the existing facilities and services currently in place in Converse and Campbell Counties.

3.17.5.2.2 No Action Alternative

Under the No Action Alternative, the West Antelope II coal lease application would be rejected and the coal included in the West Antelope II LBA tract under the Proposed Action or Alternatives 1 and 2 would not be mined. Local government facilities and services would not be affected by any additional employment or associated population growth associated with the Antelope Mine. Currently approved mining operations and associated employment levels would continue on the existing Antelope Mine leases.

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

3.17.6 Social Setting

3.17.6.1 Affected Environment

The social setting for coal development in the PRB, summarized in Section 4.2.12.9, is described in the Task IC Report for the PRB Coal Review (BLM 2005b). That report emphasizes Campbell County and its communities as the nucleus for coal development in the PRB. Converse County and the City of Douglas, also discussed in the Task 1C Report, are also affected by the Antelope Mine which is located partly within Converse County and is a major contributor to the county tax base. The Douglas area is home to 70 percent of the Antelope Mine workforce. The Antelope Mine has been in production since 1985 and the mine and its employees contribute to the social and economic stability of Converse County and the City of Douglas.

3.17.6.2 Environmental Consequences

3.17.6.2.1 Proposed Action and Alternatives 1 and 2

As discussed above, employment at the mine is not anticipated to increase substantially under the Proposed Action or Alternatives 1 and 2. Consequently,

little or no change in the social setting of Campbell or Converse counties or the communities of Gillette, Wright or Douglas would be anticipated under these alternatives.

3.17.6.2.2 No Action Alternative

Implementation of the No Action Alternative would result in the eventual loss of approximately 430 relatively high paying mining jobs in the PRB. An estimated 70 percent of those losses (315 jobs) would occur in Converse County and the community of Douglas. Loss of the Antelope Mine-related economic activity and tax revenues are described in preceding sections. These losses would likely result in a disruption in the social and economic stability of Converse County and the City of Douglas and some population relocation, unless Antelope Mine employees were able to find comparable employment within commuting distance of Douglas. Social effects of the No Action Alternative on Campbell County, the City of Gillette and the Town of Wright would be less substantial, because of the fewer number of employees involved and the potential for those employees to find other jobs in mines and other energy industries in Campbell County.

3.17.7 Environmental Justice

3.17.7.1 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 and Converse Counties, 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 high and adverse impacts on minority and/or low-income groups, including Native Americans.

3.17.7.2 Environmental Consequences

3.17.7.2.1 Proposed Action and Alternatives 1 and 2

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, Wright, Campbell County, Douglas or Converse County than they do in the state as a whole. 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 study area for the West Antelope II LBA tract. Furthermore, there are few residences in close proximity to the current mine boundary or proposed West Antelope II LBA tract. Consequently, implementation of the Proposed Action or Alternatives 1 or 2 would not adversely affect the environmental justice considerations in the area.

3.17.7.2.2 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, Douglas or the two counties than they do in the state as a whole. 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 Antelope Mine. Furthermore, there are few residences in close proximity to the existing mine boundary. Consequently, the No Action Alternative would not adversely affect the environmental justice considerations in the area.

3.17.8 Regulatory Compliance, Mitigation and Monitoring

Surface coal mines are required to pay royalty and other taxes and fees 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 royalties are paid on all of the coal that is mined.

3.17.9 Residual Effects

3.17.9.1 Human Health Impact Assessment

In 2008, public concerns were brought to BLM's attention in regard to conducting human health impact assessments in the PRB where coal mining activities occur. A health impact assessment (HIA) is a method used in assessing potential impacts of a proposed project on human health. HIAs examine health on a broad

scale, including social, emotional, and cultural impacts as well as physical impacts. HIAs rely on available scientific data, public testimony, and modeling to predict potential health impacts.

Public concerns included emissions from coal mining activities like particulate matter, PM_{10}, and nitrogen oxide exposure and their potential impact on human health and people living in the local PRB area.

BLM does not have jurisdiction in regard to conducting human health assessments. However, BLM has invited the Wyoming Department of Health/Environmental Health Section and the U.S. Center for Disease Control and Prevention to review and provide comment on the West Antelope II EIS.

Air pollution is controlled by state and federal air quality regulations and standards established under the federal Clean Air Act Amendments. State implementation plans are in place to ensure proposed actions like coal mining comply with all associated air quality regulations and criteria. The Wyoming Ambient Air Quality Standards are stricter than the National Ambient Air Quality Standards and are enforced by WDEQ.

As described in Section 3.4.2.3 of the EIS, the WDEQ/AQD developed a Natural Events Action Plan for the Coal Mines of the Powder River Basin. The plan, based on EPA Natural Event Policy guidance, identifies potential control measures for protecting public health and minimizing exceedences of the PM_{10} NAAQS.

All mines are required to conduct long-term air quality modeling to show that their proposed operations will comply with the National and Wyoming Ambient Air Quality Standards, and they are required to monitor to demonstrate that their actual air emissions do not exceed the standards. The WDEQ/Air Quality Division coal mining permit process requires air quality modeling of the primary air pollutants PM_{10} and NO_2. Please see Section 3.4.2.3 in the EIS to review air quality mitigation measures that WDEQ/AQD implemented in order to prevent exceedences of the National and Wyoming Ambient Air Quality Standards by surface coal mines.

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

The NEPA regulations at 40 CFR 1502.16 require a discussion of the "relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" as part of an EIS. This requirement is duplicated in the BLM NEPA Handbook Chapter V, Section B.2.a.(3) and C.3.h.(2) (BLM 1988).

3.18.1 Local Area

If the West Antelope II LBA tract is leased, almost all components of the present ecological system, which have developed over a long period of time, would be modified as the coal is mined. In the long term, following reclamation, the land surface would be topographically lower and, although the reclaimed surface would resemble original contours, it would lack some of the original diversity of geometric form.

Soils and vegetation would be disturbed and the associated grazing and wildlife habitat that the West Antelope II LBA tract currently provides would be lost in the short term, during mining and reclamation. During mining of the LBA tract, there would be a loss of native vegetation from 4,108.6 acres (Proposed Action) up to a maximum of 6,309.2 acres (Alternatives 1 and 2). This disturbance would occur incrementally over a period of years. Soils would be replaced and vegetation would be restored, as required by the mining plan (see Sections 3.8 and 3.9). In the long term, the reclaimed lands would provide equivalent or better forage production capacity for domestic livestock. This would be required before the performance bond is released. Long-term productivity would depend primarily on post-mining range management practices which, to a large extent, would be controlled by the private landowners.

Mining would disturb pronghorn and mule deer habitat. As discussed in Section 3.10.5, potential sage-grouse habitat is scarce throughout the general project area. There would be loss and displacement of wildlife in the short term but, based on monitoring of previously reclaimed lands, it is anticipated that the reclaimed lands would provide habitat that would support a diversity of wildlife species similar to premining conditions in the long term. 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.

If the West Antelope II LBA tract is leased and mined, groundwater quality would be different from pre-mining conditions after reclamation. The water quality would remain adequate for livestock and wildlife. Depth to groundwater would increase in an area extending further to the west and south of the existing mine area. The water levels in the coal aquifer should return to premining levels at some time after mining has ceased because recharge areas would not be disturbed when recovering 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 any public lands affected by mining would be restored, there should be no long-term adverse impacts on recreation.

The short- and long-term economy of the region would be enhanced as a result of the Proposed Action and Alternatives 1 and 2. The Proposed Action and Alternatives 1 and 2 would extend the life of the Antelope Mine from nine to 13 years (see Table 2-2).

3.18.2 Greenhouse Gas Emissions

There has been, and continues to be, considerable scientific investigation and discussion as to the causes of recent historic rise in global mean temperatures, and whether a warming trend will continue. This section will address greenhouse gas emissions as specifically related to Antelope Mine, the mine adjacent to the West Antelope II LBA tract.

Greenhouse gases (GHGs) have been raised as a concern due to the greenhouse effect. The greenhouse effect is a theory that certain gases in the atmosphere impede the release of radiation from the earth, trapping heat in the atmosphere like glass in a greenhouse. GHGs currently include carbon dioxide (CO_2), methane (CH_4), water vapor, ozone, and nitrous oxide (NO_2). GHGs are not currently regulated, but there is a consensus in the international community that global climate change is occurring and that GHGs may play a role. If the coal in the West Antelope II LBA tract is leased and mined, GHGs would be released into the atmosphere.

As discussed in Chapter 1, BLM does not authorize mining through the issuance of a federal coal lease. WDEQ, with oversight from OSM, has regulatory authority in issuing permits to mine coal in Wyoming. However, BLM considers the impacts of mining coal in this EIS because it is a logical consequence of issuing a maintenance lease to an existing coal mine.

The use of the coal after it is mined is not determined at the time of leasing. However, almost all coal that is currently being mined in the Wyoming PRB is being used to generate electricity by coal-fired power plants. A discussion of emissions and by-products that are generated by burning coal to produce electricity is included in Section 4.2.13 of the EIS. A more complete discussion of the current status of global climate change is included in Chapter 4, Section 4.2.13.1.

As discussed in Chapter 2, under the currently approved mining plan, which represents the No Action Alternative, ACC anticipates that Antelope Mine would mine its remaining estimated 394.3 million tons of recoverable coal reserves in 11

years at an average annual production rate of approximately 36 million tons. Under the Proposed Action, ACC estimates that the life of the mine would be extended by about 11 additional years at an average annual coal production rate of approximately 36 million tons. If the average annual production rate increases to 42 million tons, which is the maximum rate allowed by the current air quality permit, the life of the mine would be extended by nine additional years under the Proposed Action. Under Alternatives 1 and 2, if the entire BLM study area is leased, ACC estimates the life of the mine would be extended by 11 to 13 years.

ACC conducted an inventory of expected greenhouse gas emissions that occurred in 2007 at Antelope Mine (Table 3-20). ACC also projected emissions for a typical year of operations at Antelope Mine if the West Antelope II lands are leased and mined by ACC. Emissions are measured as CO_2 equivalents (CO_2e), a conversion to put any of the various gases emitted, i.e. methane or nitrous oxides, into the equivalent greenhouse effect as compared to CO_2.

The inventory included all types of carbon fuels used in mining operations as well as electricity used on site, and mining processes such as blasting, methane released from mined coal, and spontaneous combustion. Additional categories are on-site rail transport as well as rail transport arranged by the buyers (Rio Tinto Energy America 2008).

Table 3-20. Greenhouse Gas Emissions, Antelope Mine

Source	**2007***	**Average Year with West Antelope II LBA***
Fuel	110,877	195,173
Electricity	77,574	111,854
Mining Process	36,772	40,884
On-site Rail	1959	2251
Total at Mine	227,182	347,911
Other Rail**	656,444	754,338

*CO_2e in tonnes

**Provided for reference, assumes 10 percent increase based on demand in eastern US

Projected emission rates increase if the West Antelope II tract is added to ACC's mining operations. The increase in CO_2 emissions would result from the additional diesel fuel that would be used in consideration of the added haul distances and overburden hauling, as well as increased electricity and explosives related to increasing strip ratios.

The Center for Climate Strategies estimated that activities in Wyoming accounted for approximately 56 million metric tons of gross CO_2e emissions in 2005 (Center for Climate Strategies 2007). Using that estimate, the 2007 Antelope Mine emissions total (Table 3-20) represents 0.41 percent of state-wide emissions. With

the addition of the West Antelope II LBA tract, the projected total Antelope Mine emissions would represent 0.63 percent of state-wide emissions.

Under Alternative 3, the emission rates would continue for 11 years at approximately the rates measured in 2007 when production was about 35 mmt. The incremental change with the addition of West Antelope II to the Antelope Mine represents the estimated emissions for the proposed action as well as Alternatives 1 and 2. Estimates assume that the annual production rate is 36 mmtpy. If the West Antelope II tract is leased and mined by ACC, the tract would add nine to 13 additional years to the life of the mine. Under these alternatives, the projected emissions would occur over those nine to 13 additional years of mine life.

Please see Section 4.2.13 for an assessment of cumulative impacts related to greenhouse gases, and how the proposed action and alternatives contribute.

3.19 Irreversible and Irretrievable Commitments of Resources

The major commitment of resources would be the mining and consumption of 394.3 million tons (Proposed Action) up to a maximum of 453.9 million tons (Alternatives 1 and 2) 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 4,108.6 acres (Proposed Action) up to a maximum of approximately 6,309.2 acres (Alternatives 1 and 2) would be irreversibly changed. Soil formation processes, although continuing, would be irreversibly altered during mining related activities. Newly formed soil material would be unlike that in the natural landscape.

Direct and indirect wildlife mortalities 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 MSHA (1997) for the 10-year period 1987-1996, fatal accidents (excluding contractors) occurred at the rate of 0.003 per 200,000 man-hours worked. Disabling (lost time) injuries occurred 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.