III. AFFECTED ENVIRONMENT

A. General Setting

The proposed lease area is within a region which has been evaluated by several federal environmental analyses which describe the existing and affected environment in the area of the current proposed lease-by applications. These documents contain analyses of the impacts to be expected as a result of surface coal mining in this area. The relevant publications are as follows:

- Part 1: Regional Analysis, Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming, Volumes I and II, BLM, October 1974
- Part III: Proposed Mining and Reclamation by Atlantic Richfield Company, Final Environmental Impact Statement, Eastern Powder River Coal Basin of Wyoming, Volume III, BLM, October 1974
- Final Environmental Statement, Eastern Powder River Coal, BLM, March 1979
- Final Environmental Impact Statement, Powder River Coal Region, BLM, December 1981
- Draft Environmental Impact Statement, Round II Coal Lease Sale, Powder River Region, BLM, January 1984
- Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area Management Framework Plan: Gillette Review Area, Casper, Wyoming 1980.
- Powder River Coal Regional Tract Summaries, Cheyenne, Wyoming, 1983.
- Buffalo Resource Area, Resource Management Plan (RMP) and Final EIS, BLM, October 5, 1985.
- Coal Bed Methane Environmental Assessment, Eastern Campbell County and Western Johnson County, Wyoming WY-061-0-EA064, Casper BLM, March 1990 (for part of the socioeconomic data).
- Jacobs Ranch Federal Coal Lease Application Environmental Assessment, Casper BLM, June 1991.
- Final Environmental Impact Statement for the Medicine Bow National Forest and Thunder Basin National Grassland Land and Resource Management Plan and Final EIS, U.S. Forest Service, November 1985.

The affected environment also is described in great detail in the Black Thunder Mine and Reclamation Plan (20 Volumes), Permit Number 233-T4, which was approved for a fourth 5-year term of mining by the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) on April 1, 1991. This document is on file with the WDEQ/LQD. Moreover, detailed environmental baseline information for the proposed lease area is being gathered by TBCC and various consultants to comply with the WDEQ/LQD requirements for a mine plan submittal. This information includes land use, climatology, geology, soils, vegetation, ground water and surface water hydrology, archaeology, paleontology, history, air quality and wildlife.

These studies have revealed that the following elements of the human environment are either not present in the proposed lease area or would not be affected: Areas of Critical Environmental Concern (ACEC), prime or unique farmlands, floodplains, riparian areas, wild or scenic rivers, or wilderness.

The area is substantially similar to the adjacent BTM for which detailed site-specific environmental data have been collected and environmental analyses have been prepared by TBCC to secure the necessary mining permits. These permits and assessments have been previously reviewed in detail and approved by BLM as providing an adequate environmental assessment and employing appropriate environmental reclamation measures.

The proposed lease area is located west of and adjacent to the existing BTM as shown on Figures 2 and 3. The mine is about 50 miles southeast of Gillette, Wyoming and ten miles east of Wright, Wyoming. Access to the mine is provided by Wyoming Highway 450.

BTM is a surface coal mine owned and operated by TBCC. Coal is mined by a combination truck/shovel and dragline operation. Coal production occurs from six working faces to enable blending of the coal to meet customer quality requirements, to comply with BLM lease requirements for maximum economic recovery of the coal resource, and to optimize coal removal efficiency with available equipment. Existing facilities at the mine include crushing, overland conveying, storage, loading, administrative, and equipment maintenance facilities. Railroad access is provided for unit trains operated by the Burlington Northern Railroad and by the Chicago and Northwestern Railroad. Both rail and highway access are shared with Kerr-McGee Coal Company's Jacobs Ranch Mine, located to the north of the highway. Mining activities at Jacobs Ranch Mine are progressing toward the north whereas mining activities at BTM are progressing toward the south and west, which means that the current mining activities for the two mines are moving away from each other.

The initial mine permit for BTM was issued on December 3, 1974 and the first coal was shipped on December 14, 1977. Current production is about 30 million tons per year (mmtpy). The BTM recently obtained an air quality permit which allows them to produce up to 36 million tons of coal per year for the years 1991, 1992 and 1993. BTM's previous air quality permit, which will also be the permitted level in 1994, was for mining up to 30 mmtpy. TBCC's reason

for requesting the temporary air quality permit increase is that they need some flexibility in negotiating new contracts. BTM's current production is around their previous permit level of 30 mmtpy, and they have some long term contracts which will be expiring in the next few years. The added air quality permit level will allow them to provide coal for test burns or negotiate some contracts to replace those which are expiring.

The BTM site is situated in the rolling high plains of northeastern Wyoming. Elevations generally range from 4600 to 4800 ft above mean sea level (msl). The climate is semi-arid. Precipitation averages about 13 inches, with 75 percent of the average precipitation occurring during the growing season, which is from April through September. Summer precipitation is often in the form of brief, intense thunderstorms. Annual evaporation exceeds annual precipitation. The prevailing winds are from the northwest quadrant and the mean annual wind speed is about 8 to 10 mph.

All streams on the mine site and proposed lease tract are ephemeral, meaning they flow only in direct response to precipitation or snowmelt runoff events. Little Thunder Creek and its tributary, North Prong of Little Thunder Creek, cross the mine site from west to east, joining about 1.5 miles east of the current mine permit boundary (Figure 3). Little Thunder Creek is tributary to Black Thunder Creek which flows into the Cheyenne River about 29 miles east of the mine. The Cheyenne River is a tributary to the Belle Fourche River, which joins the Missouri River on the Oahe Reservoir north of Pierre, South Dakota.

B. Affected Resources

1. Geology and Topography

The Powder River Coal Basin of northeastern Wyoming lies within the boundaries of the Powder River structural and topographic basin. The basin is a broad asymmetric syncline bounded on the west by the Big Horn Mountains, on the east by the Black Hills, and to the south by the Casper Arch, Laramie Mountains, and the Hartville Uplift. The basin extends northward into Montana. The axis of the syncline (the deepest part of the basin) is west of the center of the basin.

On the eastern limb of the basin, where the BTM is located, the strata are gently dipping (2 to 4 degrees) to the west. In the area of the BTM, the shallow strata dip two degrees to the west-southwest. Since the proposed WBT maintenance lease tract is located west, or downdip, of the existing BTM, in general, the coal in the WBT tract is deeper than the coal in the existing lease. This means that more overburden must be removed from the proposed WBT in order to mine the coal.

Stratigraphic units of interest in the mine area include, in descending order, recent (Quaternary age) alluvial deposits, the Eocene age Wasatch Formation which comprises the overburden, and the Paleocene age Fort Union Formation (Figure 4). The contact between the

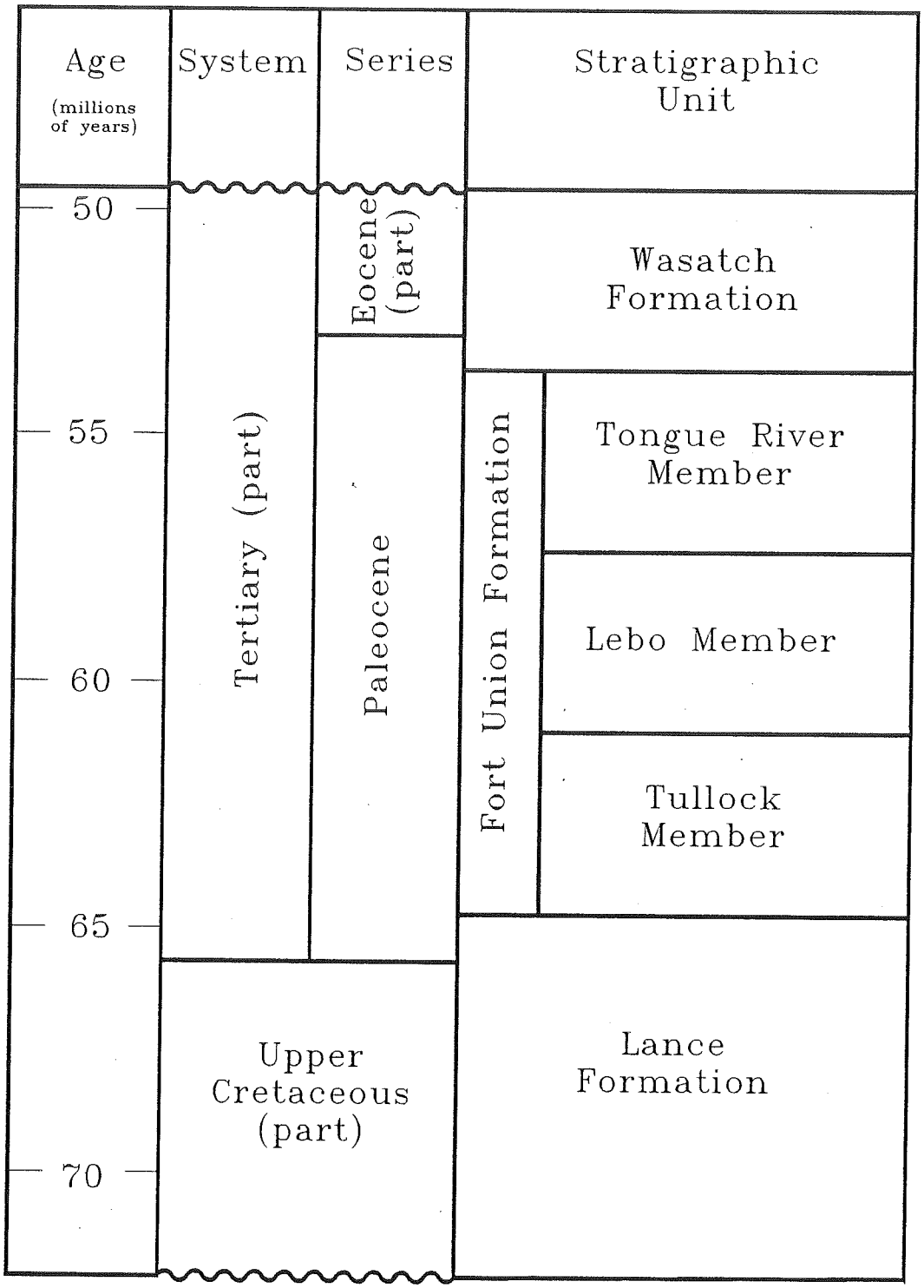


Figure 4. Generalized Stratigraphic Chart for the latest Cretaceous and early Tertiary, Powder River Basin, Wyoming. Modified from Brown, in press, and Law, Rice and Flores, 1991.

Fort Union Formation and the Wasatch Formation is designated as the top of the Wyodak-Anderson coal seam, the main coal seam being mined in the basin.

The alluvial deposits along Little Thunder Creek consist primarily of unconsolidated, discontinuous beds of clay, silt and sand. The Wasatch Formation consists of interbedded shales; siltstones; thin, discontinuous coals; and lenticular sandstones. Where sandstones in the Wasatch Formation are of sufficient porosity and areal extent they serve as aquifers for stock and domestic uses.

The Fort Union Formation consists of non-carbonaceous to highly-carbonaceous shales, mudstones, siltstones, lenticular sandstones, and coal. It is between 3500 and 4000 feet thick in the area of the WBT tract, based on correlation of oil and gas logs drilled within the tract. The Fort Union Formation is divided into three members, which are the Tongue River, Lebo Shale, and Tullock members in descending order (Figure 4).

The Tongue River member reaches thicknesses of 1,750 feet and consists of sandstone, conglomerate, siltstone, mudstone, limestone, coal and carbonaceous shale (Law, Rice, and Flores, 1991). The Wyodak-Anderson coal seam is located at the top of this member in the lease application area. The Wyodak-Anderson coal is sub-bituminous in rank, and is generally a low sulfur, low ash coal deposit. Glass (1982) reported average ash and sulfur values of 6.0 percent and 0.5 percent respectively for 59 Wyodak-Anderson samples. The average Btu/pound values for these samples was 8224. Below the Wyodak-Anderson coal bed, there are 1500 to 2000 feet of interbedded shales, siltstones, sandstones, and thin coal beds, which comprise the rest of Tongue River member.

The middle member of the Fort Union Formation is the Lebo Shale Member. It reaches a maximum thickness of approximately 3000 feet in the Powder River Basin, and consists of sandstone, siltstone, mudstone, coal and carbonaceous shale (Law, Rice and Flores, 1991).

The lower member of the Fort Union is the Tullock, which ranges in thickness from 370 feet in the northwestern Powder River Basin, in Montana, to 1440 feet in the southeastern Powder River Basin, in northwestern Converse County, and northeastern Niobrara County (Brown, in press). The Tullock Member consists of fine-grained sandstone, sandy siltstone, shale, rare thin limestone and coal (Brown, in press). Where the Tullock crops out along the southeastern edge of the Powder River Basin west of Bill, Wyoming, the Tullock consists of greater than 75 percent siltstone and mudstone with minor zones of coal and carbonaceous shale (Brown, in press). Thin, lenticular sandstone beds comprise the remainder of the member (Brown, in press).

A fourth geologic unit, clinker (locally known as scoria), is baked or fused rock formed by spontaneous prehistoric burning of coal seams. Clinker formed by burning of the Wyodak-Anderson coal seam is present along the outcrop of the Wyodak-Anderson coal seam. In the BTM area, clinker is located along the eastern boundary of the current mine area.

Methane, the main component in the natural gas which is used to heat homes, occurs in association with coal beds because it is a by-product of coal maturation. In some areas of the country, most notably in the San Juan Basin of Colorado and New Mexico and the Black Warrior Basin of Alabama, methane from coal beds is being produced and sold in significant quantities. At this time, there is a tax incentive for non-conventional fuels which can be applied to methane produced from coal beds and sold.

In the Powder River Basin, coal bed methane has been produced and sold from several wells at Rawhide Butte Field for several years. Rawhide Butte Field is located several miles west of the Eagle Butte coal mine. Two of the producing wells at Rawhide Butte Field were initially drilled by the WDEQ, to investigate methane leakage at the surface into houses located in a subdivision northwest of Gillette. In 1987, gas seepage problems were responsible for the evacuation of residents at the Rawhide Village and Horizon subdivisions.

There have been a number of reports of methane flowing from shallow water wells and coal exploration drill holes in the Powder River Basin. According to DeBruin and Jones (1989), most of the documented historical occurrences have been in the northern Powder River Basin. Olive (1957) references a water well in T54N, R74W which has produced gas for domestic use since 1916. Discussions of gas produced from shallow wells in and around have been the subject of several newspaper articles in the Gillette newspaper over the years (for example: "Gas Accompanies Flow of Water in Railroad's Well", 1/18/36, well located in the railroad yard, well 740 feet deep; "Vein of Gas Struck on L.C. Reed Ranch", 5/25/48, location 30 miles northwest of Gillette, depth to gas 262 feet; "Gas Struck in Water Well on Ted Barlow Ranch", 4/5/51, ranch location 13 miles west of Gillette, depth to gas 305 feet; and "City Paying $464,000 to Get Gas Out of Water", 7/10/84, referring to six Fort Union water wells in the city.) None of the reported historic occurrences have been as far south as the BTM area.

The historic occurrence of producible amounts of methane at shallow depths in the northern part of the basin appears to be related to geologic conditions in that area. These geologic conditions include association of the gas with structurally high features in structurally deformed areas, and the existence of effective seals (Law, Rice and Flores, 1991). Without the development of these types of features, which act to trap the gas in the coal or in an adjacent sandstone, most of the gas generated is gradually lost to the atmosphere (Law, Rice, and Flores, 1991). The absence of historic occurrences of gas, and the lack of an indication of structural deformation similar to that in the Rawhide Butte area indicate that coal bed methane is not likely to be a hazard in the BTM area, or the area of the WBT tract. This is substantiated by the fact that TBCC's coal monitoring wells produce only occasional slight amounts of methane.

The terrain in the vicinity of the lease area is gently rolling except along drainages, where channel incision has created some gullying and cut banks. The WBT tract has similar relief to that found in the active mine area, where slopes range from flat to over 19 percent and average about 5.6 percent. On the flatter highlands there are closed topographic depressions. These depressions do not contribute runoff to area streams; runoff in these depressions forms intermittent ponds, or playas, in the bottoms of the depressions.

2. Water Resources

a. Ground Water

The Quaternary alluvial deposits in the BTM vicinity range in thickness from 0 feet in the upper reaches of Trussler Creek to a maximum of about 13 feet at the confluence of North Prong and Little Thunder Creek east of the current mine area. The valley fill deposits range from basal coarse sands and gravels to silty, clayey sediments near the surface.

The Wasatch Formation is not a regional aquifer. The Wasatch is basically a matrix of siltstones and shales with interbedded lenticular sandstones and thin, discontinuous coal seams. The sandstones and coal seams, where they are saturated, can provide water to stock and domestic wells, but they generally do not have the lateral extent of the Wyodak-Anderson coal seam. Recharge to the Wasatch aquifer is from infiltration of precipitation and lateral movement of water from adjacent clinker. Regionally, water is discharged by small springs and seeps along stream drainages, by evaporation and transpiration, and by pumping of wells. There are no known discharge areas in the WBT tract. Regional flow is toward the north; however, the quantity of water is small and the rate of movement is slow because the fine-grained structure of the Wasatch Formation results in a small permeability which impedes the flow of water. Well tests at the Black Thunder Mine indicate hydraulic conductivity of this aquifer varies from 0.077 ft/day to 0.927 ft/day, with a mean of 0.37 ft/day. Martin, et al. (1988) reported a range of 0.2 ft/day to 0.35 ft/day. Transmissivity values for this aquifer as reported by Martin, et al. (1988) are less than 13 ft^2/day, while pump tests at the BTM give an average of 16.4 ft^2/day.

The Wyodak-Anderson coal bed is the most continuous hydrogeologic unit in the area. Its use as an aquifer is due more to its continuity and thickness than its permeability and quality. Recharge to the coal aquifer occurs primarily from clinker along the outcrop areas. The regional flow pattern is from the outcrop areas northwestward toward discharge areas in the northern reaches of the Powder River structural basin (Daddow, 1986). Because of its westward dip and relatively small yields, the Wyodak-Anderson coal seam ceases to be of interest as an aquifer as distance increases from the outcrop. Where the coal is deeper than a few hundred feet it is subject to little exploitation as an aquifer because there are shallower sandstones and coal seams in the overlying Wasatch Formation which can generally provide adequate water supply for stock and domestic purposes. Near outcrop areas ground-water flow in the coal can be locally controlled by topographic features, and alluvial systems can be local discharge points for the coal aquifer. This situation exists east of the WBT tract. The coal is not influenced by local topography in the WBT tract.

Pump tests in the Wyodak-Anderson coal at BTM have indicated a hydraulic conductivity ranging from 0.16 ft/day to 84.6 ft/day, with an average of 12.0 ft/day. Martin, et al. (1988) give a range of 0.8 ft/day to 0.9 ft/day for the coal. Transmissivities reported in Martin, et al. (1988) for this aquifer are less than 134 ft^2/day, while pump tests at the BTM show an average of about 500 ft^2/day.

The sub-coal Fort Union aquifers are separated from the coal aquifer by a thick shale sequence. The sub-coal Fort Union can be divided into two hydrogeologic units: the Tongue River-Lebo aquifer, and the Tullock aquifer, (Martin, et al., 1988). The Tongue River-Lebo aquifer consists of lenticular fine-grained shale and sandstone. The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone. Transmissivities are generally higher in the deeper Tullock aquifer, and many mines in the Powder River Basin have wells completed in this interval (Martin, et al., 1988). The average transmissivity for this member as reported in McIntosh, et al., 1984 is 2170 gal/day-ft or 290 ft^2/day.

The clinker is the most permeable geologic unit in the area. It has a high recharge capacity, and clinker deposits with large areal extent and saturated thickness can supply large volumes of water to wells. Saturated clinker is an important recharge source for the coal, and is so permeable relative to coal it generally acts as a constant-head boundary (that is, drawdown in coal normally does not appreciably affect water levels in the clinker). At the BTM, pump testing the clinker has produced an estimated transmissivity of 35,400 ft^2/day.

The thicknesses of the various units gives an indication of the extent of the groundwater resource present in each. At the BTM, the thickness of saturated overburden varies from zero to about 100 feet and the coal aquifer contains from zero to about 70 feet of saturated thickness. According to Martin, et al. (1988), the subcoal Fort Union averages 2000 feet thick (all saturated), of which the deeper Tullock member comprises an average of 785 feet.

Water quality in the coal aquifer varies as a function of distance from the outcrop. Near the outcrop, where recharge occurs from the clinker and overburden, the dominant ions are calcium, magnesium, sodium and sulfate. As water proceeds down-dip away from recharge areas, sulfate is reduced and the water becomes dominated by sodium and bicarbonate ions. Total dissolved solids (TDS) concentrations in the coal water on the BTM have ranged from about 500 mg/L to over 3,000 mg/L. The 500 mg/L is within the range suitable for drinking water, while the 3,000 mg/L exceeds the recommended level for irrigation (2,000 mg/L) and approaches the maximum level of 5,000 mg/L for livestock consumption (WDEQ/WQD, 1980).

Water quality in the Wasatch Formation in the BTM area is also variable, ranging from a calcium sulfate type to a sodium sulfate or sodium bicarbonate type. TDS concentrations range from about 800 mg/L to over 9,000 mg/L. Water in the clinker is a calcium sulfate type with TDS concentrations generally in the range of 2,000 to 2,500 mg/L.

Water supply for the BTM is obtained from wells and from pit dewatering. A total of eight wells have been used as water-supply wells; six of them are currently producing.

Four of the currently producing wells are completed in the Wyodak-Anderson coal seam or overlying Wasatch Formation. Two of these wells are completed in the scoria, and are associated with scoria removal. The other two drain water from the coal and overburden in the pit area.

Two wells are completed in deep subcoal units in the Tullock member of the Fort Union Formation. This latter water-supply source is a common source for mines, subdivisions and is used as a back-up source of water for the town of Gillette due to its good water quality and large saturated thickness (when numerous sands are encountered) which enables large well yields compared to shallower units. One of the BTM Fort Union wells is completed in seven different sands, with a total thickness of 186 feet, and has a total depth of 2,428 feet. It produced 25.3 million gallons (78 acre-feet) of water in 1990. The other Fort Union well is complete opposite 15 producing zones between 1,000 and 2,200 feet below the land surface. It produced 30.6 million gallons (94 acre-feet) in 1990. These wells are used for drinking, sanitary and industrial uses at the mine; water for dust suppression on haul roads is obtained from pit inflows and sedimentation ponds.

Water from the Fort Union wells is a sodium bicarbonate type with TDS concentrations below 300 mg/L. This water is generally suitable for domestic, stock and agricultural purposes.

Flow patterns in the subcoal Fort Union Formation are similar to those of the coal, with recharge occurring in outcrop areas to the east of the Wyodak-Anderson coal outcrop and regional flow trending to the west and north.

According to information provided in the BTM permit document, there are valid water rights for four water-supply wells on the WBT tract. Three are stock-water wells and one is permitted for "miscellaneous" use. Judging by their depths, one is believed to be completed in the Wasatch overburden and two in the coal seam. The depth of the fourth well is not known.

b. Surface Water

The two largest stream channels which flow across the WBT tract are Little Thunder Creek and its tributary, North Prong of Little Thunder Creek. These streams join about 1.5 miles east of the current mine area (about 5 miles east of the WBT tract). The principal tributary to Little Thunder Creek in the vicinity of the BTM is Trussler Creek. The largest tributaries to North Prong in the immediate area are Shipley Draw and Mills Draw. All channels are ephemeral and have vegetated bottoms. The local drainage system is illustrated on Figure 3.

Little Thunder Creek has a total drainage area of about 62.5 square miles, of which about 10.5 square miles are in closed depressions and do not contribute to area streamflow. The drainage area above the WBT tract is about 38.5 square miles. North Prong has a total drainage area of about 49 square miles, of which 16.6 square miles do not contribute to runoff due to closed topographic depressions. About 30 square miles of the drainage area are above the WBT tract. Average annual runoff for the Little Thunder Creek drainage basin is 0.2 inch or about 10 to 11 acre-feet per square mile (Smith, 1974 and Schumm and Hadley, 1961). The streams are typical for the region, and their flow events are closely reflective of precipitation patterns. Flow events of relatively small peak discharge can result from snowmelt during the late winter and early spring. Although peak discharges from such events are small, the duration and

therefore percentage of annual runoff volume can be considerable. During the spring, general storms (both rain and snow) increase soil moisture, hence decreasing infiltration, and can result in both large runoff volumes and high peak discharges. A general regional storm in May 1978 resulted in the largest runoff on record on Little Thunder Creek and numerous other streams in northeastern Wyoming. Brief, sometimes intense, summer thunderstorms can result in large peak flows, particularly on streams with small drainage areas. In all, streams in this region experience from three to five separate runoff events in a typical year.

c. Alluvial Valley Floors

Both Little Thunder Creek and North Prong within and near the Black Thunder and Jacobs Ranch mines have been subjected to detailed studies to determine the presence or absence of alluvial valley floors (AVF). The BTM permit area, and thus the AVF area subject to investigation, includes all of Little Thunder Creek within the existing permit area and the WBT tract as well. Following completion of these studies, the WDEQ/LQD declared that portions of the Little Thunder Creek and North Prong valleys meet the regulatory intent for AVFs. These areas are small and are located downstream from the current mine area, east of the WBT tract (BTM permit document, Book No. 15, p. II.J.1 and Exhibit II.J-1.9).

d. Wetlands

During the summer and fall of 1991, TBCC conducted a wetlands inventory for the Black Thunder Mine, including the proposed WBT lease area. The inventory was performed in three parts: an inventory of hydric soils; and inventory of hydrophytic vegetation; and inventory of areas exhibiting characteristics of wetland hydrology. The study was conducted by:

TOPIC	PERFORMED BY:
Hydric Soils	James H. Nyenhuis, Certified Professional Soil Scientist, Fort Collins, Colorado
Hydrophytic Vegetation	Warren R. Keammerer, Keammerer Ecological Consultants, Inc., Boulder, Colorado
Wetlands Hydrology and Final Reports Preparation	Nick Tiffany, Certified Professional Hydrologist, Wester Water Consultants, Inc., Western Water Consultants, Sheridan, Wyoming

The development of wetland delineation criteria has been the subject of much debate and federal legislative review. As a result, there have been numerous revisions of the delineation criteria. Since March, 1989, the January 1989 Federal Manual for Identifying and Delineating Vegetated Wetlands (Federal Interagency Committee for Wetlands Delineation (FICWD), 1989 has been used by the four federal agencies responsible for administering the various wetlands

regulations. The four agencies are the Army Corps of Engineers (USCE), the Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), and the Soil Conservation Service (SCS). Proposed revisions to the 1989 wetland delineation manual were published in the Federal Register on August 14, 1991, with a request for public comment. On August 17, 1991, an amendment was approved as part of the 1992 Energy and Water Development Appropriation Act which effectively prohibits the USCE from expending funds for the delineation of wetlands under the 1989 manual. In response to the amendment, USCE has directed that the USCE will apply the Corps of Engineers Wetland Delineation Manual developed in 1987 (USCE, 1987) for the delineation of wetlands until the proposed revisions to the 1989 manual are finalized.

Field work performed in conjunction with the soils and vegetation portions of this survey was conducted during the summer of 1991, before the approval of the amendment to the Energy and Water Development Administration Act, and was therefore conducted in conformance with the 1989 Federal Manual (FICWD, 1989). Hydrology studies were completed after the August 17 amendment, and these studies were performed in consideration of the hydrology criteria utilized in both the 1987 and 1989 wetland manuals. The final report (WWC, 1991) contains a detailed description of the procedures followed during the course of the inventory. In order to be classified as a jurisdictional wetland under the 1987 and 1989 manuals, an area had to possess all three indicators (hydric soils, hydrophytic vegetation, and wetland hydrology) .

Western Water Consultants found a total of 107.9 acres within the BTM study area, including the WBT tract, which met the definition of jurisdictional wetlands. The presence of hydrophytic vegetation proved to be the limiting factor in this determination. The study determined there to be 351.4 acres of hydric soils, 118.7 acres meeting the hydrology criteria (basically a frequency and duration of inundation analysis), and 107.9 acres of hydrophytic vegetation. Of this 107.9 acre total, 6.15 acres (4 sites) were comprised of playas, 21.38 acres (3 sites) were associated with man-made reservoirs, and 80.37 acres (9 sites) were within or immediately adjacent to stream channels. Mitigation in accordance with the prevailing USCE regulations will be addressed as part of future mining permits.

3. Soils

An SCS Order 3 soil survey has been completed for the proposed WBT lease area. Some of the map units, such as those on bottomlands of Little Thunder Creek or on slopes of less than 6 percent, were mapped at the more detailed Order 2 level. The SCS mapping is part of the ongoing Soil Survey of Campbell County, Southern Part, which is unpublished at this time (SCS, 1991a.). In addition, TBCC has completed a detailed Order 1 soil survey of the portion of the WBT tract that is within the current permit area. This area was included in the original Order 1-2 BTM soil survey, and soils were described and sampled according to WDEQ soil and overburden guideline specifications (TBCC, 1990 Permit Update, Book 12). A detailed Order 1-2 soil survey, with profile descriptions and laboratory characterization of all major soil types, is being conducted on all WBT proposed lease areas that now have only SCS Order 3 mapping. This work will be conducted during the summer and fall of 1991 subsequent to archaeological

clearance.

Seventeen soil series and two miscellaneous types are contained within 19 SCS map units on the proposed lease area. Dominant soils and relative amounts are similar to those on the current mine permit area. The soil baseline studies in the mine permit document (TBCC, 1990 permit Update, Book 12) contain a complete physical description and laboratory data for these soils. The following is a list of the soils and SCS map units found in the WBT lease area. The soils considered hydric are so noted (SCS 1991b).

- Haverdad loam (considered a hydric soil)
- Bidman loam (playa inclusions are considered hydric)
- Ulm loam and clay loam
- Maysdorf and Pugsley soils
- Cushman and Renohill loams
- Parmleed, in complex with Pugsley on rolling areas on plains, and with Renohill on bedrock controlled fans and hillslopes
- Absted-Arvada-Slickspots complex (playa inclusions are considered hydric)
- Theedle-Kishona-Shingle loams
- Worf loam, in complex with Shingle
- Samday clay loam, in complex with Shingle
- Rauzi fine sandy loam, in complex with Maysdorf

Hydric soils are of limited extent on the proposed lease area, and these have been evaluated, along with possible presence of hydrophytic vegetation and wetland hydrology, as part of the overall WBT wetlands delineation and determination during preparation of the mine permit application document. Wetland determinations are performed under criteria and methods described in the "Federal Manual for Identifying and Delineating Vegetated Wetlands" (FICWD, 1989, and as revised 1991).

Review of the current SCS Campbell County hydric soils list (SCS, 1987) indicates that only one map unit on the WBT tract, the Haverdad loam, meets hydric criteria. Haverdad loam is a well drained soil located on flood plains and low terraces of Little Thunder Creek and Trussler Creek. Trussler Creek occupies only a small part of the proposed lease area. Haverdad also occupies Little Thunder Creek bottomland which bisects the proposed lease area. Some hydrophytic vegetation occurs within the Haverdad map unit delineation.

The Haverdad soil is subject to occasional flooding during prolonged, high-intensity storms from April through June, and is considered by SCS to meet the hydric soil saturation requirement (continuous saturation nearly to the surface for two weeks during the growing season) (SCS, 1991b). However, a question exists concerning the frequency of saturated conditions (i.e., how many years in ten does the soil meet hydric criteria, and the significance

of the infrequent saturation for hydric status). Although quantitative data do not now exist (Derr, 1991), it is thought that perhaps in only two or three years in ten does sufficient spring and early summer precipitation exist for necessary soil saturation to occur.

Playa inclusions in several soil mapping units are considered by SCS to meet hydric criteria. Only the playa portion of the map unit is considered to meet these criteria. The topography of the WBT playas is flat to slightly concave. Runoff from the surrounding terrain is collected into the playa basins where the water is evaporated. About 144 acres in twelve playa areas would be affected by mining the WBT tract.

4. Vegetation

The vegetation in the WBT tract is typical of that found in the southern part of the eastern Powder River Basin and is very similar to the premining vegetation on the existing BTM area. The gently rolling upland areas support mixed-grass prairie and sagebrush-shrubland vegetation types. These vegetation types are similar, being distinguishable by the relative amount of big sagebrush present. These two vegetation types cover about 80 percent of WBT tract, occurring everywhere except in stream channels and the playas.

The mixed-grass prairie vegetation type includes needle-and-thread grass, blue grama, prairie June grass, and western wheatgrass. Big sagebrush accounts for less than ten percent of the total vegetation cover. The sagebrush-shrubland vegetation type has similar species composition to the mixed-grass type, but big sagebrush is more abundant and provides as much as 70 percent of the total vegetation cover.

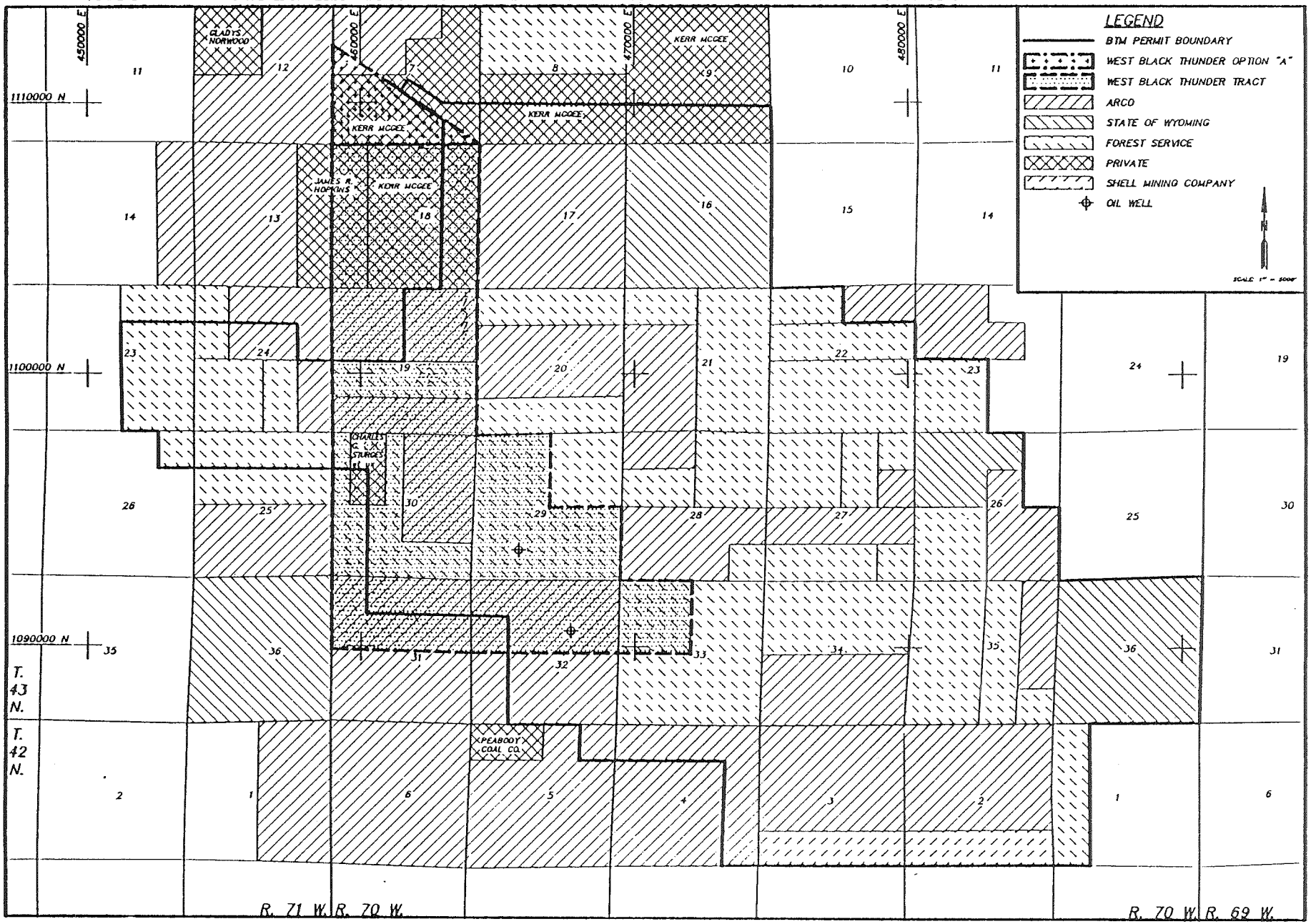
The stream channels are vegetated due to infrequent and short-duration flow events, and they support a streamside-meadow vegetation type. These communities occur as narrow bands along the channel, and major species include Kentucky bluegrass, western wheatgrass, foxtail, and common dandelion.

The playas are either barren or support a grassland vegetation type. Years of evaporation from the lake beds have created saline conditions. It appears that the degree of salinity of the substrata on the lake beds plays an important role in determining whether or not the sites can support vegetation. Sites with clayey substrate, where water cannot readily leach salts downward, tend to have the highest salinity and sparsest vegetation. Western wheatgrass accounts for as much as 85 percent of the total vegetation cover in playa grasslands.

5. Ownership And Use Of Land

The surface on the WBT tract has several separate owners, including Kerr-McGee Coal Corporation, Naomi M. Hopkins and Diane L. Sperber, Charles G. Sturges and Margaret B. Sturges, Atlantic Richfield Company, and the United States of America. Ownership is illustrated on Figure 5. Adjacent surface owners that may be affected by overstripping or surface disturbance include the State of Wyoming and Peabody Coal Company.

FIGURE 5. OWNERSHIP MAP OF WEST BLACK THUNDER TRACT AND VICINITY



The land is currently used for livestock grazing. The USFS uses a stocking rate of 5.5 acres per animal unit month (AUM). At this rate the 3,225-acre WBT tract can support about 586 AUMs, or about 49 animal units over a 1-year period. Of the proposed lease area of about 3,225 acres, about 2,480 acres are currently unavailable for grazing due to the construction of the Little Thunder Creek Diversion. This diversion project, consisting of a series of dams and ditches, intercepts the flows of Trussler Creek, BK Draw, and Little Thunder Creek and diverts the flows northward and around the active mine area to the North Prong Diversion, which conveys the combined flows eastward into the Kerr-McGee Jacobs Ranch Mine permit area. This diversion system is shown on Figure 6, which also shows the boundary of land disturbed to date.

The proposed lease area is in an area where oil and gas production currently exists. There are two producing wells in the area (Figure 5). The well in the SE1/4 SW1/4 Section 29, called the 1 Panos Federal, is on a government lease and produces both oil and gas from the Turner Sandstone for the operator, Sonat Exploration. The well in SW1/4 NE1/4 Section 32, called 1 Reno Fee "F", is a well producing oil from the Niobrara Shale for Y.H.S. Group. There are also three plugged and abandoned wells in the proposed lease area.

The potential for future oil and gas exploration also exists. Approximately two-thirds of the lease application area is underlain by federal oil and gas leases, all of which are currently leased. There are currently no applications for permit to drill on file within the proposed lease area. An approved application for permit to drill is required prior to any drilling for oil and gas, so this indicates that no drilling is currently planned in the area. However, the Niobrara Shale is a fractured shale which makes it prospective for development using horizontal drilling techniques. If Niobrara Shale development in other areas of the Powder River Basin is successful, there could be more oil and gas development in this area.

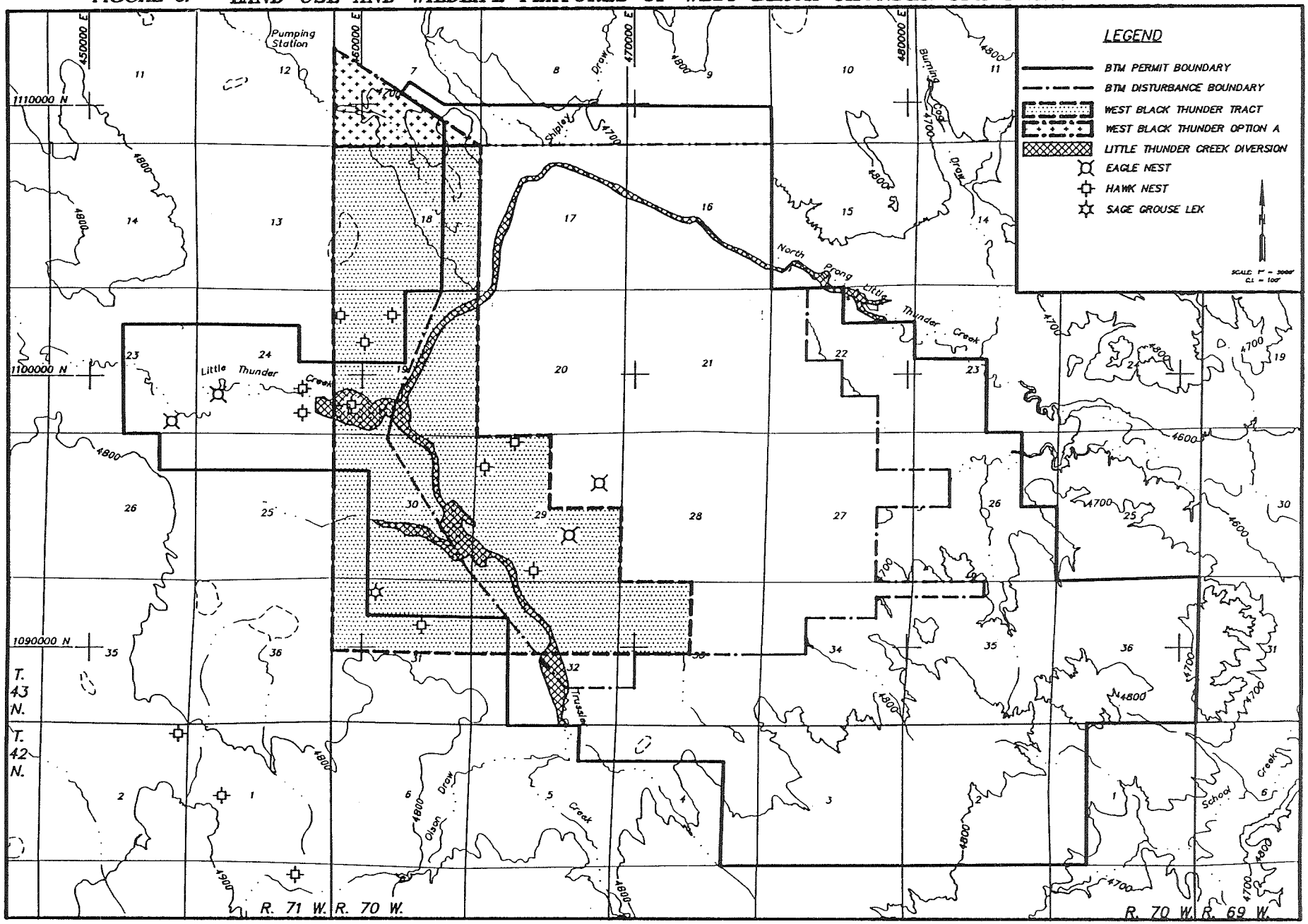
There are no occupied dwellings in the area, and no lands are used for cultivated agriculture. Hunting, primarily for antelope and mule deer, is the main recreational use of the land.

6. Wildlife

Information on wildlife in this area is available from annual monitoring data for (many surveys cover a larger perimeter around the current permit area) as well as from site-specific survey work initiated in spring 1991. The following descriptions of habitats, faunal occurrence, and faunal abundance are drawn from both sources.

The WBT tract is characterized by level to gently rolling topography. Sagebrush-grassland is the predominant habitat in the area, with big sagebrush being the primary shrub. Large areas of playa habitat are present both north and south of Little Thunder Creek. These undrained depressions are seasonal water sources in wet years. They held a substantial amount of water in the spring of 1991 for the first time in recent years. Bottomland or streamside meadows are found along both Little Thunder Creek and the North Prong of Little Thunder

FIGURE 6. LAND USE AND WILDLIFE FEATURES OF WEST BLACK THUNDER TRACT AND VICINITY



Creek.

Three big game species occur in the vicinity of the current BTM permit area: pronghorn, mule deer, and elk. No critical big game habitat is recognized by the Wyoming Game and Fish Department (WGFD) in this area and no critical wildlife issues that would affect leasing were identified (WGFD, May 23, 1991). Winter big game surveys have been conducted annually on the current permit area and its two-mile perimeter, which includes the WBT tract, since 1982. The proposed lease area is in the west-central part of that survey area. From 1982 through 1986, the Black Thunder area was surveyed as part of a larger, regional cooperative aerial big game census. In all years except 1987, the winter surveys were aerial counts. For the past three years, seasonal trend counts have been conducted along a set driving route at BTM to provide big game herd composition and habitat use data in seasons other than winter.

Pronghorn are, by far, the most common big game species in the area. The lands comprising the proposed permit extension are classified by the WGFD as winter/year-long habitat. Winter aerial survey data for the last three years yield pronghorn densities between 3 and 9 animals per square mile on the 83-square-mile Black Thunder survey area. Lowest numbers are from the 1989 survey, when visibility conditions were poor due to patchy snow cover. During the same years, pronghorn densities on the western two-thirds of the survey area (an approximately 47-square-mile area surrounding the proposed lease area) ranged from 5 to 12 animals per square mile. It appears that the WBT tract supports wintering pronghorn at a density comparable to, or slightly greater than, the Black Thunder area as a whole.

Pronghorn are present in the Black Thunder area in substantial numbers all year long. During winter surveys, the majority of sightings are generally in sagebrush-grassland habitat. This habitat is prevalent in the area, and pronghorn use it during all seasons. However, from spring through fall, many pronghorn are recorded in grassland, reclaimed grassland, and other habitats.

Mule deer are present in the Black Thunder area in small numbers year-round. Occasionally small groups or individuals are sighted on or near the proposed lease area, in sagebrush-grassland or along Little Thunder Creek and the North Prong of Little Thunder Creek. The proposed lease area contains no wooded bottomland or rough breaks habitats, so deer do not frequent the area in large numbers.

A herd of elk resides in the Rochelle Hills that border the east edge of the Black Thunder permit area. Small herds have been observed on and near the current permit area during all seasons. No elk have been recorded as far west as the proposed lease area. Although animals do wander from the protection of Rochelle Hills to forage in native and reclaimed habitats at the BTM, it is unlikely that any elk would wander onto the WBT tract.

Surveys for nesting raptors have been conducted annually since 1983 on the current BTM permit area and two-mile perimeter. The proposed lease area is within the two-mile perimeter and, consequently, has been searched for raptor nests over the past nine breeding seasons (1983-

1991). Results of previous surveys have been presented each year in the BTM's annual report to WDEQ/LQD. A mitigation plan for raptor nests in the Black Thunder area was developed in November 1989 in conjunction with the submission of the Black Thunder T-4 permit application. The mitigation plan was approved by the USFWS in December 1989.

Raptor nests on the proposed lease area include eight ferruginous hawk nests in four territories, and one golden eagle nesting platform (Figure 6). One of the ferruginous hawk territories has been consistently occupied since 1983. There are four nests in the territory within the proposed lease area; two ground nests and one platform nest in NW1/4 Section 19, T43N, R70W, and a third ground nest in SW1/4 Section 19. There are two other ground nests within this hawk territory located beyond the proposed lease area in Section 24, T43N, R71W. Adults successfully bred in this territory in 1983, 1986, 1987, 1989, 1990, and 1991. During those six breeding seasons, the adults used five different nests.

The other three ferruginous hawk territories in the proposed lease area have been used sporadically, or not at all, since 1983. In one of those territories there is a single existing ground nest in NE1/4SE1/4 Section 31, T43N, R70W. That nest was active when it was found in 1983, but has been inactive every year since. Adult ferruginous hawks were seen in the territory in 1984 and 1985, but they did not breed. No hawks have been observed in this area during any of the breeding seasons from 1986 through 1991.

There are two nests in the third ferruginous hawk territory in the proposed lease area; a platform nest and a ground nest in NW1/4NW1/4 Section 29, T43N, R70W. The platform nest was built as a mitigation measure in fall 1987. A breeding pair fledged young from the platform in 1988 and 1989. Those were the only two years in which hawks were recorded in the territory from 1983 through 1991.

The fourth potential ferruginous hawk territory in the lease area has not been occupied since 1983. That year, a single ground nest was located in SE1/4SW1/4 Section 29, T43N, R70W. Because the nest has not been used for at least nine breeding seasons, it is in very poor condition.

A golden eagle nesting platform was erected in NW1/4SE1/4 Section 29, T43N, R70W, on the proposed lease area, in fall 1989. The platform was built as an eventual site for eagles that have been the subject of mitigation studies since 1980. The eagles nested in a nearby tree on the existing Black Thunder lease area, in SE1/4NE1/4 Section 29, T43N, R70W, in 1989, 1990, and 1991 (Figure 6). That tree nest was destroyed during inclement weather in June, 1991. Now that the tree nest is not available, it is hoped that the eagles will use the Section 29 platform in the future.

The primary upland game bird species in the Black Thunder area is the sage grouse. The proposed lease area is within a larger area that has been surveyed for game bird leks annually since 1989. Despite the presence of apparently suitable breeding, loafing, and brood-rearing habitat on the permit area and proposed lease area, the sage grouse population in the vicinity of

Black Thunder is small. Sage grouse sightings have been infrequent, and only one lek has been found, in NE1/4NW1/4 Section 31, T43N, R70W. This is at the edge of the current Black Thunder permit area and within the proposed lease area (Figure 6). This lek has been monitored annually since its discovery during an aerial survey in 1984. The greatest number of males ever observed at the lek (21) was during that survey. Peak male counts since that year have ranged from nine to fourteen birds.

No appropriate habitat exists in the vicinity of the proposed lease area for turkeys, sharp-tailed grouse, or gray partridge.

The USFWS and WDEQ have expressed concern about seventeen avian species or subspecies in the Powder River Basin coal region. In 1986, a records search and field surveys were performed to document the occurrence and status of migratory birds of high federal interest (MBHFI) at BTM. Annual surveys for MBHFI have been conducted on and within one-half mile of the current Black Thunder permit area since 1986. This survey area encompasses a large portion of the proposed lease area. In spring 1991, the proposed lease area and its half-mile perimeter were added to the survey area.

Twelve of the seventeen species of MBHFI have been recorded through time on or near the Black Thunder permit area (Table 4). Conclusions regarding MBHFI have not changed since the 1986 report. No non-raptor species of MBHFI regularly use the Black Thunder area. Suitable staging or breeding habitats for the non-raptor MBHFI species do not exist to any significant extent on or near the Black Thunder permit area or the proposed permit extension which would encompass the WBT tract.

Ferruginous hawks and golden eagles are the only MBHFI that nest regularly on or within one-half mile of the proposed permit extension area. These species are discussed above. Nesting habitat for burrowing owls is present, but no nesting pairs have been found near the proposed lease area. No suitable nesting habitat for other raptor MBHFI species exists on the area.

The only threatened or endangered (T or E) species that could occur in the Black Thunder area are the bald eagle and black-footed ferret. Bald eagles are relatively common winter visitors in northeastern Wyoming. No roosting habitat (wooded canyons or large tree groves) exists on or within one mile of the proposed lease area. Bald eagles have been observed foraging on and near the area, but no unique source of prey occurs there. Black-footed ferrets have been known to reside almost exclusively in prairie dog towns. No ferrets have been sighted in the vicinity of the proposed permit extension, and no prairie dog towns exist within one mile of the area.

7. Cultural Resources

The entire proposed lease area (including a buffer zone at least 1/4 to 1/2 mile wide to the north, south, and west) has been inventoried at the Class III level. Metcalf Archaeological

Table 4. MBHFI Status in Northeast Wyoming and Expected Occurrence Near Black Thunder

Species	Seasonal Status/ Breeding Records	Sighting Records in BTM Area	Expected Occurrence in BTM Area
White Pelican	Summer/ Nonbreeder	None	Rare
Double-Crested Cormorant	Summer/ Breeder	BT	Rare
Canvasback	Summer/ One Record	BT	Rare
Ferruginous Hawk	Summer/ Breeder	BT, JR, NR	Common
Golden Eagle	Resident/ Breeder	BT, JR, NR	Common
Bald Eagle	Winter/ Nonbreeder	BT, JR, NR	Common in Winter
Osprey	Summer/ Has Nested	None	Rare
Prairie Falcon	Resident/ Breeder	BT, JR, NR	Uncommon
American Peregrine Falcon	Migrant/ Historical	BT	Rare
Richardson's Meril	Resident/ Breeder	PRES	Rare
Whooping Crane	Never Recorded	None	Very Rare
Sandhill Crane	Migrant/ Nonbreeder	BT	Uncommon
Mountain Plover	Summer/ Breeder	None	Uncommon
Long-Billed Curlew	Summer/ Possible Breeder	BT, JR	Rare
Burrowing Owl	Summer/ Breeder	PRES	Uncommon
Lewis' Woodpecker	Summer/ Breeder	None	Rare
Dicksissel	Summer/ Breeder	None	Rare

*Compiled from Oakleaf, et al. (1982), includes Campbell and Adjacent Counties

**Sighting Record References:
BT = Black Thunder Mine Permit
JR = Jacobs Ranch Mine Permit
NR = North Rochelle Mine Permit
PRES = Powder River Eagle Studies, Unpubl.data

Consultants, Inc. (1987) surveyed approximately 1,400 acres to the west of the current permit area. This included portions of Sections 23 through 26, T43N, R71W, and Sections 19, 30, and 32, T43N, R70W. Frontier Archaeology (Welch and Rosenberg, in progress) surveyed 2,120 acres. This area of examination included portions of Sections 7, 18, 19, 30, and 31, T43N, R70W, and Sections 12, 13, 24, 25, and 36, T43N, R71W. Earlier studies in the existing lease area were conducted by the Wyoming Recreation Commission, Western Cultural Resource Management, Inc., and High Plains Consulting, Inc.

The work by both Metcalf Archaeological Consultants, Inc. and Frontier Archaeology was performed at the Class III level. A Class III survey is a professionally conducted, intensive inventory of a target area, designed to locate all cultural properties which have surface and exposed profile indications. Cultural properties are recorded and sufficient information collected on them to allow evaluation for possible inclusion on the National Register of Historic Places (NRHP). That determination is made by the managing federal agency in consultation with the State Historic Preservation Officer (SHPO). Once the Class III survey is completed, site-specific testing or limited excavation is utilized to gather additional data which will: 1) determine the final evaluation status of a site and/or 2) form the basis of additional work that will be conducted during implementation of a treatment plan if the site is 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 mitigative measures as avoidance (if possible), large scale excavation, complete recording, Historic American Building Survey/Historic American Engineering Record documentation, archival research and other acceptable scientific practices.

A total of 22 cultural resource sites have been identified on the West Black Thunder lease tract and additional 14 sites have been identified within a one-mile buffer zone, for a total of 36 sites. On the lease tract itself, two sites are eligible for the NRHP, 15 sites are not eligible, and five sites are unknown with regard to their NRHP eligibility. Within the buffer zone, one site is eligible for the NRHP, seven sites are not eligible and six sites are unknown with regard to the NRHP eligibility. The current status for each site is shown on Table 5. All sites that have been determined ineligible for inclusion on the NRHP will require no further work prior to mining. All sites which are unknown with regard to their NRHP eligibility will have enough site-specific testing conducted to determine their eligibility, and if necessary, their final treatment. Prior to disturbance, a detailed treatment plan will be developed and implemented for all sites eligible for the NRHP.

The following information is provided to compare the cultural resource of the WBT tract to the active BTM. In 1982, Chapman and Miller identified 127 sites composed of 106 prehistoric and 21 historic sites on the 11,827 acre BTM and associated buffer zone. Welch has identified 26 prehistoric, 6 historic and 4 prehistoric/historic sites on the 8320 acre WBT tract and buffer zone through a literature search conducted through Wyoming SHPO. These numbers do include some overlap because the proposed WBT lease area covers part of the original BTM buffer zone. In comparison, site density on the WBT tract is less than 1/2 that observed on the BTM tract. In addition, preliminary information suggests that sites located on WBT lease tract

Table 5. Status of Known Cultural Sites Within the West Black Thunder Tract and One-Mile Buffer Zone

Site	Type	Location	NRHP Status
48CA-2685	Historic	Lease	Unknown
48CA-2686	Historic	Lease	Unknown
48CA-2687	Historic	Buffer Zone	Unknown
48CA-2688	Historic	Buffer Zone	Unknown
48CA-2725	Prehistoric and Historic	Buffer Zone	Unknown
48CA-2726	Prehistoric and Historic	Buffer Zone	Unknown
48CA-2727	Prehistoric	Buffer Zone	Unknown
48CA-401	Prehistoric	Lease	Unknown
48CA-402	Prehistoric	Lease	Unknown
48CA-1175	Historic	Buffer Zone	Eligible
48CA-1807	Historic	Lease	Eligible*
48CA-2481	Prehistoric	Buffer Zone	Unknown
48CA-1724	Prehistoric	Lease	Not Eligible
48CA-2229	Prehistoric	Lease	Not Eligible
48CA-2231	Prehistoric & Historic	Lease	Not Eligible
48CA-2333	Prehistoric	Lease	Not Eligible
48CA-1730	Prehistoric	Lease	Not Eligible
48CA-1731	Prehistoric	Lease	Not Eligible
48CA-1732	Prehistoric	Lease	Not Eligible
48CA-1733	Prehistoric	Lease	Not Eligible
48CA-1734	Prehistoric	Lease	Not Eligible
48CA-1736	Prehistoric	Lease	Not Eligible
48CA-1809	Prehistoric	Lease	Not Eligible
48CA-1729	Prehistoric	Lease	Eligible
48CA-1474	Prehistoric	Lease	Unknown
48CA-1769	Prehistoric & Historic	Lease	Not Eligible
48CA-1808	Prehistoric	Lease	Not Eligible
48CA-2226	Prehistoric	Lease	Not Eligible
48CA-1770	Prehistoric	Lease	Not Eligible
48CA-2593	Prehistoric	Buffer Zone	Not Eligible

Site	Type	Location	NRHP Status
48CA-2227	Prehistoric	Buffer Zone	Not Eligible
48CA-2228	Prehistoric	Buffer Zone	Not Eligible
48CA-2230	Prehistoric	Buffer Zone	Not Eligible
48CA-2331	Prehistoric	Buffer Zone	Not Eligible
48CA-2332	Prehistoric	Buffer Zone	Not Eligible
48CA-1157	Prehistoric	Buffer Zone	Not Eligible

* Site 48CA-1807 is being changed from eligible to non-eligible.

do not contain the level of significant data as several of those tested and mitigated at the BTM. Of the original 127 sites located on the BTM, 19 were identified for further work including evaluative testing and mitigation.

The more significant of the 19 sites mentioned above include the Lampkin homestead site (48CA897), a large stone circle habitation site (48CA1780), and several short and long term camp processing sites (i.e., 48CA403, et al.). Information gained from work conducted at the BTM will be extensively utilized to assess the significance of the sites located on the WBT lease tract and to determine appropriate treatment of those sites.

8. Native American Consultation

Native American consultation and coordination as required by the Archeological Resources Protection Act and the American Indian Religious Freedom Act was conducted during the time of the EA public review and final EA preparation periods. Affected tribes were sent certified letters requesting their comments concerning any religious or cultural areas within or near the Black Thunder tract. The list of people included in the special mailing is included in the draft EA mailing list included in Section VIII of this final EA. One comment letter was received as a result of that mailing. That letter was a request for additional information. The comment letter and BLM response are reproduced in the comment letter section in the back of the final EA. The information requested was supplied, and no further comments or requests were received.

9. Paleontological Resources

The surface formation at Black Thunder Mine is the lower Eocene Wasatch Formation. The Wasatch Formation, within the Black Thunder permit area and areas to the west (including the West Black Thunder tract), is expressed as rolling hills and low buttes, with many of the ridges capped with yellow-brown channel sandstones often containing sparse plant remains. It comprises the overburden which must be removed to mine the underlying coal.

In 1975 all bedrock outcrops on the Black Thunder permit area were searched for fossil material by Dr. Dale Hoffman, a consultant hired by Atlantic Richfield Company. In addition,

harvester ant hills were carefully examined where they occurred in the vicinity of an outcrop. If fossil material is available near the nest, fragments will be gathered by the ants and placed on the surface of the hill. To date, no significant vertebrate or invertebrate fossil remains have been found. Where plant fossils occurred, collections were made and the locality noted.

The limited flora fossils collected during the survey were of interest; however, they are not unique to the Powder River Basin. This fact, along with the lack of significant invertebrate and vertebrate fossils, indicates that disturbance of these areas would not impact any significant paleontological deposits.

10. Visual Resources

For management purposes, the BLM conducts an inventory that evaluates visual resources on all land under its jurisdiction. Once inventoried, these lands are classified into various management classes. These classification ratings range from 1 to 5 as follows:

> Class 1 - Natural ecologic changes and very limited management activity is allowed. Any contrast (activity) within this class must not attract attention.
>
> Class 2 - Changes in any of the basic elements (form, line, color, texture) caused by an activity should not be evident in the landscape.
>
> Class 3 - Contrasts to the basic elements caused by an activity are evident but should remain subordinate to the existing landscape.
>
> Class 4 - Activity attracts attention and is a dominant feature of the landscape in terms of scale.
>
> Class 5 - This classification is applied to areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to the level of one of the other four classifications.

When development is proposed, the degree of contrast between the proposed activity and the existing landscape is measured. This is called a contrast rating. In this process, various factors such as form, line, color, texture variety, contrast and lighting are evaluated.

The lands in the proposed lease area are generally classified as VRM Class 4 with some Class 5 where land has been disturbed to construct the Little Thunder Creek Diversion. Mining activity would not encounter any visual classification that would prohibit or restrict surface coal mining. Contrast would remain virtually unchanged.

11. Noise

An individual's judgement of the loudness of a noise correlates well with the A-weighted sound level (dBA) system of measurement. The A-weighted sound level, or A-scale, has been used extensively in the U.S. for the measurement of community and transportation noises. Figure 7 relates A-scale decibel readings to equivalent sounds of daily life. The existing noise sources in the proposed lease area are wind, coal mining activities and limited agricultural

activities. From these sources, the current noise level is estimated to be in the range of 30 to 45 decibels, depending on time of day and location. Mining in the immediate area would increase the noise level to a range of 85 to 95 decibels where actual operations are occurring.

12. Air Quality

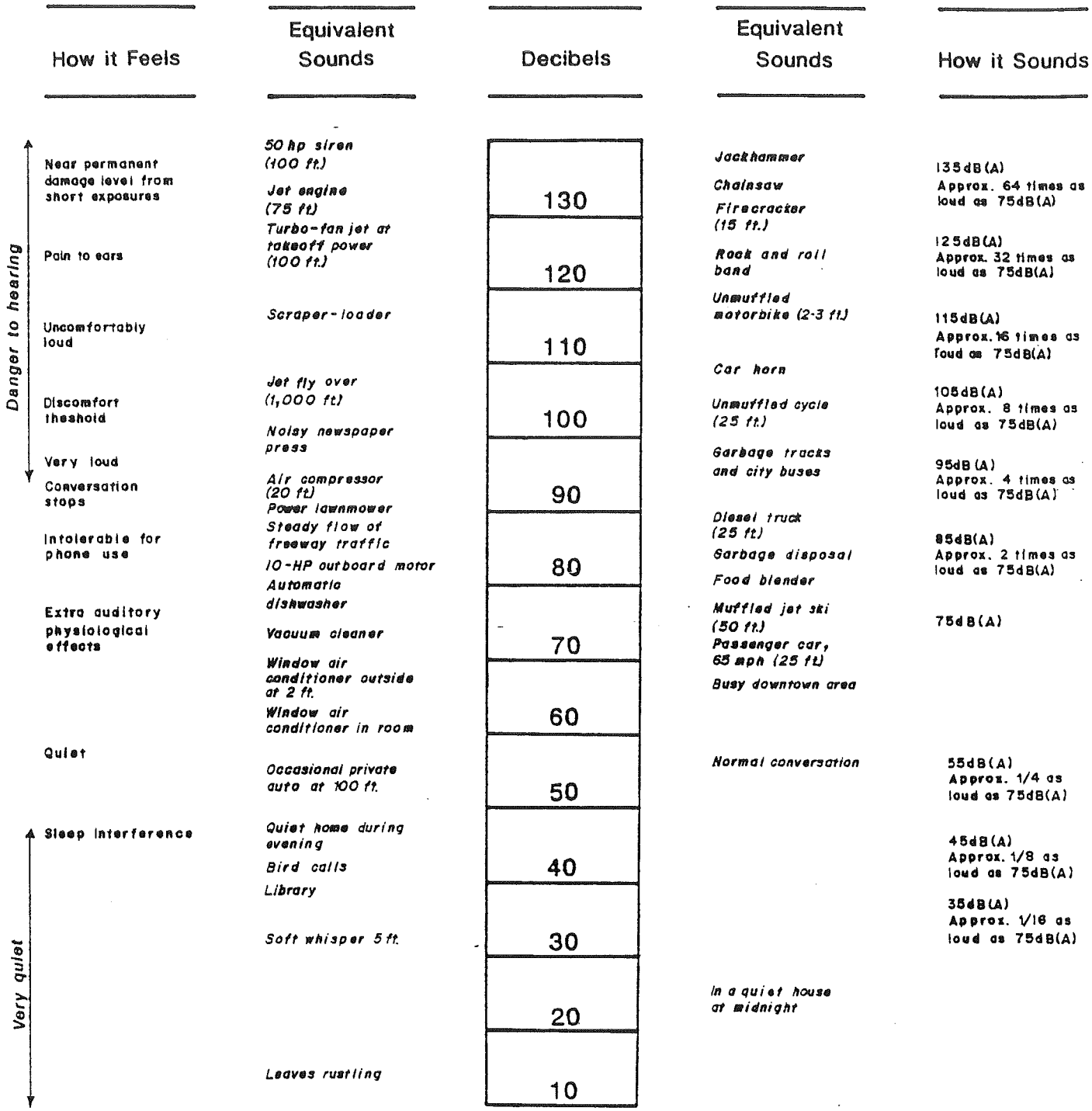
The air quality of the area is generally good with average annual particulate concentrations of 15 micrograms per cubic meter (ug/m^3) (average annual geometric mean for total suspended particulates, TSP). Visibility for more than 60 miles is common. Significant reductions in visibility are generally weather-related, although major forest fires to the west and northwest have impaired visibility in the Powder River Basin. A detailed description of the air quality of the area has been produced for the BLM (PEDCo, 1983).

The basic regulatory framework which governs air quality in Wyoming is the Environmental Quality Act, the accompanying Air Quality Rules and Regulations, and the State Implementation Plan (SIP) approved by the Environmental Protection Agency (EPA) under the Clean Air Act. This regulatory framework includes state air quality standards, which must be at least as stringent as National Ambient Air Quality Standards (NAAQS), and allowable increments for the prevention of significant deterioration (PSD) of air quality. The air quality standards which apply to coal mining are listed in Table 6. The large areas of disturbed land, crushing, loading and hauling of coal, and blasting associated with mining all produce dust which make the particulate standards the most important air quality issue for surface mining.

The current particulate standards in Wyoming are for an annual average of 50 ug/m^3 and 24-hour average of 150 ug/m^3 both for particulate matter 10 micrometers and less in diameter (PM10) and a 24-hour average of 150 ug/m^3 for TSP. The 24-hour standards are not to be exceeded more than once per year. The various motor vehicles used in mining and transport of coal and people also produce carbon monoxide, nitrogen oxides, sulfur dioxide and by secondary processes, ozone, though these are seldom at levels to cause regulatory concerns at Wyoming's surface coal mines.

The PSD program is designed to protect air quality from significant deterioration in areas already meeting state standards. In other words, an increase or increment is allowed above baseline pollution levels so long as the state standard is not exceeded. The size of the increment allowable under PSD depends on the area's designation as a Class I, II, or III area, with Class I areas allowed the smallest increment and Class III the largest. The mine area, as is all of

Figure 7. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life



Adopted From ABC's of Our Noise Codes, published by Citizens Against Noise, Honolulu, Hawaii

Wyoming outside the National Parks and wilderness areas, is Class II. Wyoming's PSD standards, which are identical to federal standards, are summarized in Table 7, except that Wyoming has not adopted Class III standards.

Table 6. Regulated Air Emissions for Wyoming

Emissions	Averaging Period	Wyoming Standard (ug/m^3)	National Standard (ug/m^3)
Total Suspended Particulate (TSP)	24-hour[1]	150	---
Particulate matter finer than 10 microns (PM-10)	24-hour[1]	150	150
	annual[3]	50	50
Nitrogen oxides (NO_x)	annual[3]	100	100
Photochemical oxidants (O_3)	1-hour[1]	160	235
Sulfur dioxide (SO_2)	3-hour[1]	1,300	---
	24-hour[1]	260	365
	annual[3]	60	80
Carbon monoxide (CO)	1-hour[1]	40,000	40,000
	8-hour[1]	10,000	10,000

[1] Standards not to be exceeded more than once per year.

[2] Annual geometric mean not to be exceeded

[3] Annual arithmetic mean not to be exceeded

Table 7. Maximum Allowable Increases for Prevention of Significant Deterioration of Air Quality in Wyoming

EMISSION	AVERAGING TIME	MAXIMUM ALLOWABLE CONCENTRATION INCREASE (micrograms per cubic meter)		
		Class I	Class II	Class III
Sulfur dioxide	Annual Mean	2	20	40
	24-hours[1]	5	91	182
	3-hour[1]	25	512	700
Total Suspended Particulate (TSP)	Annual Mean	5	19	37
	24-hour[1]	10	37	75

[1] Not to be exceeded more than once in any 12-month period.

In November 1990, the State of Wyoming submitted to the EPA a proposed revision to the SIP. One purpose of the revision was to modify Section 24, PSD. Prior to submission to

the EPA, the WDEQ/AQD held a series of public hearings. During one of the hearings, the WDEQ/AQD presented testimony documenting that the air quality resource had not been diminished during the period from 1980-1989, although coal production increased significantly during that period.

A summary of the historical monitoring data for the years 1980 through 1988 is provided as Table 8. During this period the number of mines producing coal in the Wyoming portion of the Powder River Basin increased from 10 to 16 while coal production escalated from 58.8 million tons to 139.1 million tons. The number of mines monitoring air quality increased from 12 to 16 (Table 8). The number of actual monitoring sites varied from a low in 1980 of 29 to

Table 8. Summary of Air Quality Monitoring in Wyoming's Powder River Basin, 1980-1988

Year	Number of Mines (Producing/ Monitoring)	# Sites	Coal (MMTPY)	OB (MMBCY)	TSP Average of All Geometric Means (ug/m^3)	BTM Geometric Mean TSP (ug/m^3)
1980	10/12	29	58.8	93.2	30.8	28
1981	11/13	34	68.9	108.0	30.4	32
1982	11/15	43	81.4	120.7	23.1	25
1983	13/15	41	88.0	157.2	24.3	30
1984	14/15	44	106.8	166.6	24.3	29
1985	16/15	45	113.8	196.3	24.3	34
1986	16/16	46	114.6	169.6	20.5	28
1987	16/16	45	124.6	180.9	25.6	30
1988	16/16	45	139.1	209.8	29.3	44

Note: Mines include Buckskin, Rawhide, Eagle Butte, Fort Union, Clovis Point, Wyodak, Caballo, Belle Ayr, Caballo Rojo, Cordero, Coal Creek, Jacobs Ranch, Black Thunder, North Antelope/Rochelle, Antelope, and North Rochelle.

a high of 46 in 1986. In 1988 there were 45 operating sites. Some of these sites include more than one sampler, so the number of actual high volume air samplers is greater than the number of monitoring sites.

In an effort to summarize the monitoring data in comparative form, averages of the geometric means from all sites were calculated for each calendar year. The averages ranged from a high of 30.8 ug/m^3 in 1980 to a low of 20.5 ug/m^3 in 1986. Over 23,000 samples were collected during this period.

Table 8 shows that the average of the geometric means went up during 1987 and 1988.

The cause of this increase is not clear at this time. Speculation is that it was due to mining activity approaching monitoring sites and to dry conditions due to the regional drought. The third quarter of 1988 could have been impacted by emissions from the forest fires in Yellowstone Park.

The rightmost column in Table 8 shows the annual geometric mean TSP concentrations for the Black Thunder Mine. Before the TSP annual standard was replaced by the PM-10 standard, the TSP annual standard was 60 ug/m^3. As the table shows, the annual averages are well below this former standard. Assuming that PM-10, which was not monitored during the years shown in Table 8, was about 30 percent of the TSP values, and further assuming that the geometric and arithmetic means are similar, it can be inferred form Table 8 that the BTM has historically been well within the current annual PM-10 standard of 50 ug/m^3.

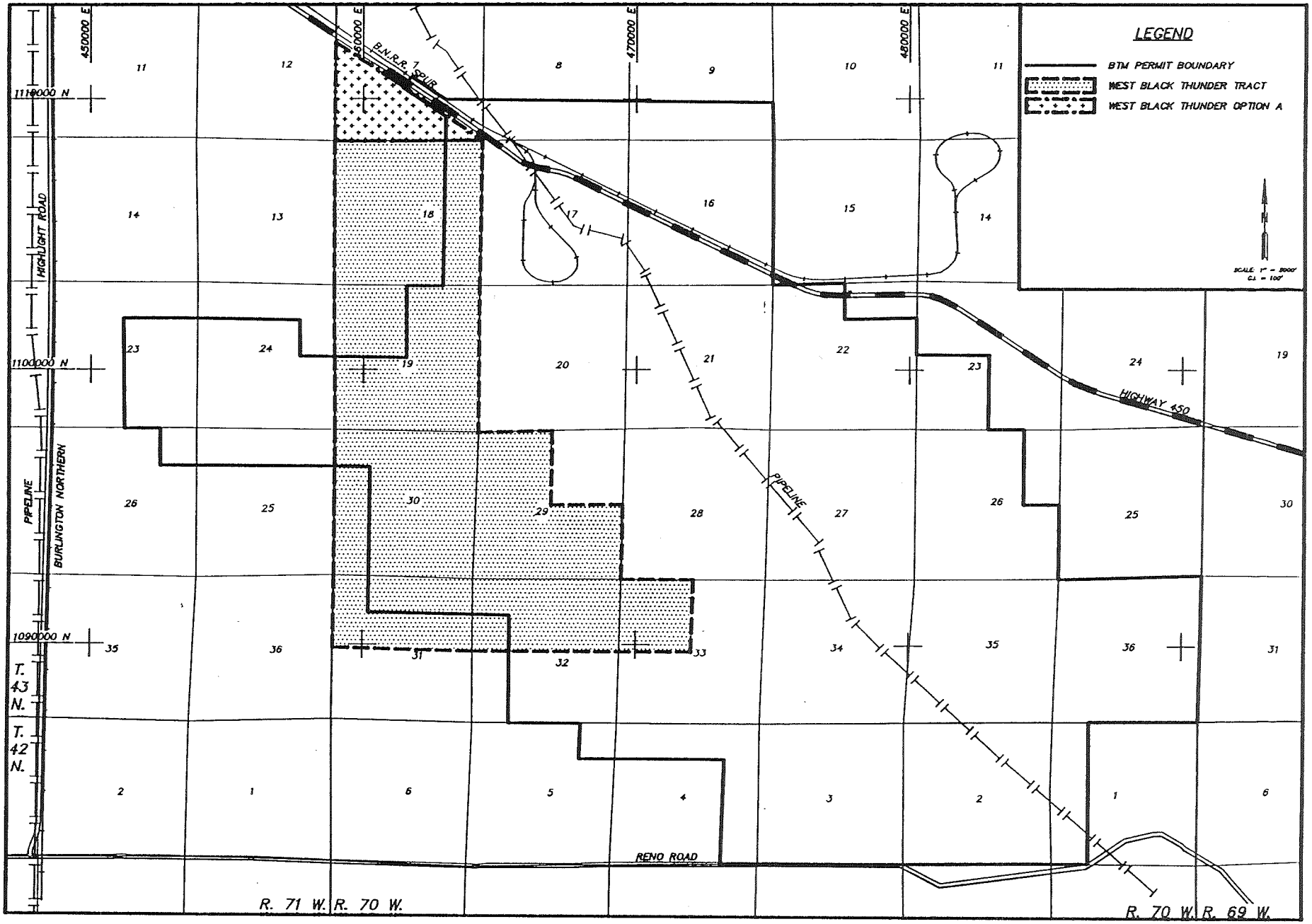
The information presented by the WDEQ/AQD indicates that air quality in the Wyoming portion of the Powder River Basin did not deteriorate while coal production increased nearly 2.5 times in the 1980-1989 period. This is due in part to the conditions attached to air quality permits, which stipulate control measures that must be implemented by the mine operators. These measures include increased sprinkling, use of EPA approved chemicals to control dust, limiting the amount of disturbed area, temporary vegetation of disturbed areas, and contemporaneous reclamation.

Under Option A, which is the preferred alternative of the BLM, the removal of WBT coal will eventually require blasting and mining operations near Highway 450 (in section 7, T43N, R70W). Thus there is a potential for impact to highway travelers if blasting and/or fugitive dust cause visibility impairment or if flyrock approaches the right-of-way. These issues will be addressed in the mine's blasting plan and in the air quality permit which must be obtained from WDEQ/AQD if the WBT lease is issued. In the early to middle 1980s, BTM existed on both sides of Highway 450 (in section 16, T43N, R70W), and used a haul road that passed under the highway, without dust or blasting related problems.

13. Transportation Facilities

Wyoming Highway 450 and a spur of the Burlington Northern Railroad are adjacent to the northeast corner of the proposed lease area. Highway 450 provides access to Wyoming Highway 59 nine miles to the west. Highway 450 was constructed and upgraded during the late 1970s to State of Wyoming standards to better serve as access for the coal industry. The BTM and the Jacobs Ranch Mine funded the initial upgrading of this highway and are currently the major users. The Highlight Road runs north-south about two miles west of the proposed lease area, parallel and adjacent to the Gillette-Douglas rail spur used jointly by the Burlington Northern and Chicago and Northwestern railroads. The Reno County Road parallels the south side of the proposed lease area about 1.5 miles to the south. These transportation facilities are shown on Figure 8.

FIGURE 8. TRANSPORTATION FACILITIES IN VICINITY OF WEST BLACK THUNDER TRACT



14. Socioeconomics

The proposed lease area lies in Campbell County within the Powder River Basin in northeastern Wyoming. Major Campbell County communities include Wright, located approximately thirteen miles to the west of the lease area, adjacent to Highway 59, and Gillette, located approximately 56 miles to the north via Highway 59.

Gillette is the county seat for Campbell County. It is the major trade center and the largest community within the affected area of the proposed coal lease property. It is the community within the region that is most likely to attract new area residents due to its current population level and resulting services and shopping amenities which exceed those of lesser populated communities within commuting distance of the proposed lease area. Gillette had a population of 17,635 in 1990, according to the 1990 Census, relative to a 1990 population for Campbell county of 29,370. Wright is a smaller community, with a population of over 1,200 people, and is home to about 40 percent of the BTM employees. Campbell County ranked sixth in population among counties within the state in 1990. Local planners are projecting Campbell County population to rise to almost 31,000 by 1995.

With a total area of 4,756 square miles, Campbell County's population density was almost 6.2 persons per square mile in 1990, compared to an average of about 4.7 persons per square mile for the state. The 1990 Census placed the state's population at 453,588.

According to the 1990 Census, Campbell County contained 11,538 housing units that year, of which 7,078 were in the town of Gillette. Vacant housing in Gillette is estimated to total about 549 units, excluding boarding and bunk house vacancies (see Table 9). The overall

Table 9. Housing Availability in Gillette, Wyoming, 1990

UNIT	OCCUPANCY NO.	VACANCY NO.	% VACANCY RATE
Single Family (single homes)	3,272	188	6
Single Family Attached (townhouse/duplex)	914	78	9
Multiple Family (rentals)	1,487	201	14
Mobile Homes	882	82	9
Total	6,555	549	8

Source: Gillette Housing Development-Planning, May 17, 1991
Note: Boarding and bunk house vacancies are unknown.

vacancy rate is about 8 percent. New workers entering the area in response to any growth in the local mining sector would probably find more vacant housing in Gillette than in other

surrounding communities. As a maintenance tract, the WBT lease application would not directly create additional jobs. However, current available housing in the affected area, including Gillette, Wright, and Newcastle, should be sufficient to accommodate over 900 additional workers.

Campbell County's economy is based largely upon coal mining, petroleum development and extraction, energy production (specifically power generation),and agriculture. Campbell County's 1989 mineral assessment equalled $1.1 billion. The 1989 state total was $3.44 billion. Coal valuation in 1989 totaled $1.17 billion for the state and $744.29 million for Campbell County. Thus, Campbell County represented about 32 percent of the state's total mineral valuation, and almost 64 percent of the state's total coal valuation.

The 1989 oil production in the county was valued at over $428.84 million, or about 26 percent of the state's output of almost $1.66 billion. The 1989 gas output in Campbell County was valued at almost $26.11 million, which is about 3.4 percent of the $771.21 million valuation for the entire state's 1989 production.

Campbell County produced about 136 million tons of coal in 1988, 144 million tons in 1989, and 155 million tons in 1990. This output equaled about 83 percent to 84 percent of the state's total coal output in those years. State output rose from 164 million tons in 1988 to 184 million tons in 1990, making Wyoming the largest coal producer among the states. Most of the state's increase occurred in the Powder River Basin. The BTM produced over 24.8 million tons of coal in 1988, about 29.5 million tons in 1989, and about 28.5 million tons of coal in 1990. Coal production and forecasts for selected years are shown on Table 10. For the foreseeable future Wyoming coal production is expected to increase at about 4.4 percent annually, while coal production in Wyoming's Powder River Basin is expected to increase at closer to 5 percent per year.

Table 10. Historic and Projected Coal Production for Wyoming and Campbell County

Year	Wyoming Million Tons	Percent Increase	Campbell Co. Million Tons	Percent Increase
1988	163.6	---	135.7	---
1989	171.1	4.6	143.8	6.0
1990	184.0	7.5	154.7	7.6
1991	187.6	2.0	157.4	1.8
1992	196.4	4.7	164.8	4.7
1993	205.0	4.4	172.4	4.6
1994	214.0	4.4	181.1	5.1
1995	223.4	4.4	190.1	5.0

Source: Wyoming Geo-Notes No. 30, Issue of May. 1991, Table 11, p. 20.

There were 2,100 producing oil/gas wells in Campbell County in 1989. Oil production in Campbell County totaled between 25 million and 25.5 million barrels (Bbls) in 1988 and 1989. Gas production in the county totaled over 22.4 million cubic feet (MMCF) in 1988 and over 19.8 MMCF in 1989. Estimates place the County's gas production at 28 MMCF in 1990. By comparison, the state produced a total of about 111.21 million Bbls of oil in 1988 and 100.35 million Bbls in 1989. It produced over 471.36 MMCF of gas in 1988 and 621.50 MMCF in 1989.

Employment in Wyoming's coal mining industry totaled 4,809 in 1988, 4,897 in 1989 and is currently about 4,700 (Wyoming Department of Employment, June 1991). The Office of the State Inspector of Mines indicates that Wyoming's coal mining sector employed 4,623 persons in 1990 of which Campbell County employed 2,590. The latest county employment data specified in this report is for 1988 and it indicates that the total mining sector of Campbell county employed about 4,666 full and part-time employees in 1988. The BTM employed 464 persons in 1988, 495 in 1989 (Geological Survey of Wyoming, Wyoming Geo-Notes No. 26) and 488 employees in 1990 (Wyoming Coal Information Committee, 1991).

The average price of coal sold in Campbell County, Wyoming declined from a peak of $9.88 per ton FOB mine site in 1982 to only $6.92 per ton in 1989 (U.S. Department of Energy, Energy Information Administration, 1990). The average coal price reflects a composite of historic contract prices that have escalated over time, new contract sales and open market (spot) coal sales. In the mid 1980s spot coal prices dropped to levels as low as $3.00 per ton. More recently, spot coal prices have ranged from $3.70 to $4.60 per ton for 8,400 to 8,800 Btu per pound coal at the mine mouth (McGraw-Hill, 1991). The BTM has not been impacted by this lowering of prices or weakened demand because of higher-quality coal and its ability to ship coal over competing rail lines.

The Wyoming Income and Employment Report for November 1990 shows that the County's agricultural sector employed between 600 and 750 in 1988. Total employment in the County in 1988 was 17,242. Labor force data for selected years are presented in Table 11. Seasonally adjusted unemployment in Campbell County in April 1991 was 6.4 percent, down from 7.4 percent in April 1990. This compares to statewide figures of 5.2 and 5.4 percent for April of 1991 and 1990, respectively. In April of 1991 there were 1,055 persons on the unemployment rolls in Campbell County (Wyoming Department of Employment, June 1991).

Personal income in Campbell County totaled almost $473.36 million in 1987 and $489.57 million in 1988. This represented a 6.06 percent decrease from 1986 to 1987 and a 3.42 percent increase from 1987 to 1988. State personal income for those years totaled about $6.28 billion and $6.58 billion, respectively, which is a 2.70 percent decrease from 1986 to 1987 and a 4.78 percent increase from 1987 to 1988. In 1989, state personal income rose to over $6.88 billion, a 4.64 percent increase over 1988. (The percentages are calculated on the non-rounded database by the State of Wyoming). In Campbell County, income earned from all mining (including oil extraction) totaled over $193.70 million in 1987 and almost $204.75 million in 1988. Earnings

in the County's agricultural sector were between $5 million and $6 million in both 1987 and 1988.

Table 11. Labor Force Data for Selected Years for Wyoming, Campbell and Weston Counties

YEAR	WYOMING no.	CAMPBELL no.	WESTON no.
1980	235,000 1/	14,430 1/	3,242 1/
1985	250,000 1/	18,592 1/	3,532 1/
1990	246,000 2/	16,504 2/	3,299 2/

Sources:
[1] Employment Security Commission of Wy., "Wyoming Labor Force", Research & Analysis, 3/1989, Casper

[2] Wyoming Department of Employment, "Wyoming 1990 LAUS Estimates", April 2, 1990 Casper

By comparison, earnings by place of work for the state totaled almost $4.59 billion in 1987, $4.76 billion in 1988, and $4.87 billion in 1989. Earnings from coal mining amounted to about $238.57 million in 1987, $251.02 million in 1988, and $257.15 million in 1989. Earned income from oil and gas extraction state wide was about $319.17 million in 1987, $333.72 million in 1988, and $318.52 million in 1989. The state's agricultural sector produced earnings of over $100 million in 1987, over $124 million in 1988, and between $66 million and $67 million in 1989.

The state's per capita income averaged $12,868 in 1987 and $13,641 in 1988. In these same years, Campbell County per capita income averaged $14,123 and $14,927, respectively.

Table 12 shows a summary of total disbursements by Campbell County, the City of Gillette, and the Campbell County school districts for selected years. In 1990, School District No.1 in Gillette employed about 439 full time classroom teachers, and had a fall enrollment of 7,759 pupils, which resulted in a pupil/teacher ratio of 17.67. According to the Wyoming Department of Education, this pupil/teacher ratio is good. The state is striving to have average pupil/teacher ratios at about 15:1 to 16:1. The Education Department also indicated that Gillette has the finances to accommodate additional students that might result from mine expansion in the area. This district had fifteen elementary, five junior high and middle schools, and three high schools in 1990.

Weston County lies to the east of the lease area, and its county seat of Newcastle is located in a commuting distance of about 55 miles east of the lease area. Newcastle has a population of about 3,003. According to Weston County Development in Newcastle, this community has 3,641 housing units of which 373 are vacant (see Table 13).

Weston County has about 8,388 people and ranks 15th in the state in terms of population

(out of 23 counties). It has 3.48 persons per square mile. Weston County's economy is based on coal, livestock, and the railroad. It had oil booms in the 1920s and 1950s and another upsurge in the 1970s, but the drop in oil prices in the 1980s resulted in an economic downturn and out-migration of population in the late 1980s.

Table 12. Local Disbursements for Campbell County and Gillette for Selected Years 1/

Years	Campbell County 1000 $	Gillette 1000 $	School District 1000 $
1980	---	15,721.0	35,885.2
1985	---	30,415.0	62,261.0
1990	158,639.9	29,717.0	59,715.9
1991	133,973.4	33,000.0	62,700.0

[1] Figures for 1980, 1985, and 1990 are actual expenditures as reported by local entities. Figures include debt servicing.

Source: BLM, June 1991, Jacobs Ranch Federal Coal Lease Application Environmental Assessment.

Table 13. Housing Availability In Newcastle, Wyoming, 1990

UNIT	OCCUPANCY NO.	VACANCY NO.	% VACANCY RATE
Single Family (single homes)	2,376	144	6
Single Family Attached (townhouse/duplex)	2	0	0
Multiple Family (rentals)	481	109	23
Mobile Homes	739	108	15
Senior Housing	43	12	28
Total	3,641	373	10

Source: Jan. 1991, Wyoming Division Of Economic and Community Development, and Weston County Development, Newcastle, Wy., Donna Bunch, Interview 5/22/91.

In 1989, oil production in Weston County totaled 1.41 million Bbls from 1,592 wells. This represented about 1.6 percent of the state's total oil production. The value of this output was estimated at $26.7 million. Gas production that year totaled 1.5 MMCF, valued at $2.9 million. The total value of all minerals produced in 1989 was $30.2 million.

During 1990, Weston County employment averaged 3,155 with an unemployment rate of 5 percent to 6 percent. In April 1991 the Weston County unemployment rate was 6.0 percent, up from 5.5 percent in April 1990. There were 198 persons on the Weston County

unemployment rolls in April 1991 (Wyoming Department of Employment, June 1991). In 1988, total earned income within the county amounted to $38.2 million, with mining as the leading industry followed by services and transportation/utilities. In 1987, per capita personal income totaled $12,413, rising to $13,917 in 1988.

Weston County has a total of seven schools; four are located in Newcastle and three in Upton. There are about 109 full time teachers employed by the county (76 are in Newcastle). The pupil/teacher ratio is 14.44 in Newcastle and 11.45 in Upton. This would indicate that the schools are well within the pupil/teacher ratio targets of the State of Wyoming.

The area being considered in this EA, like many other areas of the state, suffered from the decline in energy prices during the 1980s; therefore, it is not expanding as rapidly as had been projected earlier by various state planners. However, the preceding information would indicate that Campbell County experienced an upward movement in mining activity and related earnings in the late 1980s, and that both Campbell and Weston Counties were above the state average in per capita income. Any increase in the demand for the area's energy-related resources would further the area's economic growth, with most of this growth likely to accrue to Gillette due to its larger size and larger amount and variety of available services.