3.0 AFFECTED ENVIRONMENT

This chapter describes the existing conditions of the physical, biological, cultural, and socioeconomic resources of the lands involved in the proposed exchange. The resources that have been identified on the lands that BLM[1] would acquire are summarized in Sections 3.1, 3.2, and 3.3. The resources on the PSO Tract that could be affected by mining operations are described in Section 3.4. The resources that are addressed here were identified during the scoping process or interdisciplinary team review as having the potential to be affected.

Critical elements of the human environment (BLM 1988b) that could potentially be present on one or more of the projects lands include air quality, cultural resources, Native American religious concerns, T&E species, hazardous or solid wastes, water quality, wetlands/riparian zones, floodplains, invasive non-native species, environmental justice, and areas of critical environmental concern. T&E species are addressed in Appendix E. Prime or unique farmlands, wild and scenic rivers, and wilderness are not present in the project areas and are not addressed further.

3.1 Bridger Lands

The Bridger lands, located in east-central Lincoln County, Wyoming, are comprised of nine distinct tracts (Figures 1-1 and 1-2). These nine tracts include approximately 3,086 acres within and adjacent to the southern end of the BTNF. There are seven western tracts and two eastern tracts. As shown in Figure 1-2, the western tracts and part of one of the eastern tracts are inside the BTNF. As discussed in Chapter 1, USFS would administer the lands inside the BTNF and the BLM would administer the lands outside the BTNF if an exchange is completed. Additional information about the Bridger lands is included in Appendix F.

Topography and Physiography

The Bridger lands occupy a portion of the southern end of the Idaho/Wyoming overthrust belt physiographic province. The dominant landforms in the region are northerly trending ridges and valleys which are subparallel to major and minor thrust fault traces. The eastern tracts occupy a portion of Mahogany Ridge.

Geology and Mineral Resources

Significant oil and gas reserves are present in the overthrust belt. WOGCC records indicate there has been no oil and gas test drilling on the Bridger lands. Coal deposits are also present in this area. The two eastern tracts are located along or near Mahogany Ridge, which is underlain by coal and lignite in the lower part of the Upper Cretaceous Frontier Formation. No coal mining activities have occurred on the Bridger lands. Coal production from Lincoln County has been largely

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

from a surface mine located approximately 20 miles south of the Bridger lands.

Water Resources

The western Bridger lands are located along tributaries to the Hams Fork, a south-flowing tributary of the Green River. The eastern tracts are located along tributaries of Fontenelle Creek, an eastward flowing tributary of the Green River. Perennial and ephemeral streams flow through portions of many of the Bridger lands.

There are no known wetlands on the Bridger lands; however, riparian habitat is present on several of the tracts.

Soils

The western Bridger lands are characterized by soils that are high in clay and are subject to compaction and to accelerated erosion when disturbed. According to USFS information, the majority of the soils in the Bridger lands are considered to be "sensitive ground", which implies soils with a high erosion and compaction hazard and severe revegetation limitations.

Vegetation

The western Bridger lands are predominantly forested with mixed aspen-conifer species. The major vegetation types on these tracts include lodgepole pine, sagebrush, mountain mahogany, aspen, and willow. Lodgepole pine is the dominant tree species. In this area, lodgepole pine occurs in patches which may range in size from a few acres up to several thousand acres but are more typically several hundred acres in size. The lodgepole pine patches are broken up across the landscape by riparian areas dominated by willow; open sagebrush/grass areas and parks; wide bare ridgelines; aspen patches and stringers; and spruce-fir forested areas.

The two eastern tracts are generally unimproved rangeland. On these eastern tracts, vegetation includes mountain big sage, lodgepole pine, mountain mahogany, and grasses.

See Appendix E for discussion of threatened, endangered, proposed, and candidate plant species that USFWS has identified as potentially present in this area, and plant species that USFS and BLM have identified as potentially present Sensitive Species in the area of the Bridger lands.

Wildlife

The Bridger lands proposed for BLM acquisition (the eastern tracts) include designated elk parturition, winter and transition range, mule deer winter and yearlong range, spring, summer, and fall range for the Sublette antelope herd, and moose yearlong and crucial winter range.

The Bridger lands proposed for USFS acquisition (western tracts and a portion of one eastern tract) provide habitat for many wildlife species. Species present include small animals such as hares, grouse, beavers, neo-tropical migrant birds, and coyotes. Harvested animals such as elk, deer, moose, mountain lions, and black bears are present as well as a number of threatened, endangered, proposed, candidate, and sensitive species. The USFS Bridger tracts serve as summer, winter, and parturition range for these species and also contain important migration corridors between summer and winter ranges.

The USFS Bridger tracts include spring, summer, and fall range for a portion of the West Green River elk herd and important travel corridors between summer and winter range. This elk herd does not rely on permanent feedgrounds to sustain the population during winter months, although the elk have been fed on an emergency basis during severe winters. This area is still relatively remote. The western tracts lie within a "security" range extending along Commissary Ridge. By definition, elk security habitat must be more than one half mile from roads and at least 250 or more contiguous acres.

The USFS Bridger tracts provide parturition and crucial winter range as well as spring, summer, and fall range for the Lincoln moose herd, one of the largest moose populations in the state. Moose in this herd unit utilize a variety of plant communities that are found on the USFS Bridger tracts.

The USFS Bridger tracts provide spring, summer, and fall range for the Wyoming Range mule deer herd, the largest mule deer herd in the state. They also provide spring, summer, and fall range for the Sublette antelope herd.

Colorado River cutthroat trout are known or suspected to occupy the streams within many of the Bridger lands.

See Appendix E for discussion of threatened, endangered, proposed, and candidate wildlife species that USFWS has identified as potentially present in this area, and wildlife species that USFS and BLM have identified as potentially present Sensitive Species in the area of the Bridger lands.

<u>Land Use</u>

The rugged nature of this portion of the Wyoming Range has prevented most commercial development. Five of the seven western tracts (inside the BTNF) have recently been or are currently being logged to recover marketable timber. Recent forest fires have encroached near the tracts and fire fighting crews have used available roads for access.

The eastern tracts are largely undisturbed and unimproved native rangeland, which are used for livestock grazing. The Bridger lands outside the BTNF, which BLM would acquire, include a total of 118 AUMs. These lands are unfenced from the South LaBarge Common allotment, and the BLM Pinedale Field Office credits the grazing permittee for inclusion of these private AUMs into the grazing permit.

Public lands (USFS or BLM) surround all of the Bridger lands; therefore, public recreation has been a major use of the Bridger lands in recent years. Under current ownership, sportsmen have been allowed across these lands to access the adjacent BLM and USFS lands. All of the tracts have been used for hunting and, where appropriate, for fishing activities. Several of the tracts include many sites suitable for dispersed camping. Other recreational uses include hiking, wildlife observation, off-road vehicle use, and photography.

Transportation

The Bridger lands are accessed by two principal roads. The eastern tracts, located along Mahogany Ridge and Fontenelle Creek, are reached by improved aggregate-surfaced roads leading north from U.S. Highway 189 north of Kemmerer and generally up Fontenelle Creek. An unimproved two-track jeep trail crosses the southern-most tract; however, access across Fontenelle Creek is limited. Access to the western tracts is by way of an improved county road that follows the Hams Fork upstream to the Hams Fork Campground. The Hams Fork Campground is located about one mile west of the nearest tract. Jeep trails to some of the tracts from the main road have recently been improved for the purpose of supporting logging operations currently underway on several of the tracts.

Cultural Resources

No formal cultural resources inventory is known for the Bridger lands outside the BTNF (proposed for BLM acquisition). Mahogany Ridge is a hogsback uplift containing numerous rock outcrops and ledges which might hold prehistoric rock shelters, but none are known. Burnt Bend on Fontenelle Creek may contain historic period resources, as numerous cabins, line shacks and other stock maintenance locales are found on adjacent and similar portions of Fontenelle Creek, Coal Creek and Rock Creek. Similarly, prehistoric camp sites are expected on the terraces of Fontenelle Creek, preserved in the alluvial soils found there. Overall, however, the project area is one of low to moderate cultural resource potential.

No historic or prehistoric sites are known to exist on any of the western parcels (inside the BTNF). The USFS Kemmerer District has 49 recorded Heritage resources sites. Of these, 25 are prehistoric and the remaining 24 are historic. Most of the prehistoric sites are small lithic scatters indicative of temporary campsites utilized by nomadic hunters and gatherers. Artifacts recovered from these sites suggest that most of them date to the last 3,000 years; however, one site contained material suggesting an age of over 8,000 years.

Native American Consultation

The Mahogany Site, a prehistoric pictograph site of reported Ute affinity, is located a few miles from the eastern tracts. This site is a rare and significant rock art locality and is considered an important site to modern day Native Americans (the Shoshone and Ute, specifically). While no sites of interest to or considered sensitive by modern Tribal individuals are known for any of the lands proposed for acquisition, consultation and/or site visits have not been conducted. Thus, it would be premature to rule out the presence of localities considered important to modern Tribal interests.

3.2 JO Ranch Lands

The JO Ranch property, located in southwest Carbon County, Wyoming, includes approximately 1,236.5 acres that are primarily along the valley floor of Cow Creek (Figures 1-1 and 1-3).

Topography and Physiography

Cow Creek and its tributaries drain the western foothills of the Sierra Madre Mountains. West of Cow Creek, the area is described as gently rolling topography. To the east of Cow Creek the slopes rise gradually upward forming the deeply dissected foothills of the Sierra Madre Mountains.

Geology and Mineral Resources

The JO Ranch lands are located in the Washakie Basin, which contains oil and gas reserves. There are actively producing conventional oil and gas wells in the vicinity of the JO Ranch lands but, according to WOGCC records, there are currently no producing conventional oil and gas wells on the lands proposed for exchange. Portions of the JO Ranch lands are underlain by coal beds. The coal in this area is not economically mineable and there are no operating coal mines in this area. There is proposed development in the area of the lands proposed for exchange. One CBM test well was drilled in 1999 on one 40-acre lot included in the exchange proposal; however, there is no record of any production from that well. A search of the WOGCC records in March 2003 revealed that there are no CBM wells completed or permitted to be drilled within the JO Ranch lands tract.

Water Resources

Cow Creek is a southwest-flowing ephemeral drainage (Figure 1-3). Cow Creek and its tributaries drain the western foothills of the Sierra Madre Mountains. Cow Creek joins Muddy Creek, a tributary of the Little Snake River, about one mile southwest of the JO Ranch lands.

Soils

In general, soils in the area were formed under a dry, cool climate with spring moisture, have low organic matter, and are formed from residuum on bedrock-controlled uplands and in alluvium associated with streambeds and floodplains. Shallow soils occur on areas underlain by bedrock and in areas of steeper topography. Deep soils are present on alluvial deposits. Soil productivity is naturally low because low precipitation rates produce limited vegetation cover, consequently limited organic matter for the soil is available.

Vegetation

The bottom lands along Cow Creek are mostly a riparian-grassland habitat type, dominated by Nebraska sedge, beaked sedge, tufted hairgrass, redtop, Kentucky bluegrass, and a variety of forbs. At the upper end of the creek there are willows and waterbirch. The uplands consist of Wyoming big sagebrush and mixed grass habitat types, with local areas along the west boundary containing a high percentage of bitterbrush. The northern portion of the JO Ranch lands lies at the edge of the Sand Hills (Figure 1-3), which contain a mixture of shrubs including silver sagebrush, basin big sagebrush, Douglas and rubber rabbitbrush, bitterbrush, rose, serviceberry, snowberry, and chokecherry. Needle-and-thread grass and prairie sandreed are the dominant grasses along with other grasses and forbs. The overall condition of these plant communities is good. Thistles may be present in the meadow habitat, but no noxious plant species are known to occur in this area. Both the riparian and sand hills plant communities are important in terms of the plant and animal life they support and neither are very common in terms of total acreage in this area.

See Appendix E for discussion of threatened, endangered, proposed, and candidate plant species the USFWS has identified as potentially present in this area, and plant species that USFS and/or BLM have identified as potentially present Sensitive Species in the area of the JO Ranch lands.

Wildlife

The portion of Cow Creek included in the exchange proposal has live water and is considered a willow riparian/meadow grassland type of habitat. The northern portions of the JO Ranch lands fall within the area that is known as the Sand Hills, which is a unique upland habitat.

The JO Ranch lands include both mule deer and elk crucial winter range and mule deer, elk, and antelope winter/yearlong range. This area is part of the Baggs Elk Crucial Winter Range Management Area.

The area falls within the two-mile buffer of ten Greater sage grouse leks, but no leks have been identified on the JO Ranch lands. This area is considered good nesting and brood rearing habitat for Greater sage grouse. The area may be important to Columbia sharp-tailed grouse since these birds are expanding their range into areas adjacent to these parcels. No raptors have been identified on the lands proposed for exchange, but several historic ferruginous and golden eagle nests have been identified within one-quarter mile.

The portion of Cow Creek included in the exchange proposal could include habitat for non-game BLM sensitive fish species such as roundtail chubs, flannelmouth suckers, and bluehead suckers.

See Appendix E for discussion of threatened, endangered, proposed, and candidate wildlife species that USFWS has identified as potentially present in this area, and wildlife species that USFS and/or BLM have identified as potentially present Sensitive Species in the area of the JO Ranch lands.

Land Use

Livestock production, both cattle and sheep, and supplemental hay production for winter feed have historically been and remain the principal uses of the JO Ranch lands. Currently the property is leased for the purpose of cattle grazing. The lands immediately adjacent to and surrounding the JO Ranch property are federal or state surface and have also historically been used primarily for sheep and cattle production.

The JO Ranch lands are generally unimproved. Recreational uses of the JO Ranch lands are primarily associated with pronghorn antelope, mule deer, elk, and sage grouse hunting. The extensive public lands surrounding the JO Ranch property are readily accessible and therefore important to hunters. Other than fall hunting activity, the area attracts limited numbers of recreationists engaged in back county camping and hiking, rock hounding, wildlife observation, off-road vehicle use, outdoor photography, and scenic touring.

Cultural

The JO Ranch lands include the JO Ranch or Rankin Ranch buildings, which are a collection of stone buildings that date from the late 1800s. These buildings are eligible for National Historic Site status.

Native American Consultation

No sites of interest to or considered sensitive by modern Tribal individuals are known for the lands proposed for acquisition. Consultation and/or site visits have not been conducted.

Transportation

The property is accessed by improved aggregate-surfaced roads off of Wyoming State Highway 789 approximately 20 miles north of Baggs, Wyoming. There are numerous two-track ranch roads located throughout the property.

3.3 Welch Lands

The Welch lands, located in north-central Sheridan County, Wyoming, are in the same general area as the PSO Tract (the federal coal lands that P&M proposes to acquire in Sheridan County), which is described below in Section 3.4 (Figure 3-1). The Welch lands are located in the PRB, a part of the Northern Great Plains which includes most of northeastern Wyoming and a portion of southeastern Montana. The Big Horn Mountains are within sight of the Welch lands to the west.

Topography and Physiography

The Welch lands occupy a portion of the Tongue River valley floor and the adjacent dissected uplands between

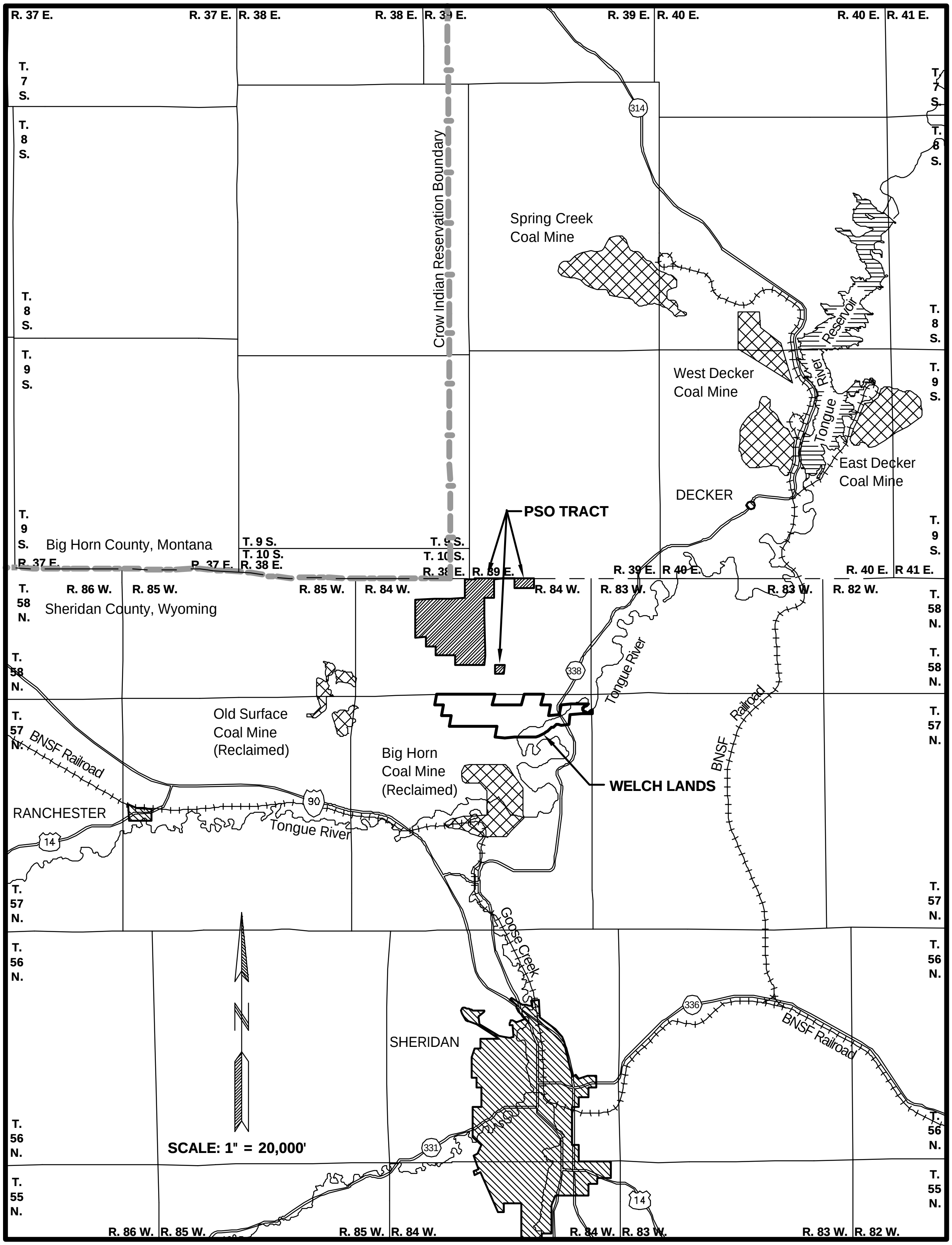


Figure 3-1. General Analysis Area.

Ash Creek and Hidden Water Creek, both tributaries of the Tongue River (Figures 1-4 and 3-2).

Geology and Mineral Resources

The Welch lands are underlain by coal. There is a long history of coal mining activities in the Sheridan Coal Field. Coal was mined extensively from some surface strip mines and numerous underground mines that were located primarily along the Tongue River upstream of the Welch lands. Coal beds that were mined in this area include, in descending order, the Dietz 2, Dietz 3, Monarch, and Carney. Underground coal mining began in the late 1800s and continued into the early 1950s. Many square miles of room and pillar underground mine workings extend on both sides of the confluence of Goose Creek with the Tongue River, located about three miles south-southwest of the Welch lands. The closest underground mine, the Acme Mine No. 42, extends beneath a portion of the Welch lands (Figure 3-3). Maps of the Acme Mine that were prepared in 1940 show the approximate extent of mining at that time. According to a U.S. Geological Survey Professional Paper on this area (Dunrud and Osterwald 1980), this mine was active from 1911 through 1940 and produced coal from the Monarch coal bed. According to the book 'Black Diamonds of Sheridan' (Kuzara 1977), mining in the Acme Mine No. 42 continued until about 1942. Taff, in USGS Bulletin 341-B (Taff 1909) mentions the Evans mine, where coal was mined for domestic use prior to 1909. That publication reports an Evans mine along the west bank of the Tongue River in the south half of Section 2, T.57N., R.84W. This suggests the possibility that underground mine workings exist on the Welch lands beyond the mapped limits. The underground mines in the Sheridan Coal Field were all closed and sealed off by 1953, following the railroad's conversion from coal to petroleum fuel and the advent of surface coal mining.

Roof collapses over the closed Acme Mine No. 42 led to the development of underground coal fires in the Monarch and possibly Carney coal beds. Most of these fires apparently started in the abandoned underground mines by spontaneous combustion when oxygen and water were introduced to the mine workings through subsidence cracks and pits and unsealed portals or shafts (Dunrud and Osterwald 1980). The Monarch has been burning sporadically for many years. As the fire advances in the Monarch bed, the overburden collapses, the overlying Dietz 3 and Dietz 2 beds also collapse, and the resulting subsidence fractures and cracks may be allowing air to circulate and cause these overlying coal beds to catch on fire as well (Figure 3-3). The WDEQ/AMLD has conducted a number of reclamation and emergency rehabilitation projects over the past 20 years in attempts to extinguish these fires. Mine maps obtained from OSM's Mine Map Repository show that most of the Monarch coal seam in the SE¼ SE¼ of Section 3, T.57N., R84W., which is included in the Welch lands area, was mined out as

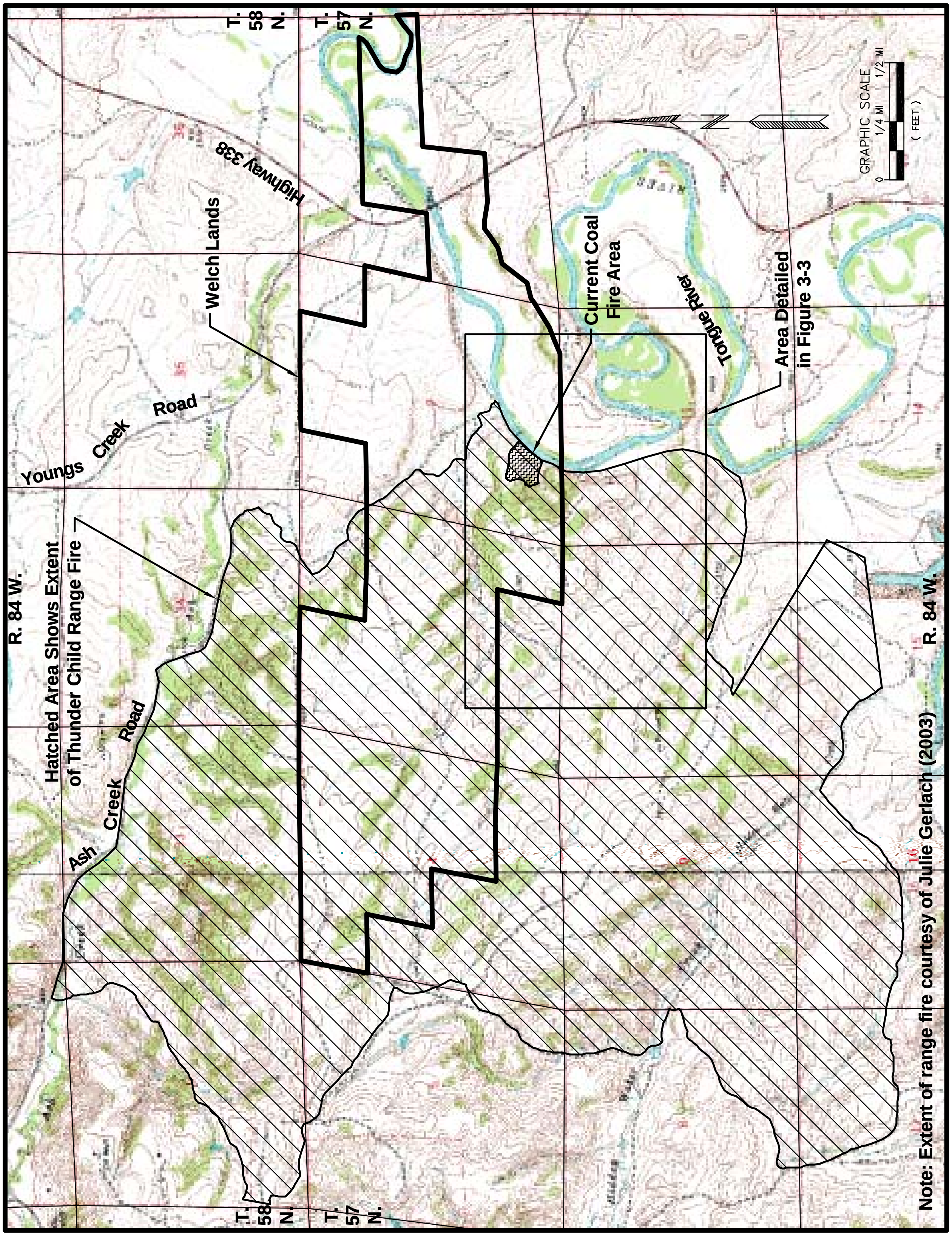


Figure 3-2. Welch Lands and Extent of Thunder Child Range Fire.

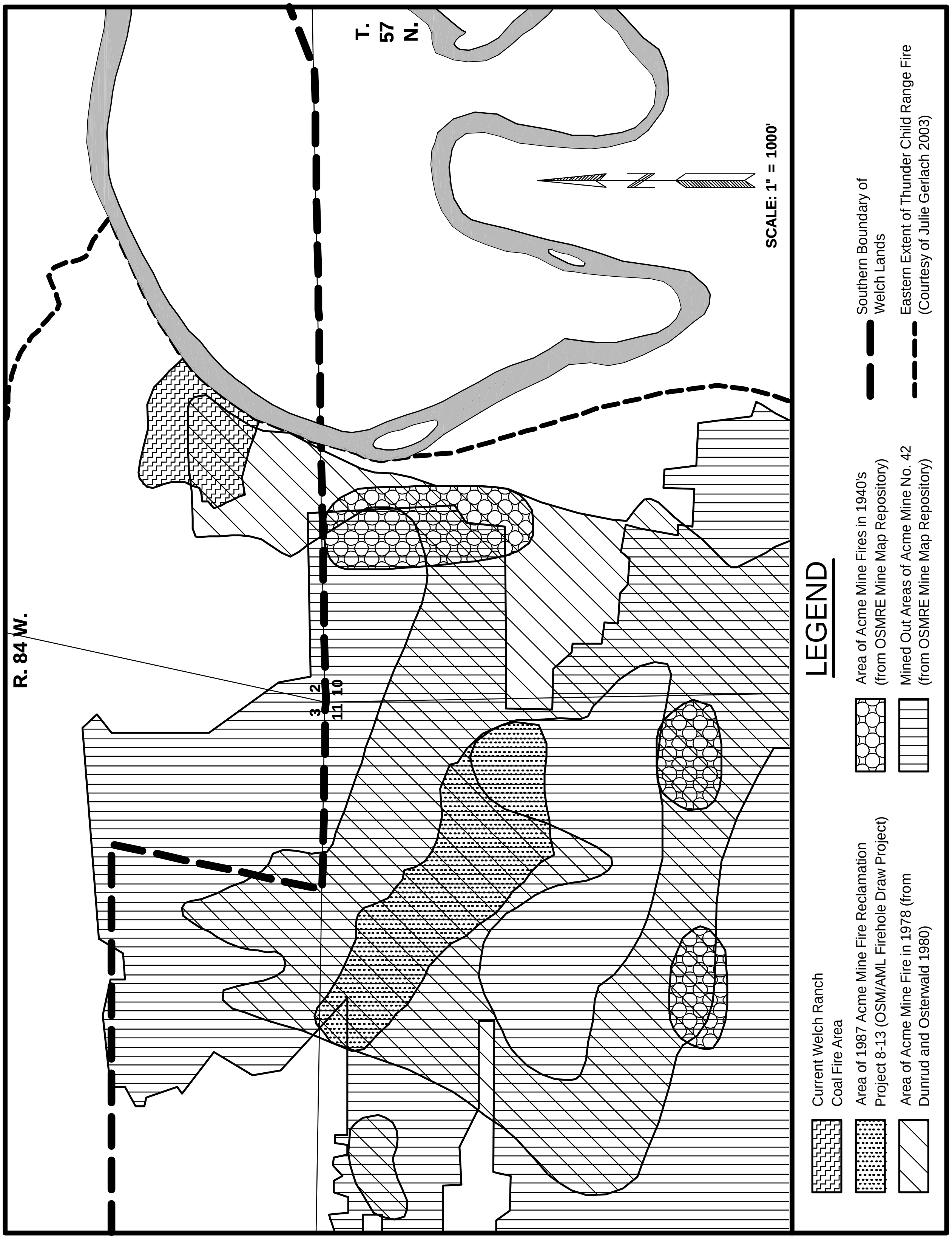


Figure 3-3. Extent of Underground Acme Mine and Coal Fire Areas on the Welch Lands and Vicinity.

part of the Acme Mine No. 42 mining operations (Figure 3-3). A prehistoric burn line kept the mine from advancing further north. Only limited mining was shown in the SW¼ of Section 2, T.57N., R.84W.

An underground coal fire is currently burning in the SW¼ SW¼ of Section 2 (Figure 3-3). This coal seam fire is probably related to the underground coal fires at the abandoned Acme Mine No. 42. Less likely alternatives are that the fire on the Welch lands originated from a spontaneous outcrop fire or resulted from roof collapse related to the small Evans mine mentioned in USGS Bulletin 341-B (Taff 1909) in this immediate area. Concerns expressed about the presence of this underground coal fire on lands the federal government is considering acquiring led to the preparation of a technical report on the coal fire by BLM in March 2003. This report is included as Appendix D in this EIS, and information from this report is summarized in the preceeding and following discussions.

Figure 3-3 shows the known extent of the Acme mine fires in 1940, the known extent of the fires in 1978, the mined-out area of Acme Mine No. 42, and the area of current burning in Section 2, T.57N., R.84W. Based on this information, the coal mine fire has moved north several hundred feet in the past 24 years.

The coal fire in Section 2, T.57N., R.84W. occupies a hillside between and north of two draws along the west bank of the Tongue River (Figure 3-3). The hillside is bare of trees and shrubs; only grasses grow. Partly burned ponderosa pine and juniper trees are present along the perimeter of this area. The treeless area occupies approximately 13 acres. There is evidence, in the form of cracks and fissures as much as several feet deep, that the coal underlying the upper part of the hillside is actively burning at this time. Some of these fissures have been filled in.

There are three coal beds present below the surface of the hillside, the Dietz 2, Dietz 3, and Monarch. The main burning at the site appears to be occurring in the Dietz 3 coal bed. Data are lacking as to whether the Monarch has burned at this site, although it has burned or is burning over a large area south of the Welch lands.

In September of 2002, contractors for the WDEQ/AMLD worked onsite to stabilize the north end of the fire on the Welch lands. The smaller cracks were excavated to the base of each crack (six to eight feet on average), filled with two feet of crushed scoria fines and backfilled the rest of the way with country rock. The larger cracks were filled with a slurry of scoria fines and water. A visit to the site by BLM Buffalo Field Office personnel in February 2003 found that this action did not extinguish the fire (see Appendix D).

A wild fire, the Thunder Child Range Fire, burned 5,207 acres, including portions of the Welch lands, in late July of 2001 (Figure 3-2). The fire originated in the vicinity of the underground coal seam fire in the

SW¼ of Section 2, T.57N., R.84W. The cause of the fire is undetermined, but potential causes include a lightning storm and/or the underground coal seam fire (see additional discussion in Appendix D).

P&M acquired its ownership in the Welch lands in October 1998. The previous owners obtained a permit to mine coal in a portion of the Welch lands in 1979 and began stripping topsoil to access shallow coal reserves on the property. A short haul road was also constructed. Plans to mine the area were canceled and, because minor surface disturbance had occurred and mining was not anticipated in the foreseeable future, the disturbed area was reclaimed under the direction of WDEQ in 1999. Currently there are no active surface coal mines in Sheridan County, although large-scale surface mining is being conducted approximately eight miles northeast of the Welch lands in Montana. In the past few years CBM has been developed in this area (refer to Section 3.4.3 for additional discussion of CBM development in this area). A search of the WOGCC records in March 2003 revealed that there are 16 CBM wells permitted to be drilled within the Welch lands.

Water Resources

Approximately 1.5 miles of the Tongue River runs through the eastern portion of the Welch lands. The river and riparian area lie within an AVF.

Soils

The soils in the area of the Tongue River valley are dominated by very deep soils on the flood plain, low terraces, and alluvial fans. The soil association is described as a Haverdad-Ziegweid-Nuncho. The soils developed predominantly in residuum on the upland areas are very similar to those soils on the PSO Tract listed in Section 3.4.4.

Vegetation

The vegetation along the portion of the Tongue River that runs through the eastern portion of the Welch lands includes late seral cottonwood, green ash, and chokecherry. This riparian area is in proper functioning condition. The meadows along the river are irrigated under a territorial water right for hay production. The river and riparian area lie within an AVF, which contains the highest diversity of vegetation and wildlife on the Welch lands and is in pristine condition.

The upland areas on the property contain sagebrush/grasslands intermixed with skunkbush sumac and ponderosa pine and juniper stands. Several draws contain green ash, chokecherry and hawthorne shrubs. A large portion of the upland woodlands was burned in a July 2001 wildfire, the Thunder Child Range Fire discussed above.

See Appendix E for discussion of threatened, endangered, proposed, and candidate species that USFWS has identified as potentially present in this area, and plant species that USFS and/or BLM have identified as potentially present Sensitive Species in the area of the Welch lands.

Wildlife

Wildlife typically present on the Welch lands include antelope, mule deer, white-tailed deer, coyote, fox, sage grouse, sharp-tail grouse, turkey, grey partridge, pheasant, waterfowl, golden eagle, red-tailed hawk, turkey vulture, and numerous non-game birds and mammals. Other species observed or known to frequent the Welch lands include bald eagle, cormorant, blue heron, mountain lion, blackbear, bobcat, and elk.

The Tongue River along this stretch is a transition zone between cold-water and warm-water fish species and contains small-mouth bass, sauger, walleye, catfish, brown trout, and numerous non-game species.

See Appendix E for discussion of threatened, endangered, proposed, and candidate wildlife species that USFWS has identified a potentially present in this area, and wildlife species that USFS and/or BLM have identified as potentially present Sensitive Species in the area of the Welch lands.

Ownership and Use of Land

The surface of the Welch lands is owned by P&M, the oil and gas estate is privately owned, and the coal estate is privately owned (owned by P&M) and federally owned (unleased). P&M surface and coal estate rights are included in the exchange proposal.

The property consists predominantly of unimproved rangeland, scattered pine and juniper forests in deep drainages, and hay croplands typical of a flood and subirrigated AVF. A large portion of the upland woodlands was burned in a July 2001 wildfire.

Historically, the property has been used principally for livestock grazing, with crop production concentrated along portions of the valley floor of the Tongue River. Since the property was settled in the early 1900s, grazing practices have been relatively unchanged. The current surface leaseholder grazes a small number of cattle in the area.

Currently, development and associated disturbance on the property include an irrigation ditch, a diversion dam, fences, utility easements, a reclaimed gravel pit, reclaimed surface mine operations (described in the section on Geology and Mineral Resources), the previously mentioned area where contractors for the WDEQ/AMLD worked onsite to stabilize the north end of the coal fire on the Welch lands, and unimproved dirt roads and trails.

Recreational opportunities on the lands include big game and game bird hunting (both upland and waterfowl) and sport fishing. The Tongue River valley offers a greater diversity of game bird habitat than is found on the adjacent lands, and the Tongue River in this area is a good small-mouth bass fishery resource. White-tailed deer hunters may also experience success on the Welch lands because the denser riparian vegetation within the Tongue River valley is a habitat that is preferred by the deer. In addition, the two-track ranch roads and trails that traverse the property provide access for other outdoor activities such as hiking, biking, and photography.

The federal coal included in the lands proposed for exchange is unleased. The oil and gas estate is privately owned. There has been no oil and gas exploration or development on the Welch lands; however, CBM wells have been drilled in the area and CBM wells are permitted to be drilled on the Welch lands.

Cultural Resources

The Welch lands have been inventoried at the Class III level, a number of sites have been tested, and 44 sites are recorded, including 27 lithic scatters, two quarries, six camps or occupations, three historic homesteads or structural remains, one wagon mine, one historic bridge, and two prehistoric lithic scatters associated with sheepherder's monuments or historic cairns. The Welch lands are located adjacent to Tongue River and close to the Thunder Child Treatment Center.

Native American Consultation

None of the inventoried sites included in the Welch lands are known to be of interest to or considered sensitive by modern Tribal individuals. Consultation and/or site visits have not been conducted. If these lands are acquired by the BLM, consultation would take place when management of these lands is incorporated into the *Resource Management Plan for Public Lands Administered by the BLM Buffalo Field Office*.

Transportation

The Welch lands can be accessed from Sheridan via Wyoming State Highway 338 (Figure 1-4). Several unimproved two-track ranch roads serve the property both from Highway 338 and from the Ash Creek Road located just north of the property.

3.4 PSO Tract

The following paragraphs describe the resources present on the PSO Tract. PSO would acquire the federal coal underlying the PSO Tract if the exchange is completed. The resources present on the PSO Tract are described in some detail because P&M proposes to mine the coal under these lands if the exchange is completed. Because of the proximity of the PSO Tract to the Welch lands, there are many similarities in the affected environment for both tracts (Figure 3-1).

3.4.1 General Setting

The PSO Tract, like the Welch lands, is located in the PRB, a part of the Northern Great Plains which includes most of northeastern Wyoming and a large portion of southeastern Montana. Vegetation is primarily sagebrush, mixed prairie grass, and ponderosa pine with a shrub understory. The climate is semi-arid and characterized by cold winters, warm summers and a large variation in annual and seasonal temperature and precipitation. Wind, precipitation, and temperature patterns in the study area are significantly affected by the Big Horn Mountain range, which is within sight of the project area to the west.

The average annual precipitation at Sheridan (Figure 3-1) for the period of record 1920-2000 is just over 15 inches (WRCC 2001). The annual precipitation records for the period of record 1949-1974 near the Decker Coal Mine (Figure 3-1) ranged from a low of about 6.5 inches in 1960 to a high of about 17.6 inches in 1968, with an average of about 11.8 inches. About 45 percent of the annual precipitation falls in the three-month period April through June. In Sheridan, June (2.79 inches) and May (2.54 inches) are the wettest months, and February (0.48 inch) is the driest. Nearly 30 percent of the annual precipitation falls as snow from October through March. Snowfall averages 44.8 inches per year, with most occurring in March (9.2 inches) and January (7.6 inches). The remainder of the annual precipitation generally occurs as summer thunderstorms, and most flooding in the area occurs in response to high-intensity thunderstorms of comparatively short duration. Potential evapotranspiration at approximately 22 inches (Martner 1986) exceeds annual precipitation.

The seasonal and daily variations between maximum and minimum temperatures are often extreme. Temperatures at Sheridan have historically ranged from 106°F to minus 37°F, while the temperatures in the Tongue River valley approximately 30 miles north of the project area have been recorded to range from 107°F to minus 45°F. July is the warmest month, with a mean daily temperature of 69.6°F, and January is the coldest month with a mean daily temperature of 19°F. The frost-free period in Sheridan averages 125 days (WRCC 2001).

Winds are greatly affected by local topography. The prevailing winds recorded by the Decker Coal Mine come from the northwestern, southern and northeastern directions. Winds blowing from the western half of the compass are generally faster than winds blowing from the eastern half. The greatest percentage of fast winds come from the northwest quadrant. The average wind velocity recorded in Sheridan is about eight mph; however, velocities in excess of 25 mph are common throughout the year. The fastest wind speed ever recorded at the Sheridan airport, 84 mph, was in November 1949. Hot, dry winds commonly blow during the summer and strong winds often accompany winter snow storms causing drifting.

General information describing the area's resources were gathered from draft BLM Buffalo Field Office planning documents (BLM 1996a, 1996b, 1996c, 1996d, 1996f) and a

BLM coal leasing study (BLM 1996e).

3.4.2 Topography and Physiography

The PRB is an elongated, asymmetrical structural downfold. It is bounded by the Casper Arch, Laramie Mountains, and Hartville Uplift to the south; the Miles City Arch in Montana to the north, the Big Horn Mountains on the west, and the Black Hills on the east. The PSO Tract is located near the northwest limb of the structural basin, near the Tongue River valley and within sight of the Big Horn Mountains. The PRB landscape consists of broad plains, low hills, and tablelands. Generally, the topography changes from open hills with 500-1,000 ft of relief in the northern part of the PRB to plains and tablelands with 300-500 ft of relief in the southern part. Playas are common in the basin, as are buttes and plateaus capped by clinker or sandstone.

The PSO Tract lies within the drainages of Ash Creek and Youngs Creek. These perennial streams are tributaries of the Tongue River, which lies about three miles east and four miles south of the project area. Most of the project area consists of the dissected uplands between Ash Creek and Little Youngs Creek, a perennial tributary of Youngs Creek (Figure 2-2). The tributaries of these streams have dissected numerous deep, steeply sloping ravines that are separated by relatively flat rounded uplands. The eastern portion of the proposed Ash Creek Mine area, which overlies privately-owned coal, is dominated by a broad valley occupied by Little Youngs Creek and its confluence with Youngs Creek (Figure 2-2). Slopes range from nearly flat to over 60 percent. Slopes on the uplands and valley bottoms are generally between one and ten percent, while the bedrock areas along the valley edges exhibit the steeper slopes. Slope analyses would be done for the proposed Ash Creek Mine permit application if the exchange is completed.

3.4.3 Geology

Stratigraphic units in the proposed Ash Creek Mine area that would be impacted if the exchange is completed and a mine is opened are, in descending order, recent (Quaternary age) alluvial and eolian deposits and the Paleocene age Fort Union Formation (which contains the target coal beds). Figure 3-4 shows two geologic cross-sections drawn through the proposed Ash Creek Mine area (one roughly north-south and one northeast-southwest). These cross sections are a basic representation of the geology in the vicinity of the PSO Tract. Figure 3-5 is a chart showing the stratigraphic relationships and hydrologic characteristics of the surface and subsurface geologic units in the area of the PSO Tract.

Surficial deposits in the analysis area include Quaternary alluvial, colluvial and eolian deposits, clinker, and weathered Fort Union Formation. There are alluvial deposits, consisting of floodplain, stream and terrace deposits, along the area's major drainages (Ash Creek, Youngs Creek, Little Youngs

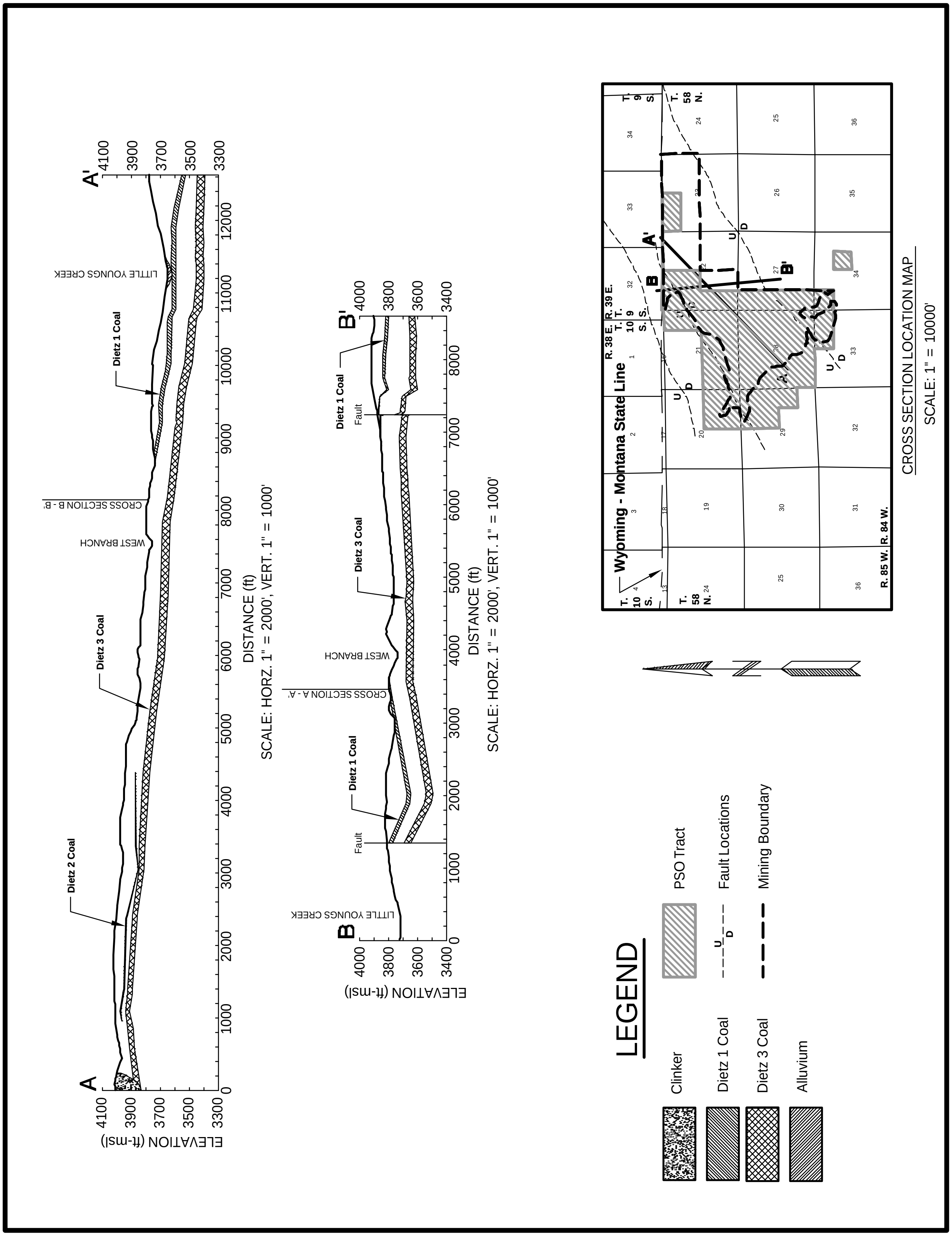


Figure 3-4. Geologic Cross Sections for the Ash Creek Mine.

<table>
<tr><th colspan="2">Geologic Unit</th><th>Hydrologic Characteristics</th></tr>
<tr><td colspan="2">RECENT ALLUVIUM
HOLOCENE</td><td>Typically fine grained and poorly sorted in intermittent drainages. Occasional very thin, clean interbedded sand lenses. Low yields and excessive dissolved solids generally make these aquifers unsuitable for domestic, agricultural and livestock usage. Low infiltration capacity unless covered by sandy eolian blanket.</td></tr>
<tr><td colspan="2">CLINKER
HOLOCENE TO
PLEISTOCENE</td><td>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 from 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</td></tr>
<tr><td colspan="2">WASATCH FORMATION*
EOCENE</td><td>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 which does meet the Class I standard.</td></tr>
<tr><td rowspan="3">FORT UNION FORMATION
PALEOCENE</td><td>TONGUE RIVER
MEMBER</td><td>The coal seams serve as regional groundwater aquifers and exhibit 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.</td></tr>
<tr><td>LEBO
MEMBER</td><td>The Lebo Member, also referred to as “The Lebo Confining Layer” has a mean thickness of 711 feet in the PRB and a thickness of about 400 feet in the vicinity of Gillette (Lewis and Hotchkiss 1981). 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 (Lewis and Hotchkiss 1981).</td></tr>
<tr><td>TULLOCK
MEMBER</td><td>The Tullock Member has a mean thickness of 785 feet 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.</td></tr>
<tr><td rowspan="3">UPPER
CRETACEOUS</td><td>LANCE
FORMATION</td><td>Sandstone and interbedded sandy shales and claystone provide yields generally of less than 20 gpm. Higher yields are sometimes achieved where sand thicknesses are greatest. Water quality is typically fair to good.</td></tr>
<tr><td>FOX HILLS
SANDSTONE</td><td>Sandstone and sandy shales yield up to 200 gpm, however, yields are frequently significantly less. The water quality of the Fox Hills is generally good with TDS concentrations commonly less than 1000 mg/l.</td></tr>
<tr><td>PIERRE SHALE</td><td>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.</td></tr>
<tr><td colspan="3">* Not present in the general area of the PSO lands.</td></tr>
</table>

Figure 3-5. Stratigraphic Relationships and Hydrologic Characteristics of Upper Cretaceous, Lower Tertiary, and Recent Geologic Units, Powder River Basin, Wyoming. (Compiled from Hodson et al. 1973 and Lewis and Hotchkiss 1981).

Creek, and West Branch Little Youngs Creek). In general, these alluvial sediments are composed of interbedded silts and clays overlying beds of sand and gravel. Unconsolidated materials that occupy the bottom of the Little Youngs Creek drainage have a maximum thickness of about 40 ft, including as much as 23 ft of interbedded sand and gravel, generally overlain by finer-grained materials (Hedges et al. 1980). The gravel consists primarily of rounded to subrounded detrital clinker with a maximum particle size of approximately two inches in diameter (Ash Creek Mining Company 1984). Colluvium, sheetwash, and residual deposits derived from the Fort Union Formation bedrock occur on the uplands and slopes.

The Eocene age Wasatch Formation is not present within the PSO Tract area.

The Fort Union Formation is approximately 3,400 ft thick in this vicinity and consists primarily of interbedded shales, mudstones, siltstones, lenticular sandstones, and coal. It is divided into three members: Tongue River (which contains the target coal seams), Lebo, and Tullock, in descending order (Figure 3-5).

The Tongue River Member consists of interbedded claystone, silty shale, carbonaceous shale and coal, with lesser amounts of fine-grained sandstone and siltstone. The clastic beds of the Tongue River Member were deposited on floodplains of large rivers, in river and stream channels, or on deltas extending outward into swamps. The clastic beds tend to be lenticular in shape and of limited areal extent. As a result, the lithology of the strata often changes rapidly over short distances, making it difficult to characterize the exact lithology of the overburden or interburden for any great lateral distances.

The Fort Union coal seams of mineable depth and thickness in the PSO Tract area include, in descending order, the Anderson and Dietz coal seams. The Anderson and Dietz seams are correlatable over a broad area. At the Decker Coal Mine, they are mined as the D1 and D2 seams. At the Big Horn Coal Mine the Dietz seam is correlatable with the Dietz 2 and Dietz 3 coals. The Anderson is stratigraphically higher than the mining disturbance at the Big Horn Coal Mine and generally occurs only as isolated remnants south and west of the PSO Tract (Ash Creek Mining Company 1984). Within the general Monarch, Wyoming and Decker, Montana area, the Fort Union coal seam nomenclature varies with respect to location and/or author (Law et al. 1979). The Anderson seam in the PSO Tract area is correlatable to and is also called the Dietz 1 seam. The Dietz 1 seam in the PSO Tract area is correlatable to and is also called the Dietz 2 seam. The Dietz 2 seam in the PSO Tract area is correlatable to and is also called the Dietz 3 seam. For the sake of consistency, the two mineable coal seams within the PSO Tract will be referred to as the Dietz 1 and Dietz 3 coal seams throughout the remainder of this EIS.

Thickness of the coal seams varies across the PSO Tract area. The Dietz 1 coal seam is present only in the northern half of the site because of erosion and burning, and its thickness increases from approximately five ft to an average of approximately 20 ft in Sections 22 and 23 of T.58N., R.84W. The Dietz 3 seam is present across the proposed mining area and ranges in thickness from approximately 10 to 50 ft, averaging about 41 ft. Overburden above the Dietz 1 seam ranges from approximately one to 275 ft in thickness. The overburden above the Dietz 3 where Dietz 1 is not present is from 20 to 120 ft thick. The interburden thickness between the Dietz 1 and Dietz 3 seams ranges from 20 to 140 ft, with a thickening trend from east to west.

The stratigraphy in the PSO Tract area is similar to that found at the other surface coal mining sites in the general area (Figure 3-1). Overburden and interburden consists of scoria (clinker), siltstone, shale, and minor sandstone units. Clinker is the result of prehistoric coal fires, which heated the rock overlying the burning coal beds and produced the baked and fused clinker. Clinker is present at several locations in the PSO Tract area, particularly to the south where the Dietz seams crop out at the surface.

Two northeast-trending structural faults approximate the northwest and southeast boundaries of the proposed mining area (Figure 3-4). These faults are known to be present, although their exact locations and displacements have not been accurately defined by the existing drilling. The displacements across each of these two major faults are estimated to be 60 to 180 ft. Generally, the stratigraphic dip is to the northeast at approximately four percent between the faults. There are local areas where the shallow strata dip at higher angles, generally due to local folding or faulting.

The portion of the Tongue River Member that is below the Dietz 3 coal bed and the Lebo Shale and Tullock Members of the Fort Union Formation, which underlie the Tongue River Member (Figure 3-5), would not be disturbed if mining occurs. These two lower members of the Fort Union Formation consist primarily of sandstone, siltstone, mudstone, shale, and coal. In general, the Tullock Member contains more sand than the Lebo Shale Member.

3.4.3.1 Mineral Resources

The PRB contains large reserves of fossil fuels including oil, natural gas or methane (from conventional reservoirs and from coal beds), and coal, all of which are currently being produced. In addition, uranium, bentonite, and scoria (clinker) are mined in the PRB (BLM 1996f).

Coal

Some of the largest accumulations of subbituminous coal reserves in the world are contained within the

PRB. Surface coal mining occurs where the coal is at its shallowest depth, i.e., nearest the outcrops along the eastern and western edges of this structural basin. Active surface coal mining in the PRB is centered in two general zones: the eastern side of the basin and the western side of the basin. The eastern zone is in Campbell and Converse Counties, starting about 20 miles north of Gillette, Wyoming and extending south for about 75 miles. The major producing seams in that area are the Fort Union Formation's Anderson and Canyon coal seams (combined they form the Wyodak seam). The western zone is an area between Sheridan, Wyoming (the Sheridan Coal Field) and Colstrip, Montana. At the present time there are six active surface mines in the western zone, all of which are located in Montana. Numerous old, abandoned, underground coal mines exist immediately north of Sheridan (Section 3.3). Surface coal mines also operated immediately north of Sheridan, including the Big Horn Coal Mine, which was closed and reclaimed in 2000 and 2001, and an older unnamed strip mine, known locally as the Hidden Water Pits (see Figure 3-1). Near the Montana State line the major producing seams are the Fort Union Formation's Anderson, Dietz, and Monarch (Canyon) seams.

A surface coal mine north of Sheridan was permitted with the WDEQ in 1976 as the PSO No. 1 Mine, which is now called the Ash Creek Mine (WDEQ Permit No. 407). This mine is located in the northeast quarter of Section 22, T.58N., R.84W., adjacent to the federal coal being considered for exchange. An initial box cut, overlying privately owned coal, was opened in the late 1970s. The mine plan was contingent upon approval and construction of a proposed railroad spur for an adjacent proposed mine in Montana. No method of coal transportation was built and all operations ceased in 1980. Operations remained suspended through 1995 when reclamation activities began. Reclamation was completed and a full area bond release request by the Ash Creek Mining Company was granted by WDEQ/LQD in 1996. Mine Permit 407 was transferred from Central and Southwest Services, parent company of the Ash Creek Mining Company, to P&M in 1997.

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. The quality of the recoverable coal reserves within the area of the federal coal being considered for exchange is represented by the analyses (done on an as-received basis) of recent exploration drilling samples collected by P&M. The Dietz 1 seam has a weighted average heating value of approximately 9,279 Btu/lb and contains 5.8 percent ash and 0.44 percent sulfur. The Dietz 3 seam has a weighted average heating value of approximately 9,352 Btu/lb and contains 5.4 percent ash and 0.53 percent sulfur. The volatile matter, fixed carbon and moisture percentages were not available from the analyses of these recently obtained samples, although those values for the Dietz 1 and Dietz 3 seams, respectively, as determined for the PSO No. 1 Mine area were as follows: 31.68 percent and 32.98 percent for volatile matter, 35.82 percent and 36.43 percent for fixed carbon, and 26.05 percent and 26.05 percent for moisture (Ash Creek Mining Company 1984).

Oil and Gas

Oil and gas have been produced in the PRB for more than 100 years from reservoir beds that range in age from Pennsylvanian to Oligocene (DeBruin 1996). There are approximately 500 fields that produce oil and/or natural gas. The estimated mean amounts of undiscovered conventional hydrocarbons in the basin are 1.94 billion barrels of recoverable oil and 1.60 trillion cubic ft of gas (USGS 1995). Depth to gas and oil-bearing strata is generally between 4,000 ft and 13,500 ft, but some wells are as shallow as 250 ft.

The western portion of the PSO Tract is located near geologic structures that contain producible quantities of oil. The Ash Creek and Ash Creek South Fields, both discovered in the early 1950s, are located in T.10S., R.38E., Section 3, Big Horn County Montana, and in T.58N., R.84W., Sections 29, 30, 31, and 32, Sheridan County, Wyoming, respectively. Production is from the Upper Cretaceous Ash Creek sandstone, which lies approximately 4,600 ft below the surface in this area (Morgando 1958). See Section 3.4.11 for further discussion of wells that are currently producing and associated facilities.

Coal Bed Methane

The generation of methane gas from coal beds occurs as a natural process. Methane produced by coal may be trapped in the coal by overburden pressure, by the pressure of water in the coal, or by impermeable layers immediately above the coal. Deeper coal beds have higher pressures and generally trap more gas. Under favorable geologic conditions, methane can be trapped at shallow depths in and above coal beds, and this seems to be the case in the PRB. Without the existence of conditions which act to trap the gas in shallow coals or in adjacent sandstones, the gas escapes to the atmosphere. It is likely that much of the methane generated by the coal beds in the PRB has gradually escaped into the atmosphere because of the relatively shallow coal burial depths. A recent study estimates that there are approximately 38.2 trillion cubic ft of CBM gas in place in PRB coal beds and that an estimated 25.6 trillion cubic ft of that gas is recoverable (Finley and Goolsby 2000). The authors of this study indicated that these numbers reflect only coal beds that are thicker than 20 ft and deeper than 200 ft because it is generally accepted by industry that coal beds 20 ft or more are necessary for economic production of CBM and that coal beds less than 200 ft deep have already been de-pressured and much of the gas has escaped to the atmosphere.

Historically, methane has been reported flowing from shallow water wells and coal exploration holes in parts of the PRB. According to DeBruin and Jones (1989), most of the documented historical occurrences have been in the northern PRB. Olive (1957) references a water well in T.54N., R.74W., which began producing gas for domestic use in 1916.

CBM has been commercially produced in the PRB since 1989 when production began at Rawhide Butte Field, west of the Eagle Butte Mine. CBM exploration and development is currently ongoing throughout the PRB in Wyoming, and it is estimated that there are now as many as 15,000 productive CBM wells in place. The predominant CBM production to date has occurred from coal beds of the Wyodak - Anderson zone in seams known as the Anderson, Canyon, Wyodak, Big George, as well as other locally-used names, like the Dietz, Monarch, and Carney beds. These are generally equivalent to the seams that are being mined by the surface mines along the eastern and western margins of the basin.

CBM development requires more extensive facilities in areas where there are splits between the coal seams. In the vicinity of the PSO Tract, the Dietz, Monarch, and Carney seams are separated by interburden that reaches 120 feet in thickness. Current CBM well completion technology within the PRB will not accommodate completion of multiple seams separated by thick shales within a single wellbore. As a result, in the areas where there are two or more coal seams separated by interburden, a “cluster” of two or more wells would be required to produce essentially the same reserve that would be produced from a single well in a single contiguous seam.

Since the early 1990s, the Wyoming BLM has completed numerous EAs and EISs analyzing CBM projects. The most recent of these was the *Final Environmental Impact Statement and Proposed Plan Amendment for the Powder River Basin Oil and Gas Project* (BLM 2003a). This document analyzed the potential impacts based on the assumption that by the year 2012, there will be about 51,000 producing private, state, and federal CBM wells and associated ancillary facilities in an almost 8,000,000-acre area covering all or parts of Campbell, Converse, Johnson, and Sheridan Counties, Wyoming. The cumulative impacts of reasonably foreseeable conventional oil and gas development within the Wyoming portion of the PRB were also analyzed.

The Montana BLM also recently completed the Montana *Final Statewide Oil and Gas EIS and Proposed Amendment of the Powder River and Billings Resource Management Plans* (BLM 2003b). The Montana document evaluated the potential impacts of drilling and producing up to 18,265 CBM wells.

Approved spacing for CBM wells in the Wyoming PRB is one well per coal seam per 80 acres, or eight well cluster locations per section. Since there are three potential productive coal seams (i.e., Dietz 3, Monarch, and Carney) in the Ash Creek area, a total of 78 CBM wells could be drilled within the boundary of the federal coal being considered for exchange. As of March 2003, five CBM wells had been completed or spudded on privately-owned oil and gas leases within the PSO Tract. Fourteen others are permitted to drill. Two of the existing wells are currently producing.

The ownership of oil and gas resources, including CBM, in the PSO Tract is discussed in Section 3.4.11 of this EIS.

Bentonite

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. Bentonite beds are mainly found in Cretaceous marine shales, not in the Eocene continental shales, sandstones, and coals found on the PSO Tract. No mineable bentonite reserves have been identified on the PSO Tract.

Uranium

Uranium exploration and mining were very active in the 1950s, when numerous claims were filed in the PRB. A decreased demand combined with increased foreign supply reduced uranium mining activities in the early 1980s. There are currently two in-situ leach operations in central Converse County in the southern PRB. Production at another recovery site ended in 2000. No known uranium reserves exist on the PSO Tract.

Scoria

Scoria or clinker has been and continues to be a major source of gravel for road construction in the area. Scoria is present in the PSO Tract area.

No mining claims, mineral material sales contracts, free use permits, or solid mineral leases exist within the PSO Tract.

3.4.4 Soils

The soils on the PSO Tract are typical of the soils that occur on the adjacent lands. The area covered in this study was covered by a soil survey completed and published by the NRCS.

Based on the NRCS soils studies, there is enough suitable topsoil for salvaging within the PSO Tract area to redistribute suitable soils to a depth of about two to three ft over all disturbed areas.

All soil surveys were completed to an order 2-3 resolution by the NRCS. The inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples.

The following is a list of the soil series that comprise the various map units delineated on the affected area associated with the Proposed Action.

Soils developing predominantly in alluvial or colluvial fan deposits

- Bidman - Ulm, dry, complex, 0 to 6 percent slopes
- Cambria - Forkwood complex, 0 to 15 percent slopes
- Cushman - Forkwood association, 3 to 15 percent slopes
- Harlan loams, dry, 0 to 15 percent slopes
- Haverdad - Worthenton complex, 0 to 3 percent slopes
- Kishona - Cambria complex, 3 to 6 percent slopes
- Parmleed - Bidman association, 3 to 15 percent slopes
- Zigweid - Cambria loams, 0 to 15 percent slopes
- Zigweid - Kishona - Cambria complex, 6 to 15 percent slopes

Soils developing predominantly in residuum on uplands

- Baux - Bauxson association, dry, 0 to 65 percent slopes
- Cushman - Worf association, 3 to 25 percent slopes
- Parmleed - Worfka association, 0 to 15 percent slopes
- Shingle, moist - Baux - Rock outcrop complex, 30 to 60 percent slopes
- Shingle - Haverdad association, 0 to 80 percent slopes
- Shingle - Rock outcrop complex, 30 to 50 percent slopes
- Shingle - Samday clay loams, 6 to 60 percent slopes
- Shingle - Theedle - Kishona association, 6 to 25 percent slopes
- Shingle - Wibaux complex, 0 to 60 percent slopes
- Shingle - Wibaux complex, cool, 15 to 80 percent slopes
- Shingle - Worf complex, 6 to 15 percent slopes
- Spearman - Wibaux association, 6 to 25 percent slopes
- Theedle - Kishona association, 6 to 15 percent slopes

Soils developing predominantly in eolian sand deposits

- Hiland - Decolney complex, 3 to 15 percent slopes
- Taluce - Tullock - Vonalee association, 6 to 15 percent slopes

Table 3-1 provides the extent of five depth classes of suitable topsoil within the PSO Tract.

An average of about two ft of topsoil would be redistributed on all disturbed acres. Soils sites with high alkalinity, salinity, or clay content are unsuitable for use in reclamation.

The soil depths and types on the PSO Tract are similar to soils currently being salvaged and utilized for reclamation at the other surface mines in the Sheridan area. The tract is expected to have an adequate quantity and quality of soil for reclamation. The site-specific soil surveys have located hydric soils and/or inclusions of hydric

Table 3-1. Acres of Topsoil Available for Reclamation Within the Boundary of the Federal Coal Being Considered for Exchange Under the Proposed Action.

Thickness of Suitable Topsoil (inches)	Acres	Percent
0	0.0	0.0
0 - 12	83.1	4.1
12 - 30	1,585.9	77.6
30 - 48	168.1	8.2
48 - 60	207.9	10.1
Total	**2,045.0**	**100.0**

soils. The presence of hydrophytic vegetation and wetland hydrology would be determined during jurisdictional wetland determinations included in the mine permit application package (see Section 3.4.8).

3.4.5 Air Quality and Climate

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

The PSO Tract area is located in the Tongue River airshed, which comprises approximately 4,500 square miles in a rectangular area extending along the Tongue River from the Big Horn National Forest to the confluence with the Yellowstone River about 145 miles to the north-northeast. Information on the climate and meteorology of the area, as presented in this section, is based on available data from the City of Sheridan as well as nearby stations.

3.4.5.1 Topography

Wyoming can be characterized as having a combination of both highland and mid-latitude semiarid climates. The dominant factors that affect the climate of the area are elevation, local relief, and the mountain barrier effect. This barrier effect can produce marked temperature and precipitation differences between windward and leeward slopes. Generally, temperatures decrease and precipitation increases with increasing elevation. The climatic description of the project area itself is high plains semi-arid, characterized by large diurnal and seasonal variations in temperature and seasonal variations in precipitation.

3.4.5.2 Climate and Meteorology

The general climate of the area is typical of a semi-arid high plains environment with relatively large seasonal and diurnal variations in temperature and seasonal variation in precipitation. Long-term average monthly maximum, minimum and mean temperatures for Sheridan are presented in Table 3-2. These data show the large seasonal variation in temperature with the warmest month being July, with a mean at 69.6°F, while the coldest month is January, with a monthly mean at 19.0°F. July is the month with the warmest average maximum (86.7°F) while January is the month with the coolest average minimum (5.9°F). The annual mean temperature for the area is 43.9°F.

Precipitation data descriptive of the general region was obtained from a station east of Clearmont, Wyoming and presented in Table 3-3. The average annual precipitation received is 12.0 inches with the majority falling between April and September.

The month with the highest precipitation total is June 2.9 inches while the months with the lowest totals are December, January, and February at 0.4 inch each. As is typical with a semi-arid area, year-to-year and month-to-month values temperature and precipitation can and will vary widely from the climatic averages.

Winds are greatly affected by local topographic features. Wind data have not been collected from the specific project area, but such data are available for a five-year period from Sheridan. These data (1984 and 1987 through 1990) were processed into a joint frequency distribution of wind direction by wind speed and the results are presented as a wind rose diagram in Figure 3-6. The predominant wind directions for Sheridan are from the northwest and west-northwest at 12.7 percent and 11.5 percent of the time, respectively. The annual average wind speed for the period was 8.7 mph with the strongest winds coming out of the west-northwest (12.3 mph) and northwest (12.1 mph).

Wind data are also available for the last five years (1996 through 2000) from the Decker Coal Mine. These data were also processed into a frequency distribution of wind direction and are depicted as a wind rose diagram in Figure 3-6. The prevailing wind directions recorded at the Decker Mine are from the northwest and south, both at 12.5 percent of the time. Wind directions at the Decker meteorological station are strongly influenced by the local terrain and close proximity to the Tongue River Reservoir (Figure 3-6). The PSO Tract area is characterized by the Ash Creek and Youngs Creek drainages which both flow generally from the west-northwest toward the Tongue River to the east. The area has some complex terrain, especially in the western half of the property. As such, it is anticipated that the wind flow patterns will follow relatively closely the patterns observed at Decker, but with a greater frequency of return flows from the southeast sectors, up the

Table 3-2. Average Maximum, Minimum and Monthly Mean Temperatures for Sheridan, Wyoming.

Month	Average Maximum (EF)	Average Minimum (EF)	Monthly Mean (EF)
January	31.9	5.9	18.9
February	36.6	10.7	23.7
March	44.5	19.5	32.0
April	57.0	30.0	43.5
May	67.4	39.7	53.6
June	76.5	47.9	62.2
July	87.3	53.5	70.4
August	86.6	51.1	68.9
September	74.6	40.8	57.7
October	61.9	30.6	46.3
November	44.9	18.6	31.8
December	35.5	9.7	22.6
Year	58.7	29.8	44.3

[1] Sheridan Field Station; located 44.43EN and 106.83EW at 3,750 ft above sea level. Data period from 1920-2000; WRCC 2001.

Table 3-3. Climatic Monthly Precipitation For Arvada 3 N Located in Sheridan County, Wyoming.

Month	Precipitation (inches)
January	0.4
February	0.4
March	0.6
April	1.1
May	2.0
June	2.9
July	1.0
August	0.9
September	1.1
October	0.7
November	0.5
December	0.4
Annual	12.0

[1] Climatic precipitation data from NCDC cooperative station, 1936 through 1977. Arvada 3N in Sheridan County, located at 44.7EN and 106EW, at 3,681 ft above mean sea level; NCDC 2001.

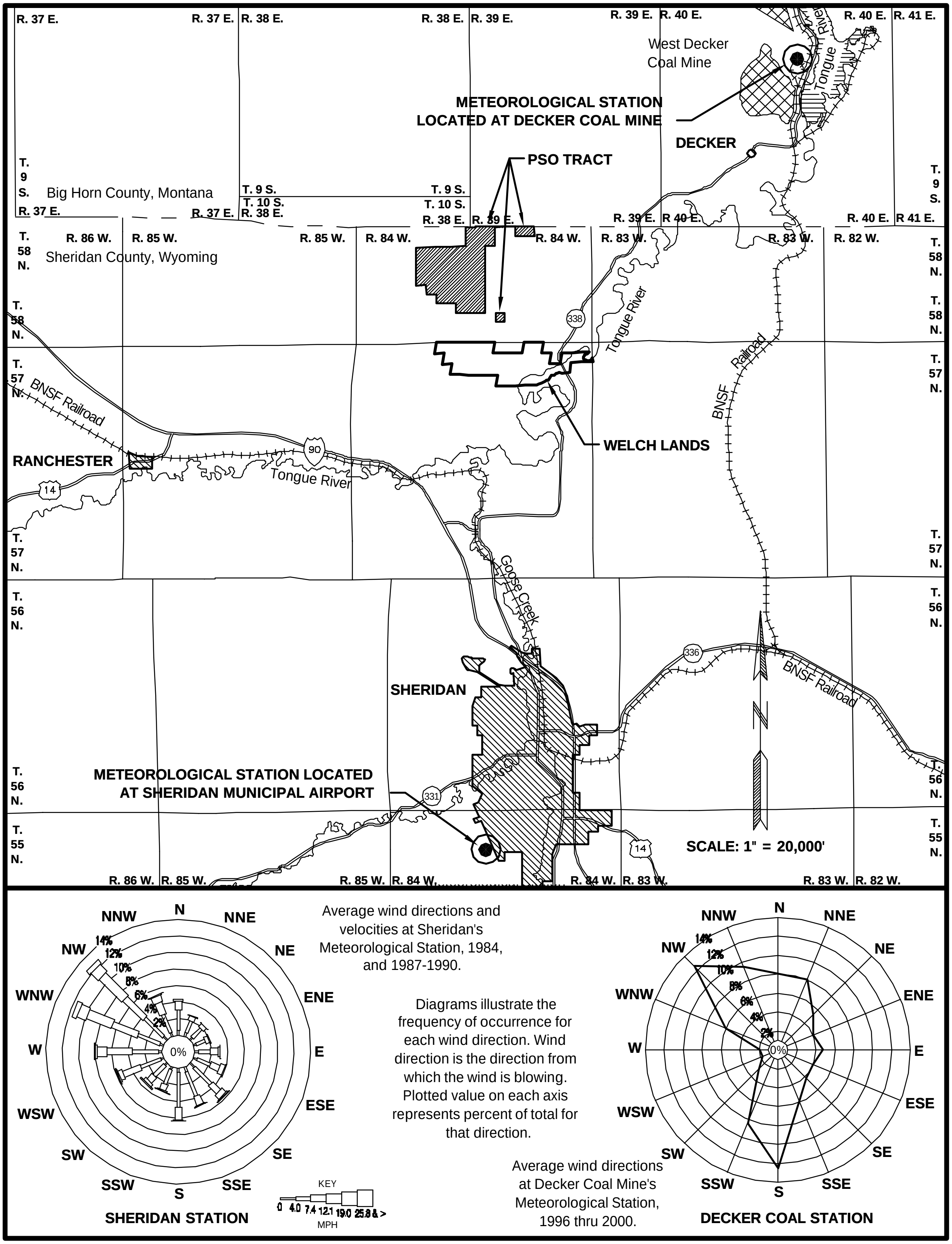


Figure 3-6. Wind Roses and Meteorological Stations at the Decker Coal Mine and Sheridan Municipal Airport near the PSO Tract.

drainage valleys, as a result of afternoon heating.

3.4.5.3 Regulatory Framework

Air quality and pollutant emissions to the air are regulated under both federal laws and regulations (CAA) and Wyoming state laws and regulations implemented by the WDEQ. A fundamental requirement of both federal and state regulations is that ambient concentrations for specific criteria pollutants not exceed allowable levels, referred to as the AAQS. These standards have been established by the U.S. EPA and the WDEQ at levels deemed necessary to preclude adverse impacts on human health and welfare.

The applicable federal, Wyoming, and Montana AAQS are shown in Table 3-4. While the proposed Ash Creek Mine would be located in Wyoming, the Montana AAQS are included in Table 3-4 because of the proximity of the tract to Montana.

An analysis of air quality impacts was conducted for the Wyoming and Montana BLM by Argonne National Laboratories to analyze potential air quality impacts from the oil and gas development alternatives considered in the Wyoming *Final EIS and Proposed Plan Amendment for the PRB Oil and Gas Project* (BLM 2003a) and the Montana *Statewide Final EIS and Proposed Amendment of the Powder River and Billings RMPs* (BLM 2003b). This analysis projected potential cumulative air quality impacts as a result of ongoing mineral development in the PRB, including reasonably foreseeable CBM and surface coal mining development. As part of this analysis, Argonne assembled and reviewed monitoring data measured throughout northeastern Wyoming and southeastern Montana and selected data representing the best available background air pollutant concentrations throughout the PRB in Wyoming and Montana. Table 3-4 presents the specific values that Argonne used to define background conditions in this cumulative air quality impact analysis. The assumed background pollutant concentrations are below applicable NAAQS and WAAQS for all criteria pollutants and averaging times.

States designate areas within their borders as being in Aattainment@ or Anon-attainment@ with the AAQS. Since the PSO Tract is near the border of Wyoming and Montana, the attainment status of nearby areas in both states is considered. The PSO Tract is in an area that is designated an attainment area for all pollutants. However, the town of Sheridan, Wyoming, located about 12 miles south of the project area, is a non-attainment area for PM_{10}. The town of Lame Deer, Montana, located about 50 miles northeast, is also a non-attainment area for PM_{10}. The towns of Laurel and Billings, Montana, non-attainment areas for SO_2, are located about 90 miles northwest of the project area. The non-attainment status of these areas is due to pollution generated in the immediate vicinity of those population centers.

Future development projects which have the potential to emit more than 250 tpy of any criteria pollutant (or

Table 3-4. Assumed Background Air Pollutant Concentrations, Applicable Ambient Table Air Quality Standards, and PSD Increment Values (in σg/m³).

Pollutant	Averaging Time[1]	Background Concentration	Primary NAAQS[2]	Secondary NAAQS[2]	Wyoming Standards	Montana Standards	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	1-hour	3,500[3]	40,000	40,000	40,000	40,000	---	---
	8-hour	1,500	10,000	10,000	10,000	10,000	---	---
Nitrogen dioxide	1-hour	---	---	---	---	566	---	---
	Annual	16.5[4]	100	100	100	100	2.5	25
Ozone	1-hour	82[5]	235	235	235	196	---	---
	8-hour	130[5]	157	157	157	NA	---	---
PM_{10}	24-hour	42[7]	150	150	150	150	8	30
	Annual	17[7]	50	50	50	50	4	17
$PM_{2.5}$	24-hour	19[7]	65	65	65	NA	---	---
	Annual	7.6[7]	15	15	15	NA	---	---
Sulfur dioxide	1-hour	---	---	---	---	1,300	---	---
	3-hour	8[6]	---	1,300	1,300	---	25	512
	24-hour	8[6]	365	---	260	260	5	91
	Annual	3[6]	80	---	60	60	2	20

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 Amoco Ryckman Creek collected for an eight month period during 1978-1979, summarized in the Riley Ridge (BLM 1983).
4 Data collected in Gillette, Wyoming (1996 - 1997).
5 Data collected in Pinedale, Wyoming (1992 - 1994).
6 Data collected in Devil's Tower, Wyoming (1983).
7 Data collected in Gillette, Wyoming (1999).
Source: (Argonne 2002)

certain listed sources that have the potential to emit more than 100 tpy) would be required to undergo a regulatory PSD Increment Consumption Analysis under the federal New Source Review permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of BACT and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, PM_{10}, or SO_2. The PSD increments are shown in Table 3-4. A regulatory PSD Increment Consumption Analysis may be conducted as part of a New Source Review, or independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. Finally, an analysis of cumulative impacts due to all existing sources and the permit applicant's sources is also required during PSD analysis to demonstrate that applicable ambient air quality standards will be complied with during the operational lifetime of the permit applicant's operations. In addition, sources subject to PSD permitting requirements would provide specific analysis of potential impairment of AQRVs such as visibility and acid rain.

Existing surface coal mining operations in the PRB are not currently affected by the PSD regulations for two reasons. Surface coal mines are not on the EPA list of 28 major emitting facilities for PSD regulation and point-source emissions from individual mines do not exceed the PSD emissions threshold of 250 tpy. A new mine would be classified as a major source if potential emissions of any regulated pollutant equal or exceed 250 tpy.

This NEPA analysis compares potential air quality impacts from the Proposed Action and Alternatives to applicable ambient air quality standards, PSD increments, and AQRVs (such as visibility), but it does not represent a regulatory PSD analysis. Comparisons to the PSD Class I and II increments are intended to evaluate a threshold of concern for potentially significant adverse impacts, and do not represent a regulatory PSD Increment Consumption Analysis. Even though the development activities would occur within areas designated PSD Class II, the potential impacts are not allowed to cause incremental effects greater than the stringent Class I thresholds to occur inside any distant PSD Class I area. Finally, the CAA directs the EPA to promulgate the Tribal Authority Rule, establishing tribal jurisdiction over air emission sources within the exterior boundaries of tribal lands. Pursuant to this rule, the Crow and Northern Cheyenne tribes north of the analysis area in Montana may request that they be treated in the same manner as a state (including Section 105 grants and formal recognition as an affected "state" when emission sources are located within 50 miles of tribal lands) under the CAA.

The WDEQ/AQD administers a permitting program to assist the agency in managing the State's air resources. Under this program, anyone planning to construct, modify, or use a facility capable of emitting designated pollutants into the atmosphere must obtain an air quality permit to construct. Coal mines fall into this category.

In order to obtain a construction permit, an operator may be required to demonstrate that the proposed activities will not increase air pollutant levels above annual standards established by the WAQSR (WDEQ/AQD 2000). The operator will also be required to utilize BACT for minimizing emissions from the facility. Monitoring may be required as a condition of the permit to construct. A permit to operate will also be required and will contain specific emission limitations and other measures of performance for operation of the facility.

The demonstration required for a construction permit often entails development of an emission inventory for the proposed facility, an estimate of the emissions from all other permitted sources of air pollutants in the vicinity, and the collection of local ambient air quality and meteorology data. This information is utilized in dispersion modeling to predict the cumulative impact of the proposed facility along with existing sources on the quality of the air in the immediate vicinity, including the impact on any special resource areas.

The CAA also provides specific visibility protection of mandatory federal Class I areas. Mandatory Federal Class I areas were designated by the U.S. Congress on August 7, 1977, and include wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size. The mandatory federal Class I areas located nearest to the analysis area are listed in Table 3-5. In addition, the Northern Cheyenne Tribe (located 25 miles north of the PSO Tract in Montana) has designated their lands as PSD Class I. As shown in Table 3-4, the allowable incremental impacts for NO_2, PM_{10}, and SO_2 within these PSD Class I areas are very limited. All of the PRB in Wyoming, including the analysis area, is designated as PSD Class II with less stringent requirements.

3.4.5.4 Existing Air Quality

WDEQ detects changes in air quality through monitoring and maintains an extensive network of air quality monitors throughout the state. Particulate matter is most commonly measured as particles finer than 10 microns or PM_{10}. The eastern side of the PRB has one of the most extensive networks of monitors for PM_{10} in the nation due to the density of coal mines. There are also monitors in Sheridan and Gillette, Wyoming and WDEQ installed monitors in Arvada and Wright, Wyoming in November 2002 (Figure 3-7).

WDEQ uses monitoring stations located throughout the state to anticipate issues related to air quality. These monitoring stations are located to measure ambient air quality and not located to measure impacts from a specific source.

Table 3-5. Approximate Distances and Directions from the General Analysis Area to PSD Class I and Class II Sensitive Receptor Areas.

Receptor Area	Distance (miles)	Direction to Receptor
Mandatory Federal PSD Class I		
Badlands Wilderness Area[1]	215	SE
Bridger Wilderness Area	174	SW
Fitzpatrick Wilderness Area	166	SW
Gates of the Mountains Wilderness Area	269	WNW
Grand Teton National Park	184	WSW
North Absaroka Wilderness Area	119	WSW
Red Rock Lakes Wilderness Area	235	W
Scapegoat Wilderness Area	312	NW
Teton Wilderness Area	148	WSW
Theodore Roosevelt National Park (North Unit)	250	NE
Theodore Roosevelt National Park (South Unit)	215	NE
UL Bend Wilderness Area	176	NNW
Washakie Wilderness Area	126	WSW
Wind Cave National Park	190	SE
Yellowstone National Park	146	W
Tribal Federal PSD Class I		
Fort Peck Indian Reservation	215	NNE
Northern Cheyenne Indian Reservation	25	N
Federal PSD Class II		
Absaroka-Beartooth Wilderness Area	130	W
Agate Fossil Beds National Monument	237	SE
Bighorn Canyon National Recreation Area	55	W
Black Elk Wilderness Area	173	SE
Cloud Peak Wilderness Area	36	SSW
Crow Indian Reservation	<1	N
Devils Tower National Monument	113	ESE
Fort Belknap Indian Reservation	213	NNW
Fort Laramie National Historic Site	225	SSE
Jewel Cave National Monument	165	SE
Mount Rushmore National Memorial	180	SE
Popo Agie Wilderness Area	175	SSW
Soldier Creek Wilderness Area	248	SE

The U.S. Congress designated the Wilderness Area portion of Badlands National Park as a mandatory federal PSD Class I area. The remained of Badlands National Park is a PSD Class II area.

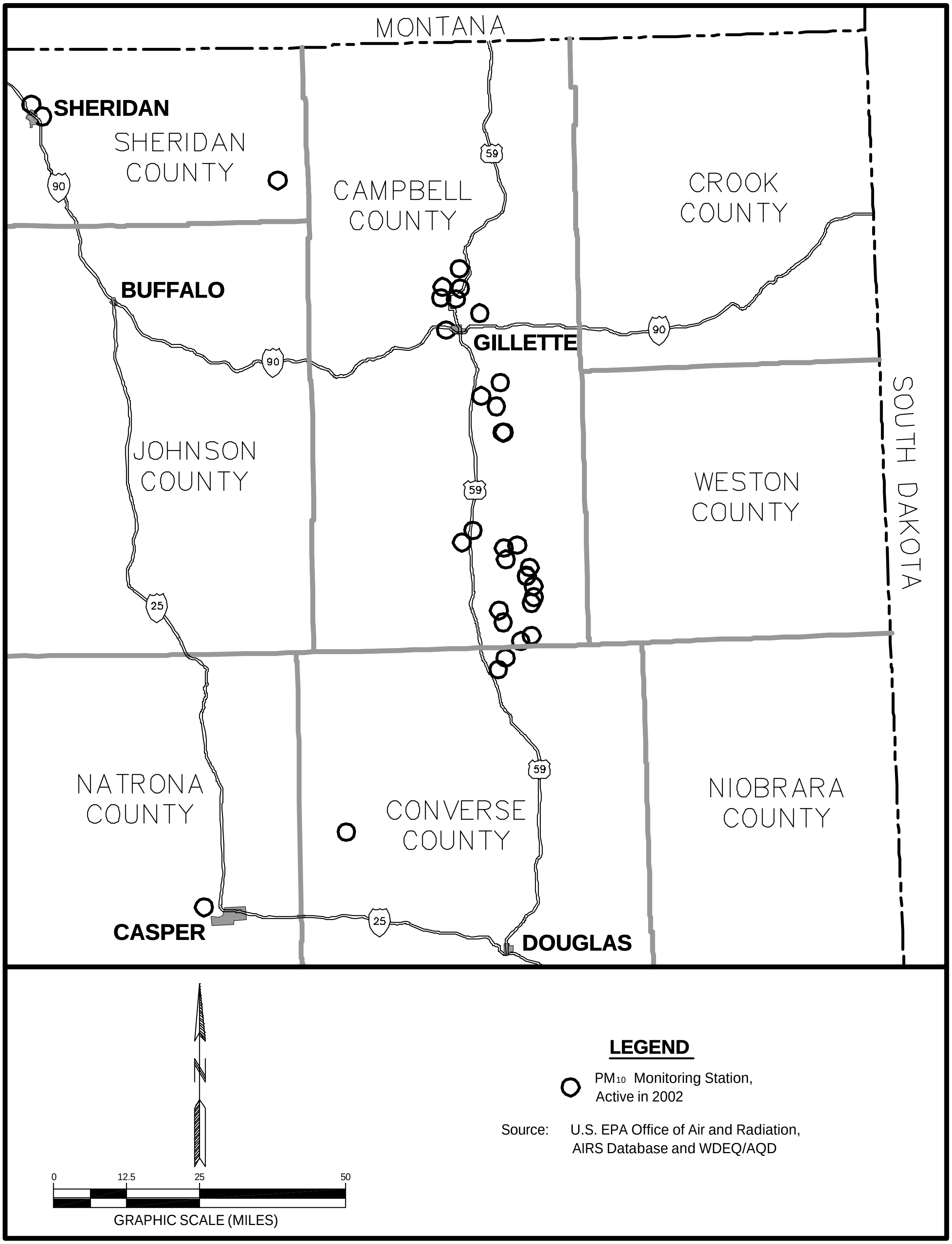


Figure 3-7. Active PM_{10} Monitoring Stations in Northeastern Wyoming.

Monitors located to measure impacts from a specific source may also be used for trends. These data are used to pro-actively arrest or reverse trends towards air quality problems. When WDEQ became aware that particulate readings in the PRB were increasing due to increased coal mining, coal bed methane activity, and exacerbated by prolonged drought, the WDEQ approached the counties, coal mines, and CBM industry. A coalition involving the counties, coal companies, and CBM operators have made significant efforts towards minimizing dust from roads. Measures taken have ranged from the implementation of speed limits to paving of heavily traveled roads.

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

WDEQ has also sited two visibility monitoring stations in the PRB. One of these sites is 32 miles north of Gillette, Wyoming and includes a Nephelometer, a Transmissometer, an Aerosol Monitor (IMPROVE Protocol), 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 other visibility monitoring station is located 14 miles west of Buffalo, Wyoming and includes a Nephelometer, a Transmissometer, an Aerosol Monitor (IMPROVE Protocol), instruments to measure meteorological parameters (temperature, RH, wind speed, wind direction), and a digital camera.

Other air quality monitoring in the PRB includes WDEQ NO_2 monitoring along the east side of the PRB, WARMS monitoring of sulfur and nitrogen concentrations near Buffalo, Sheridan, and Newcastle, Wyoming, and NADP monitoring of precipitation chemistry in Newcastle.

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

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

Blasting is responsible for another type of emission from surface coal mining. Overburden blasting sometimes produces gaseous reddish-brown clouds that contain NO_2. Exposure to NO_2 may have adverse health effects, which are discussed in Chapter 4. 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 3-4.

Other existing air pollutant emission sources within the region include:

- exhaust emissions (primarily CO and oxides of nitrogen [NO_x]) from existing natural gas-fired compressor engines used in production of natural gas and CBM; gasoline and diesel vehicle tailpipe emissions of combustion pollutants (VOCs, CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2);
- dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas, and road sanding during the winter months;
- transport of air pollutants from emission sources located outside the region;
- emissions from railroad locomotives used to haul coal (primarily NO_2 and PM_{10}); and
- SO_2 and NO_x from power plants.

3.4.5.5 Historical Ambient Air Quality: Particulates

Until 1989, the federally regulated particulate matter pollutant was measured as TSP. This measurement included all suspendable dust (generally less than 100 microns in diameter). In 1989, the federally regulated particulate matter pollutant was changed from a TSP based standard to a PM_{10} based standard. PM_{10} is particulate matter with an aerodynamic diameter of 10 microns or less that can potentially penetrate into the lungs and cause health problems. Wyoming added PM_{10} based standards to match the federal standards in 1989 and retained the TSP based standards as state standards until March 2000. Wyoming's ambient air standards for PM_{10} are shown in Table 3-4.

Regional

WDEQ/AQD requires the collection of information documenting the quality of the air resource at each of the PRB mines. Each mine monitored air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. All PM_{10} monitors are now required by WDEQ/AQD to sample air quality for a 24-hour period every three days, beginning in 2002. Data for TSP dates back to 1980 with data for PM_{10} dating back to 1989. This has resulted in over

55,000 TSP and 14,000 PM_{10} samples collected through 2002 and makes the eastern PRB one of the most densely monitored areas in the world (Figure 3-7). Table 3-6 uses the annual arithmetic average of all sites to summarize these data.

As indicated in Table 3-6, the long-term trend in particulate emissions remained relatively flat through 1998. TSP concentration from 1980 through 1998 averaged 33.1 σg/m, ranging between 27.8 $\sigma g/m^3$ and 39.4 $\sigma g/m^3$. There were increases in 1988 and 1996, which may have been the result of fires in the region during those years. PM_{10} concentration from 1989 through 1998 averaged 15.4 $\sigma g/m^3$, ranging between 12.9 $\sigma g/m^3$ and 16.5 $\sigma g/m^3$.

This time period (1980-1998) was associated with significant growth in the surface coal mining industry. Coal production increased from about 59 mmtpy to over 308 mmtpy (an increase of over 249 mmtpy), and associated overburden production increased from 105 mmbcy to over 710 mmbcy per year (a 605 mmbcy per year increase). From 1990 through 2002 the average annual increase in coal production was 7.0 percent, while annual overburden production increased an average of 13.9 percent over the same time period. The larger annual increase in overburden production is probably due to the fact that mines are gradually moving into deeper coals as the shallower reserves are mined out.

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

As indicated in Table 3-6, the annual average TSP concentration increased from 33.9 $\mu g/m^3$ in 1998 to 55.3 $\mu g/m^3$ in 1999, and has continued to increase at a slower pace through 2002. The average annual PM_{10} concentration increased from 15.9 $\mu g/m^3$ in 1998 to 21.6 $\mu g/m^3$ in 1999, it continued to increase to 27.2 $\mu g/m^3$ through 2001, and in 2002 it was at 23.3 $\mu g/m^3$. There were no major fires in the region from 1998 through 2002. The increases in coal production over those four years (3.8 percent per year and 12.8 mmtpy over the four-year period) and associated overburden production (9.8 percent per year and 72.0 mmbcy over the four-year period) were not larger than any of the four-year increases during the previous 18 years, but the particulate concentration increase was much larger than in previous years.

As discussed above, TSP was the federally regulated pollutant until 1989 and was retained as a state regulated pollutant until 2000. PM_{10} became a federal standard in 1989 and was also adopted by the State of Wyoming. After 1989 and until recently, TSP measurements

Table 3-6. Summary of WDEQ/AQD Reports on Air Quality Monitoring in Wyoming's PRB, 1980-2002.

Year	**Coal Produced (mmtpy)**	**Yards Moved (mmbcy)**	**Number of Mines Operating/ Monitoring TSP/ Monitoring PM_{10}[1]**	**Number of TSP/PM_{10} Monitoring Sites[2]**	**TSP Average ($\sigma g/m^3$)**	**PM_{10} Average ($\sigma g/m^3$)**
1980	58.7	105.3	10/14/0	34/0	35.5	na[3]
1981	71.0	133.4	11/13/0	35/0	39.4	na
1982	76.1	141.1	11/14/0	40/0	31.2	na
1983	84.9	150.9	13/14/1	41/1	32.6	11.2
1984	105.3	169.5	14/16/1	42/1	33.9	11.1
1985	113.0	203.4	16/17/0	49/0	32.3	na
1986	111.2	165.7	16/17/0	45/0	29.3	na
1987	120.7	174.6	16/17/0	43/0	31.7	na
1988	138.8	209.7	16/17/0	43/0	37.7	na
1989	147.5	215.6	15/17/3	40/3	32.1	15.9
1990	160.7	223.5	17/17/5	47/5	34.3	14.8
1991	171.4	245.9	17/17/5	46/6	32.7	16.5
1992	166.1	296.0	17/17/7	41/7	31.7	15.9
1993	188.8	389.5	17/17/8	40/11	27.8	14.5
1994	213.6	483.9	17/18/8	44/11	31.7	15.5
1995	242.6	512.7	16/18/8	41/12	29.6	12.9
1996	257.0	605.4	17/18/8	41/12	35.4	16.0
1997	259.7	622.0	16/17/10	39/15	33.3	15.9
1998	308.6	710.7	16/17/12	36/17	33.9	15.9
1999	317.1	758.0	15/17/12	36/18	55.3	21.6
2000	322.5	845.3	15/15/12	31/17	56.1	23.4
2001	354.1	927.1	12/11/12	29/29	57.5	27.2
2002	359.7	1,032.1	13/11/13	23/38	56.0	23.3

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

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

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

Sources: 1980 through 1996 emissions and production data from April 1997 report prepared by WMA for WDEQ/AQD. 1997 through 2002 emissions data from EPA AIRData database. 1997 through 2002 emissions and production data from WDEQ/AQD.

were used as a surrogate for PM_{10} in lieu of having to replace and/or co-locate an existing TSP sampler with a new PM_{10} sampler. There were no violations of the PM_{10} standards anywhere in the PRB through the first quarter of 2001. In 2001 and 2002 the 24-hour PM_{10} standard was exceeded several times in the southern portion of the PRB. The WDEQ/AQD is continually reviewing the data and considering regulatory options. Particulate emissions from non-mining sources have not been quantified; however, more intense monitoring and regulatory inspections have been implemented at all PRB coal mines. In addition, the proximity of the monitors where the standard was exceeded to unpaved county roads has resulted in county/industry partnerships to treat portions of these roads with chemical dust suppressants.

Control Measures

Control of particulate emissions at existing surface coal mines in the PRB is accomplished with a variety of measures. Emissions at coal crushing, storage, and handling facilities (point sources) are controlled with baghouse dust collection systems, PECs, or atomizers/foggers. These are all considered BACT controls by WDEQ/AQD.

Fugitive emissions are also controlled with a variety of measures that the agency considers BACT. Typically, mine access roads have been paved and water trucks are used to apply water and chemical dust suppressants on all haul roads used by trucks and/or scrapers. 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. Fugitive emissions from the coal truck dumps are controlled with stilling sheds. Some of the mines have participated in the control of fugitive emissions from some nearby unpaved county roads by applying dust suppressants.

Site Specific

As stated previously, the PSO Tract is located in the Tongue River airshed. According to current regulatory standards by which air quality is defined, surface mining development in the Tongue River Basin has not resulted in impacts to air quality that have exceeded federal or state standards. The maximum 24-hour PM_{10} concentration observed in the last six years (from nearby mine data) was 118 $\sigma g/m^3$ recorded in 1995. Annual PM_{10} concentrations average about 11 $\sigma g/m^3$. These values are well below the AAQS of 150 and 50 $\sigma g/m^3$ for the 24-hour and annual averaging times, respectively.

In order to obtain a state air quality construction and operating permit, a surface coal mine may be required to demonstrate, through dispersion modeling, that its activities will not increase PM_{10} levels above the annual standard established by the

WAQSR (WDEQ/AQD 1995). The modeling demonstration must include the estimated air pollutant emissions from other existing pollution-generating activities, including adjacent mines, so that control of overall air quality is part of the permitting process.

Fugitive emissions from mining activities during the most active mining year at the Ash Creek Mine are estimated to be 259 tpy, but potential emissions that count towards the PSD applicability threshold would be much less than 250 tpy. Thus, the project would not be classified as a major source and would not be subject to PSD review. Again, a new mine is classified as a major source if potential emissions of any regulated pollutant equal or exceed 250 tpy. Fugitive emissions are not included in the definition of potential emissions except for certain specified source types [40 CFR 52.21, (b)(1)(iii)]. For the proposed Ash Creek Mine, fugitive emissions directly associated with the coal preparation plant would be counted toward the PTE for PSD applicability purposes. Mining related fugitive emissions are exempt from the applicability determination. Because final engineering for the coal preparation plant is not complete, it is not possible to determine the exact level of emissions that would count towards the PSD threshold at this time.

NSPS Subpart Y, AStandards of Performance for Coal Preparation Plants@ (40 CFR 60.250), applies to coal preparation plants that process more than 200 tpd of coal and which are constructed or modified after October 24, 1974. The standard applies to affected facilities at the plant, including (but not limited to) coal crushers, conveyors, storage systems, transfer and loading systems. The standard specifies opacity limits for affected units.

The proposed Ash Creek Mine satisfies the applicability requirements for this NSPS. Thus, affected equipment constructed at the coal preparation plant would be required to meet the requirements of this NSPS.

NSPS Subpart Kb, AStandards of Performance for Volatile Organic Liquid Storage Vessels@ (40 CFR 60.1106), applies to certain storage vessels constructed or modified after July 23, 1984. This NSPS could apply to the facility depending upon final engineering. However, final engineering is not complete and details necessary to determine applicability of this NSPS standard are not yet available.

3.4.5.6 Historical Ambient Air Quality: NO_2

NO_2 was monitored from 1975 through 1983 in Gillette and from March 1996 through April 1997 at four locations in the PRB. Table 3-7 summarizes the results of that monitoring. Beginning in 2001 the coal industry in cooperation with WDEQ/AQD installed a network of NO_2 monitors in the PRB. The 2001 data from this regional network are summarized in Table 3-8. None of these sites are in the vicinity of the PSO Tract.

Table 3-7. Annual Ambient NO_2 Concentration Data.

Site	Gillette	Black Thunder Mine	Belle Ayr Mine	Bill
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.
Source: McVehil-Monnett 1997

Table 3-8. 2001 Annual Ambient NO_2 Concentration Data.

Monitor	Annual Mean NO_2 Concentration (σg/m³)
Antelope Mine	7
Belle Ayr Mine	14
Black Thunder Mine	5*

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

Annual NO_2 levels measured in the March 1996 to April 1997 timeframe were below applicable standards. The highest reading was 22 σg/m³ as compared to the 100 σg/m₃ standard. All 2001 annual mean NO_2 concentrations are well below the standards of 100 σg/m³.

Control Measures

Some of the mines in the PRB have implemented programs designed to control/limit public exposure to the intermittent, short-term NO_2 releases associated with blasting and they all comply with the blasting plan publication/notification requirements associated with the Permits to Mine issued by WDEQ/LQD.

Voluntary measures that have been instituted by some mines include:

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

Mine operators in the eastern PRB and blasting agent manufacturers have been working together to reduce NO_x emissions through the use of different blasting agent mixtures and additives used with regard to the relative competency of the overburden and its moisture content. Operators continue to employ new blasting techniques such as the use of sophisticated electronic detonation systems that can vary shot timing, the use of different shot hole patterns, and the use of plastic liners within the shot holes to help prevent unspent blasting agent from dispersing out into the deformable overburden rock upon detonation (Doug Emme 2003).

WDEQ has identified measures that it may require in cases where there are concerns with public exposure the blasting clouds. These measures include:

- notification of neighbors and workers in the general area of the mine prior to the blast;
- last 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; and
- closing public roads when appropriate to protect the public.

3.4.5.7 Air Quality Related Values-Visibility and Acidification of Lakes

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

Visibility

Potential impacts to visibility were considered at 29 PSD Class I and sensitive Class II areas in the vicinity of the PRB. Table 3-5 shows the nearest distances from the sensitive receptor areas to the PSO Tract.

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. Maximum visual range in the western United States would be about 140 miles. Presently, the visibility conditions monitored in the Bridger Wilderness Area are among the best in the United States. Visual range monitoring in the Bridger Wilderness Area shows that one can see more than 70 miles 70 percent of the time.

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 U. S. EPA's Regional Haze Rule to achieve the National Visibility Goal. 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. Figure 3-8 shows annual averages for the 20 percent best, worst, and middle visibility days at Badlands and Bridger Wilderness Areas from 1988 to 1998, respectively (IMPROVE 2002)[2].

Acidification of Lakes

The acidification of lakes and streams is caused by atmospheric deposition of pollutants (acid rain). Lake acidification is expressed as the change in ANC measured in σeq/L, the lake's capacity to resist acidification from acid rain. Table 3-9 shows the existing ANC monitored in some mountain lakes.

3.4.6 Water Resources

3.4.6.1 Groundwater

Within the PSO Tract there are two water-bearing geologic units that could be disturbed by mining. These units are the alluvium of West Branch, Little Youngs Creek and Youngs Creek, and the Dietz 1 and Dietz 3 coal seams. The sub-Dietz coal Fort Union Formation would not be disturbed by mining activities. The stratigraphic units beneath the PSO Tract and the hydrologic properties are displayed in Figure 3-5.

The PSO No. 1 Mine completed 17 monitoring wells near the PSO Tract in 1980; two in the Dietz 1 seam, five in the Dietz 3 seam, and 10 in the alluvium (Figure 3-9). As discussed previously, the Ash Creek Mine, as it is currently called, was initially permitted as the PSO No. 1

---

[2] Summaries are based on IMPROVE aerosol data using procedures from the EPA *Draft Guidance for Tracking Progress under the Regional Haze Rule.*

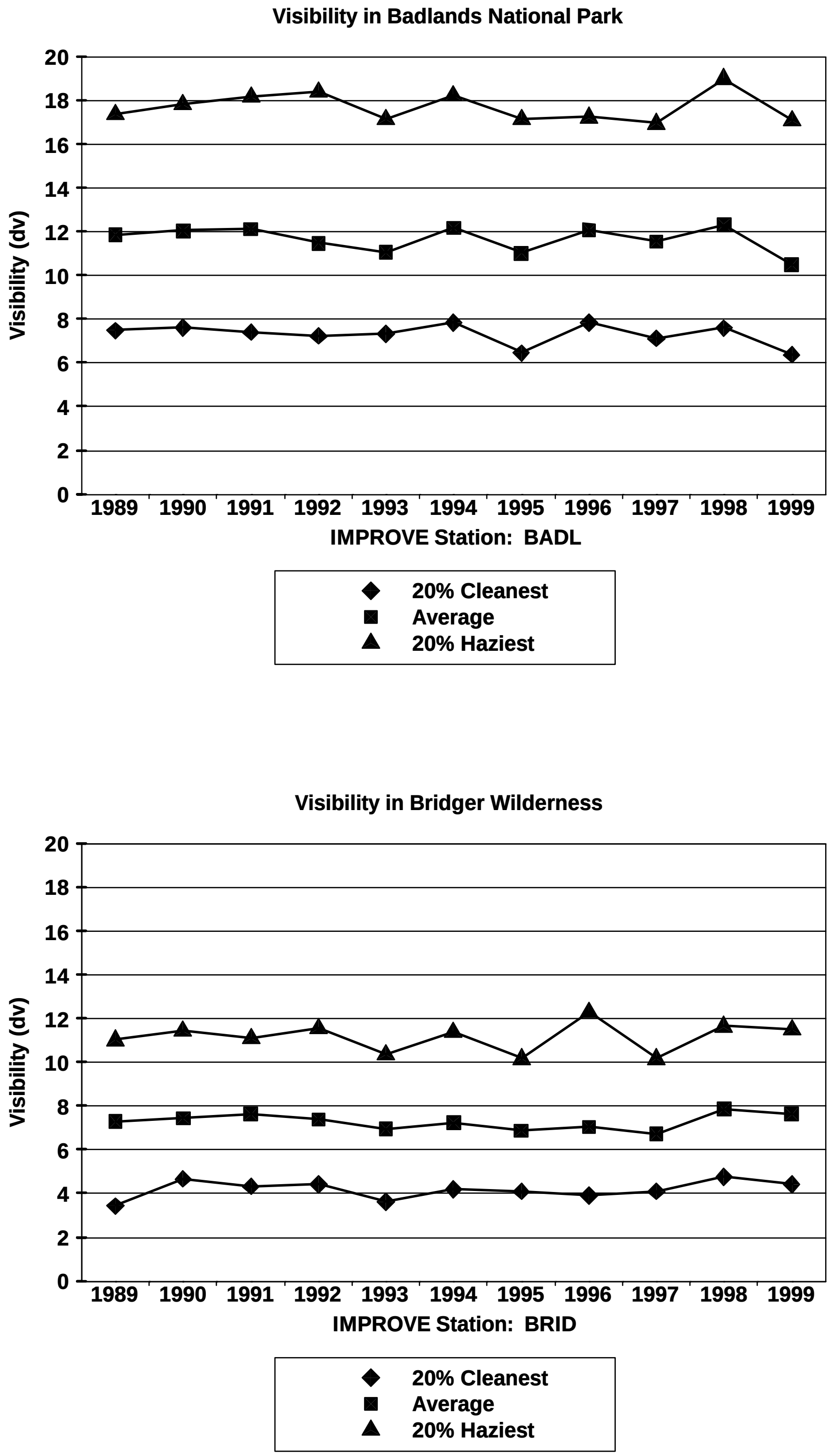


Figure 3-8. Visibility in the Badlands and Bridger Wilderness Areas.

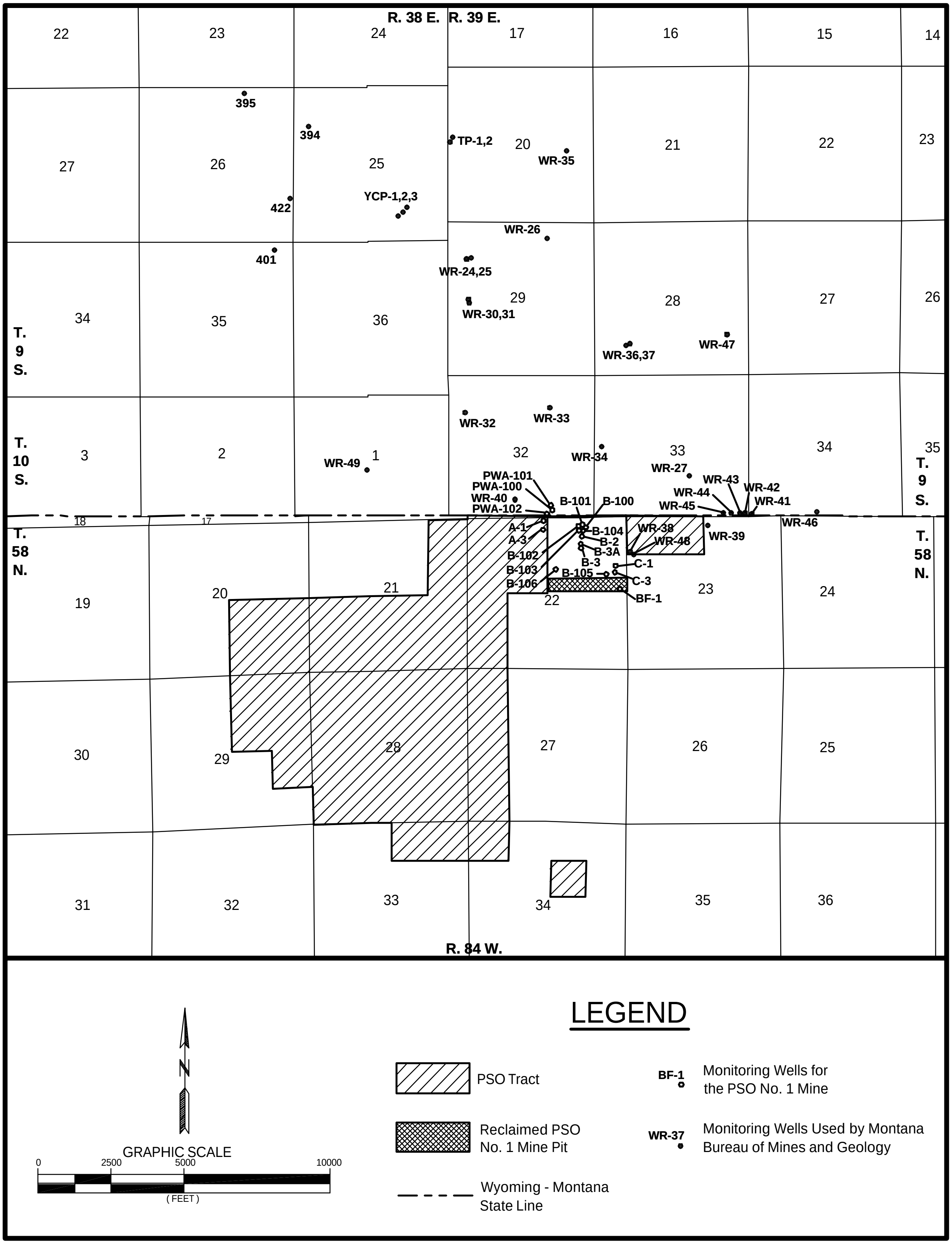


Figure 3-9. Monitoring Well Locations Within and Adjacent to the PSO Tract.

Table 3-9. Existing Acid Neutralizing Capacity in Sensitive Lakes.

Wilderness Area	**Lake**	**Background ANC (σeq/L)**
Bridger	Black Joe	69.0
	Deep	61.0
	Hobbs	68.0
	Upper Frozen	5.8[1]
Cloud Peak	Emerald	55.3
	Florence	32.7
Fitzpatrick	Ross	61.4
Popo Agie	Lower Saddlebag	55.5

[1] Since the background ANC value is less than 25 σeq/L, the potential ANC change is expressed in σeq/L, and the applicable threshold is 1.0 σeq/L.

Source: Argonne (2002)

Mine in 1976. This was prior to most of the current regulations and guidelines governing surface coal mining in Wyoming. Most of the monitoring wells for the PSO No. 1 Mine were installed after pit development; therefore, groundwater level drawdowns had already occurred at many of the well locations when the first measurements were recorded.

The future of the PSO No. 1 Mine was contingent upon approval and construction of a proposed railroad spur for an adjacent mine in Montana that was being contemplated by Shell Oil Company. A railroad spur was not built and commercial mining did not commence, although the pit remained open until late 1995 when reclamation of the PSO No. 1 Mine site began. By mid-1996, reclamation was complete and a single backfill monitoring well was then installed. Data from the PSO No. 1 Mine's 18 monitoring wells, as well as data collected by MBMG to identify the hydrogeology of the adjacent proposed surface coal mine area in Montana (Hedges et al. 1980), were used to prepare the following description of the baseline groundwater conditions in the PSO Tract area. Figure 3-9 shows the locations of the PSO No. 1 Mine pit and the MBMG monitoring wells as well as the 18 PSO No. 1 Mine monitoring wells.

Recent Alluvium

Within the boundary of the federal coal being considered for exchange, alluvium is present along West Branch. Little Youngs Creek is located just north of the tract proposed for exchange and could be affected if privately owned coal adjacent to the tract is mined (Figure 2-2). The alluvium along Little Youngs Creek ranges from roughly 50 to 100 ft wide and consists of 10 to 20 ft of fine-grained clays, silts, and sands underlain by up to 35 ft of coarse sand and scoria gravel (Ash Creek Mining Company 1984). Hedges et al. (1980) reported that slightly thicker deposits of alluvium occupy the bottom of the Youngs Creek drainage where the maximum thickness of unconsolidated materials is approximately 65 ft. Alluvial deposits along West Branch are not extensive and were not intensively investigated for the baseline hydrology section of the PSO No. 1 Mine permit application.

The hydraulic properties of the alluvium are variable, although the coarse material in the basal Little Youngs Creek alluvium forms a moderate to high yield aquifer. The hydraulic conductivity of the Little Youngs Creek alluvium ranges from 86 to 134 ft/day, the average computed for the entire saturated thickness is about 120 ft/day (Ash Creek Mining Company 1984). Aquifer testing of both the Little Youngs Creek and Youngs Creek alluvium also indicated that the groundwater is confined in the coarse-grained basal materials beneath the overlying clay and silt deposits at some well locations, whereas at other locations the basal gravels may not behave as a confined aquifer.

Water levels in the Little Youngs Creek alluvium were affected by the construction of the initial pit of the PSO No. 1 Mine. The pit did not disturb the majority of the valley fill of Little Youngs Creek, although some alluvium was removed. As a result, the natural groundwater flow pattern was altered and gradients were toward the pit until backfilling occurred in 1996. Since reclamation, alluvial groundwater levels have apparently fully recovered and underflow through the alluvium has been reestablished.

Alluvium along the area's watercourses transmits large volumes of groundwater southeastward. It is recharged vertically from streamflow and precipitation, and laterally from subcrops of discharging bedrock aquifers. It provides temporary storage of water during periods of high streamflow and returns it to the streams during periods of low streamflow. Most flow in the alluvium occurs within the basal gravels that consist of locally derived burn/clinker materials.

Groundwater sampled from the Little Youngs Creek alluvial aquifer is generally a magnesium-, calcium-bicarbonate type. The TDS concentrations are usually about 500 to 600 mg/L, and it is classified as permissible to good for irrigation and livestock uses.

Clinker

Another geologic unit consisting of sediments that were baked, fused, and melted in place is clinker, also called scoria, or burn. The clinker is the result of prehistoric coal fires that heated the rock overlying the burning coal beds and produced the clinker, which collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the PRB. Scoria deposits occur within the PSO Tract area. The hydrologic function of scoria in the general area is to provide infiltration of precipitation and recharge to laterally contiguous Dietz 1 and Dietz 3 coal seams.

Dietz 1 and Dietz 3 Coal Seams

Due to their lateral continuity, the Dietz 1 and Dietz 3 coal seams are considered regional aquifers within this area of the PRB, although both are somewhat low yielding. Within the PSO Tract area, the Dietz 1 coal seam is present over a wide range of depths below the surface (approximately one to 275 ft), and due to erosion and burning it occurs as a 20-ft thick seam only in the northern half of Sections 21, 22, and 23, T.58N., R.84W. The Dietz 2 and Dietz 3 seams have an interburden thickness ranging from approximately 20 to 40 ft. The Dietz 2 seam is present only in the southern part of the PSO Tract area and is less than five ft thick. Therefore, the Dietz 2 is not considered mineable, nor is it considered an aquifer in this area. The Dietz 3 seam is present across the entire general area and ranges from approximately 10 to 50 ft thick.

The value of the Fort Union coal seams as sources of groundwater is largely dependent upon their depths and occurrence with respect to recharge areas. In addition, the hydraulic conductivity of a coal seam is typically 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 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 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 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 coal fractured by unloading only.

The hydraulic properties of the coal seams within and adjacent to the PSO Tract are expected to be very similar to those that were determined by aquifer pump testing some of the monitoring wells shown in Figure 3-9. The hydraulic conductivity of the Dietz 1 and Dietz 3 coal seams ranges from 0.13 to 3.6 ft/day. The average hydraulic conductivity for the coal bed aquifers is estimated to be 1.0 ft/day (Hedges et al. 1980). The average storage coefficient value was determined to be roughly 0.0003, indicative of a confined aquifer and typical for Fort Union coal seams that are usually overlain and underlain by relatively impermeable siltstone and shale strata. These values agree well with those measured at other surface mining operations in this general area of the PRB.

Prior to mining, the direction of groundwater flow within a coal aquifer is generally from the recharge areas near the outcrop and burn zones downgradient following the dip of the coal. Variations in the degree and extent of fracturing (thus transmissivity), outcrop geometry, and structural faulting also control flow patterns.

The Dietz 1 seam receives recharge primarily via clinker along the coal's burned outcrop areas and in places where subcrops of the coal lie beneath the water table in alluvium along watercourses. Discharge from the system ultimately occurs primarily along the Tongue River east-northeast of the PSO Tract area. As discussed in Section 3.4.3, two northeast-trending structural faults approximate the northwest and southeast boundaries of the proposed mining area. These faults, which are shown in Figure 3-10, act to control the groundwater flow patterns. This is because the coal bed is offset an estimated 60 to 180 ft across the faults, and these stratigraphic offsets act as barriers to groundwater flow. Therefore, the Dietz 1 coal is not continuous to the west or south and essentially no recharge west or south of the PSO Tract area can occur. The subcrop zone lies beneath the alluvium of the West Branch and Little Youngs Creek and the seam is saturated downdip to the northeast indicating the alluvial subcrop is a source of recharge. Discharge from the Dietz 1 coal aquifer occurs mostly at the seam's subcrops beneath the Tongue River valley to the east-northeast of the PSO Tract area.

The Dietz 3 seam is burned over broad areas north, south, and west of the PSO Tract area (Figure 3-10). The structurally and topographically high outcrops of scoria there are the primary recharge areas. The Dietz 3 seam is also offset by the faults that approximate the northwest and southeast boundaries of the proposed mining area. As shown in Figure 3-10, the Dietz 3 coal outcrop is located along the north side of Ash Creek valley. As a result, the Dietz 3 coal is not continuous to the northwest, southwest, or southeast of the PSO Tract area. Discharge from the Dietz 3 coal aquifer occurs mostly at the seam's subcrops beneath the Tongue River valley to the east-northeast of the PSO Tract area.

The baseline potentiometric surfaces of the Dietz 1 and Dietz 3 beds are very similar and are in fact identical where the two beds converge downdip of the PSO Tract area. Groundwater flow direction in both the Dietz 1 and Dietz 3 seams is to the northeast parallel to the structural gradient and bounded by the northeast-trending fault planes.

Site-specific water level data collected at monitoring wells shown in Figure 3-9 indicate that opening the PSO No. 1 Mine box cut pit in 1976 caused groundwater level drawdowns to occur locally in both the Dietz 1 and Dietz 3 coal seams due to pit dewatering, although the general flow direction remained toward the northeast, down the structural gradient. The pit penetrated through the Dietz 1 coal in 1976. This coal seam is dry near the pit, but monitoring wells located north of the pit which do have water in them recorded drawdowns. Currently, groundwater flow in the Dietz 1 seam is still toward the pit and this should continue until the

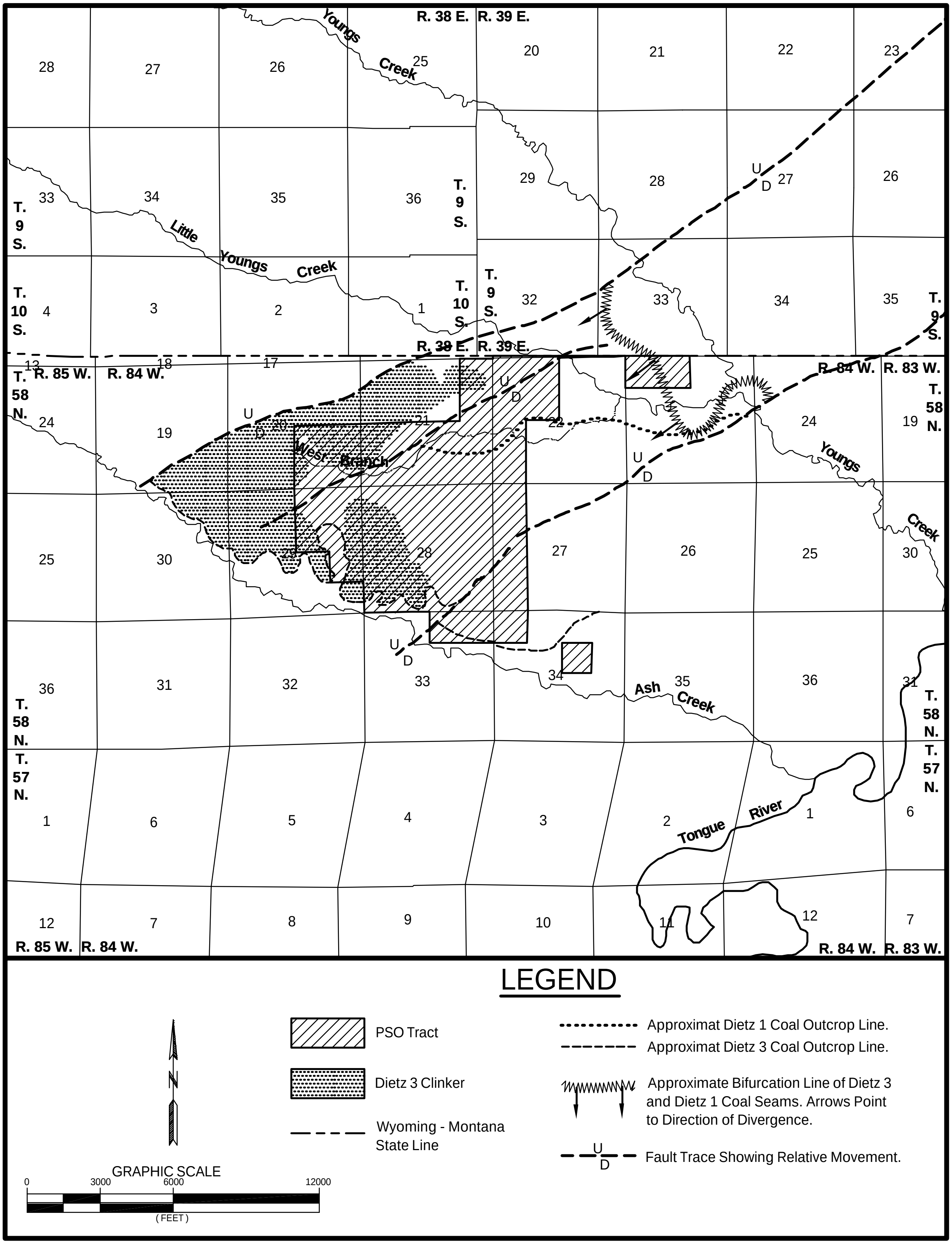


Figure 3-10. General Geologic Map of the PSO Tract Area.

backfill fully saturates and equilibrium is reestablished.

Recovery has proceeded rapidly since reclamation occurred. The PSO No. 1 Mine pit partially removed the shale interburden between the Dietz 1 and Dietz 3 seams. As a result, groundwater from the Dietz 3 seam migrated through this confining layer upward into the excavation, thus lowering the Dietz 3 seam's hydrostatic pressure. Reclamation has apparently stopped the upward leakage, as groundwater level elevations have been quickly increasing (P&M 2001). Current groundwater level information suggest that recent nearby CBM activity may influence the rate at which premining groundwater level equilibrium will be reached.

The chemistry of groundwater in the coal seams is variable with respect to location from the recharge areas. In waters near recharge areas, magnesium, calcium, sodium, sulfate, and bicarbonate are all present in significant concentrations. At a short distance downgradient (northeastward), magnesium and calcium concentrations are reduced and sodium becomes the principal cation. Similarly, the percentage of sulfate concentration is reduced leaving bicarbonate the predominant anion. Further downgradient, sulfate is nearly absent, leaving sodium and bicarbonate overwhelmingly the predominant ions. TDS concentrations range from 1,000 to 3,000 mg/L. The SAR is typically very high and the water is poor to unsuitable for most uses except livestock watering (Hedges et al. 1980, Ash Creek Mining Company 1984).

Sub-Dietz Coal Fort Union Formation

No hydrologic units below the Dietz 3 coal seam would be directly disturbed by the proposed Ash Creek Mine. The thickness of interburden between the Dietz 3 seam and the next water-bearing unit, which is the Monarch (also called the Lower Monarch or Canyon) coal seam, is approximately 100 ft. Roughly another 100 ft of interburden separate the Monarch seam from the next aquifer - the Carney coal seam. Below the Carney seam, the Tongue River Member is interbedded with the Lebo Shale Member of the Fort Union Formation. The Lebo Member, also referred to as the "Lebo Confining Layer", is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). Beneath the Lebo Member is the Tullock Member, consisting of discontinuous lenses of sandstone separated by interbedded shale and siltstone. The transmissivities of the Tullock Member sandstones are generally high and many of the surface mines in the PRB have water supply wells completed in this interval (Martin et al. 1988). However, due to its excessive depth, the Tullock Member is not utilized as a source of water in this area of the PRB.

In the vicinity of the PSO Tract area the hydrologic units stratigraphically beneath the Dietz 3 coal seam that have been or are presently being dewatered are the Monarch and Carney coal seams. The Monarch seam was mined at the Big Horn Coal Mine and actively dewatered until final reclamation was completed in 2000. Currently, CBM development is occurring to the north, south, and east of the PSO Tract area and is reducing water levels in the Dietz 3, Monarch, and Carney coal seam aquifers.

Lance and Fox Hills Formations

Underlying the Fort Union Formation is the Lance Formation of Cretaceous age. At the base of the Lance Formation is the Fox Hills Sandstone. Neither the Lance or Fox Hills Formations are to be affected by the proposed Ash Creek Mine, nor are these formations being affected or utilized as a source of groundwater in the general Ash Creek area.

<u>3.4.6.2 Surface Water</u>

The area surrounding the PSO Tract consists of relatively flat, rounded uplands dissected by numerous deep, steeply sloping ravines. In general, the streams within this area are typical for the region, and their flow events are closely reflective of precipitation patterns. Flows would be expected to vary widely on a seasonal and annual basis. 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. Perhaps as much as 60 to 80 percent of the annual streamflow volume would be expected to result from spring snowmelt runoff. During the spring, general storms (both rain and snow) increase soil moisture, hence decreasing infiltration capacity, and subsequent rainstorms can result in both large runoff volumes and high peak discharges. The surface water quality varies with streamflow rate; the higher the flow rate, the lower the TDS concentration but the higher the suspended solids concentration. Surface water features within and adjacent to the PSO Tract are displayed in Figure 3-11.

Surface water drainages within and adjacent to the PSO Tract area include Youngs Creek, Little Youngs Creek, West Branch, and Ash Creek. Youngs Creek, Little Youngs Creek, and Ash Creek are perennial streams. The streams of primary interest are the main stems of Little Youngs Creek and its ephemeral tributary, West Branch. Little Youngs Creek is a tributary to Youngs Creek, which is a tributary to Tongue River. Little Youngs Creek flows in an east-southeast direction towards its confluence with Youngs Creek, and West Branch flows eastward toward its confluence with Little Youngs Creek (Figure 3-11). The PSO Tract area lies within the drainages of Youngs Creek and Ash Creek; however, the main stems of these two streams do not fall within the boundary of the federal coal being considered for exchange. West Branch lies within the PSO Tract. The relationship between the area of the federal coal being considered for exchange and

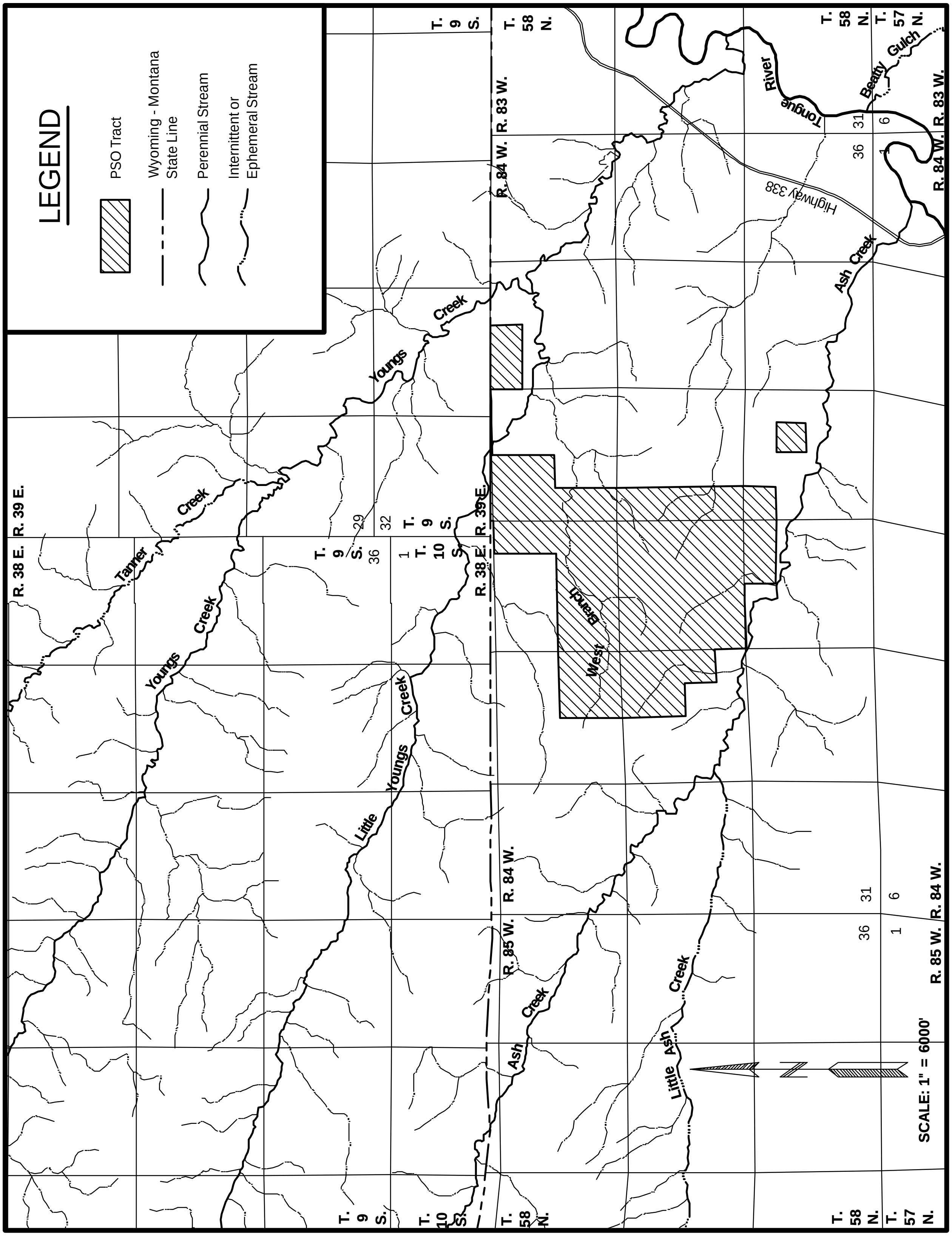


Figure 3-11. Surface Water Features Within and Adjacent to the PSO Tract.

the area of the proposed Ash Creek Mine, which includes privately-owned coal adjacent to the PSO Tract, is shown on Figure 2-2. As shown in Figure 2-2, portions of Little Youngs Creek and Youngs Creek could be affected by mining privately-owned coal adjacent to the PSO Tract, if the exchange is completed and PSO opens a mine as proposed.

Little Youngs Creek originates in the Wolf Mountains in Montana. Only about 22 percent of its drainage area is situated within the State of Wyoming. The drainage area of Little Youngs Creek above the state line is approximately 13.8 square mi. Little Youngs Creek streamflow varies with the seasons and is further affected by stream diversions for stock reservoirs and irrigation withdrawals, as well as irrigation return flows. During the low-flow season, streamflow is maintained largely by groundwater seepage from the alluvial system (Hedges et al. 1980). Based primarily upon long-term observations by local residents, Little Youngs Creek would be classified as a perennial stream, particularly throughout its lower reaches. These observations also indicate that the natural base flow is very small, probably only a fraction of one cfs during the low-flow season. During the driest years there may be periods of time when there is no streamflow. A streamflow monitoring station located about one-half mile upstream of the state line was maintained by Shell Oil Company for portions of the 1980 through 1982 water years, and records from that station indicate that the stream was dry for prolonged periods of time during the low-flow season (Ash Creek Mining Company 1984).

West Branch is classified as an ephemeral stream, meaning it flows only in direct response to snowmelt or precipitation runoff events. The West Branch alluvial system is not extensive enough to maintain streamflow by seepage of groundwater. The upper reach of this stream lies entirely within the PSO Tract area and its confluence with Little Youngs Creek is approximately one mile downstream (east) of the PSO Tract area.

The drainage area of Little Youngs Creek is approximately 17 square miles and the mean annual runoff is roughly 1,300 ac-ft. The entire drainage area of West Branch is situated in Wyoming and it is approximately two square miles in area. The mean annual runoff from the West Branch is roughly 150 ac-ft. Because no long-term streamflow data are available for Little Youngs Creek or West Branch, an indirect hydrologic correlation method was used to estimate the mean annual flows. Measured regional streamflows, precipitation records, and drainage basin characteristics were used to estimate the unit annual discharge for the Little Youngs Creek drainage basin.

In 1975, prior to any mining activities at the PSO No. 1 Mine, water samples were collected from Little Youngs Creek and West Branch to document baseline surface water quality in the general vicinity of the mine site (Ash Creek Mining Company 1984). Local surface waters were characterized as moderately alkaline, very hard, and slightly turbid. Calcium and magnesium were the predominant cations while bicarbonate and sulfate were the major anions. The SAR was less than 1.0, indicating that the water is suitable for irrigation on all types of soils. Concentrations of nutrients were low indicating that upstream input of organic materials does not occur; however, relatively high fecal coliform bacteria values indicated that either domestic or animal wastes were entering the streams upstream from the mine. Surface water quality is usually unsuitable for domestic uses without treatment, but suitable for most agricultural uses, livestock, and wildlife.

Flows and water quality are currently monitored on Little Youngs Creek by P&M both upstream and downstream of the reclaimed PSO No. 1/Ash Creek Mine site. These monitoring results are reported to the WDEQ/LQD annually (P&M 2001). In general, the TDS concentrations show no appreciable increase from upstream to downstream indicating that the reclaimed area has no apparent effect on surface water quality.

3.4.6.3 Water Rights

Records of the Wyoming SEO and the Montana DNRC were searched in March 2003 for groundwater rights within a three-mile radius of the federal coal lands being considered for exchange. This information would be required for a WDEQ mine permit application. SEO and DNRC data indicate there are 516 permitted water wells within three miles of the federal coal being considered for exchange, of which 500 are within Wyoming and 16 are within Montana. Of the 500 permitted wells in Wyoming, 85 are related to surface coal mining. There are 37 mine-related monitoring wells in Montana, although the DNRC does not require a Certificate of Water Right for scientific monitoring wells, as there is no beneficial use of water. Of the 431 other wells in Wyoming and Montana that are not related to surface coal mining, 38 are permitted for stock watering, 16 are permitted for domestic use, 18 are permitted for stock watering and domestic use, 224 are permitted for both CBM development and stock watering, 58 are permitted for CBM development only, 71 are permitted for both irrigation and CBM development, three are permitted for stock, miscellaneous, and CBM development, two are permitted for miscellaneous, and one is permitted for stock and irrigation use. In addition, a total of 67 CBM wells currently exist in Montana that are within a three-mile radius of the federal coal being considered for exchange. Similar to monitoring wells, the State of Montana has ruled that a Certificate of Water Right is not required for a CBM well unless the discharge water is put to a beneficial use (i.e., stock watering). A listing of the 431 permitted wells that are not related to mining is presented in Appendix G.

Wyoming SEO and Montana DNRC records were also searched for surface water rights within one-half mile upstream and three miles downstream of the federal coal lands being considered for exchange. Again, this information would be required for a WDEQ mine permit application. SEO and DNRC records indicate 98 permitted surface water rights within the search area, of which 89 are within Wyoming and nine are within Montana. Five of the 89 surface water rights in Wyoming are held by the PSO No. 1 Mine/Ash Creek Mining Company for industrial and miscellaneous uses. The 93 non-coal mine surface water rights are primarily for stock watering and irrigation uses, with a small number of domestic, industrial, miscellaneous, temporary, and wildlife uses. A listing of the 93 non-coal mine surface water rights is included in Appendix G.

3.4.7 Alluvial Valley Floors

WDEQ regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Prior to leasing and mining, AVFs must be identified because SMCRA restricts mining activities which affect AVFs that are determined to be significant to agriculture. In accordance with 30 CFR 822.12, impacts to designated AVFs are prohibited 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 the essential hydrologic functions of the AVF must be reestablished 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.

The portion of Little Youngs Creek that was within the PSO No. 1/Ash Creek Mine permit area was investigated for the presence of an AVF (Ash Creek Mining Company 1984). This area is not on the PSO Tract proposed for exchange, but it could be affected by mining operations on private coal if the exchange is completed. The investigation concluded that portions of Little Youngs Creek constitute an AVF within the northeastern portion of the PSO No. 1 Mine permit area, specifically where Little Youngs Creek crosses the NE¼ of Section 22, T.58N., R.84W. The two AVF components that led to this conclusion are the presence of unconsolidated stream-laid deposits and the existence of irrigation agricultural activities.

Three essential hydrologic functions were identified for restoration during the reclamation of the Ash Creek Mine: channel stability, alluvial underflow, and flood irrigation. These three essential hydrologic functions were reestablished upon the mine's final reclamation. Because the PSO No. 1 Mine's pit did not disturb the majority of alluvial valley fill on Little Youngs Creek, groundwater underflow through the alluvium was not significantly changed. Irrigation ditches that were disturbed but had been neglected several years prior to disturbance were renovated, thus reestablishing the potential for flood irrigation. Reclaimed channels were constructed to safely convey the probable discharges at non-erosive velocities, thus reestablishing channel stability.

If P&M acquires the federal coal in the PSO Tract as proposed and applies for a permit to mine, the mine permit application submitted to WDEQ must include an investigation determining the presence of AVFs within the proposed permit area. As depicted by the schematic mine plan for P&M's proposed Ash Creek Mine (Figure 2-2), portions of West Branch, Little Youngs Creek, and Youngs Creek would be within the permit area. West Branch is within the PSO Tract. Little Youngs Creek and Youngs Creek are outside of the PSO Tract but would be disturbed if the privately-owned coal adjacent to the PSO Tract is mined as shown in Figure 2-2. Ash Creek and its alluvial valley would be outside of the mined areas; therefore, it is unlikely that AVF investigations of the Ash Creek valley would be necessary. Specific declarations of the presence of AVFs and their significance to agriculture within the proposed Ash Creek Mine permit area would be made by WDEQ.

3.4.8 Wetlands

Wetlands are defined as areas inundated or saturated with surface or ground water 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 (40 CFR 230.3 and 33 CFR 328.3). Wetlands generally include swamps, marshes, bogs, and similar areas. Jurisdictional wetlands are those wetlands that are under regulatory authority of the EPA and the COE pursuant to Section 404 of the Clean Water Act. Such wetlands must exhibit all three diagnostic characteristics including hydrophytic vegetation, hydric soils, and wetland hydrology under normal circumstances.

The presence of jurisdictional wetlands on a mine property does not preclude mining but does entail special permitting procedures to assure that after mining is completed there would be no net loss of wetlands. A wetland delineation must be done according to approved procedures (COE 1987) and submitted to the COE for verification as to the amounts and types of jurisdictional wetlands present. 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 at least an equal number and type of wetlands.

General jurisdictional wetland inventories were completed in 2001 on the federal coal lands considered for exchange. Formal inventories would be completed and submitted to the COE as a required part of the mine permit application. The wetland delineations are completed in accordance with the procedures and criteria contained in the COE 1987 Wetland Delineation Manual. A total of 15.32 acres of waters of the U.S. have been identified, of which 6.20 acres are estimated to be jurisdictional wetlands. The remaining 9.12 acres are classified as other waters of the U.S. The 6.20 acres of wetlands are associated primarily with man-made stock ponds while the 9.12 acres of other waters are associated with stockponds (6.3 acres) and ephemeral stream channels (2.82 acres).

3.4.9 Vegetation

A preliminary vegetation baseline study on the federal coal lands being considered for exchange was completed in 2001. The study area includes part or all of Sections 15, 20, 21, 22, 23, 27, 28, 29, 33, and 34, T.58N., R.84W. The vegetation communities in this area were delineated and mapped.

A total of three vegetation types have been identified and mapped within the PSO Tract. Table 3-10 presents the acreage and percent of the area encompassed by each vegetation type within the PSO Tract. The vegetation types include Mixed Shrub Grass, Ponderosa Pine, and Rough Breaks. These vegetation types are described as follows:

The **Mixed Shrub Grass** vegetation type is the largest mapping unit identified within the PSO Tract, occupying approximately 1,592.1 acres, or 77.85 percent of the study area. This vegetation type typically occurs in upland positions throughout the study area. Major perennial species include big sagebrush (*Artemisia tridentata*), western wheatgrass (*Agropyron smithii*), bluebunch wheatgrass (*Agropyron spicatum*), needle-and-thread (*Stipa comata*), broom snakeweed (*Gutierrezia sarothrae*), and fringed sagewort (*Artemisia frigida*). Japanese chess (*Bromus japonicus*) is an annual species that is common on this vegetation type.

The **Ponderosa Pine** vegetation type is the second largest mapping unit comprising approximately 330.8 acres, or 16.18 percent of the area. This vegetation type occurs throughout the study area on north facing rocky slopes, outcrops, and smaller foothills. Along with ponderosa pine (*Pinus ponderosa*) several other plant species dominate this vegetation type. These species include skunkbush sumac (*Rhus trilobata*) and Rocky Mountain juniper (*Juniperus scopulorum*). The understory vegetation is dominated by bluebunch wheatgrass, broom snakeweed, fringed sagewort, green needlegrass (*Stipa viridula*), and hairy goldenaster (*Heterotheca villosa*).

The **Rough Breaks** vegetation type occurs throughout the study area and makes up approximately 122.1 acres, or 5.97 percent of the study area. This vegetation type occurs on steep sideslopes and rocky outcrops. Common species for this vegetation type include big sagebrush, rubber rabbitbrush (*Chrysothamnus nauseosus*), broom snakeweed, winterfat (*Ceratoides lanata*), and fringed sagewort. Perennial grasses include bluebunch wheatgrass,

Table 3-10. Vegetation Types Identified and Mapped Within the PSO Tract.

Vegetation Type	Acres	Percent of Area
Mixed Shrub Grass	1592.1	77.85
Ponderosa Pine	330.8	16.18
Rough Breaks	122.1	5.97
Total	2,045.0	100.00

western wheatgrass, and needle-and-thread.

3.4.9.1 Threatened, Endangered, Proposed, and Candidate Plant Species, BLM Sensitive Species, and State Species of Special Concern

Refer to Appendix E.

3.4.10 Wildlife

3.4.10.1 Wildlife Resources

Background information on wildlife in the vicinity of the PSO Tract area was drawn from several sources including: Ash Creek Mine Annual Reports, WGFD and USFWS records, and personnel contacts with WGFD and USFWS biologists.

Wildlife monitoring has been ongoing for the P&M Ash Creek Mine since the mine was permitted. The program was designed to meet the WDEQ/LQD and federal requirements for the annual monitoring and reporting of wildlife activity on coal mining areas. Detailed procedures and site-specific requirements have been carried out as approved by WGFD and USFWS. The annual monitoring studies for a mine permit area of this size (less than 500 acres) involve the measurement and assessment of selected wildlife species, and studies are not as detailed as baseline inventories or monitoring programs for larger mines. The monitoring program has continued in accordance with Appendix B of the WDEQ/LQD Rules and Regulations. For the Ash Creek Mine, all wildlife species coincidentally observed during wildlife surveys are recorded. Any signs of species that are not visually sighted are also recorded.

The most recent annual wildlife monitoring program for the P&M Ash Creek Mine was conducted by Intermountain Resources of Laramie, Wyoming and the results are included in the 2002 *Ash Creek Mine Annual Mining and Reclamation Report*, which was submitted to the WDEQ/LQD (P&M 2002). Some of the 2003 surveys have been conducted but the results of those surveys are not yet available.

Baseline and monitoring surveys cover large perimeters around each mine's permit area. Consequently, a majority of the PSO Tract area has been surveyed during annual wildlife monitoring for the P&M Ash Creek Mine by Intermountain Resources. In addition, the entire PSO Tract area has undergone a wildlife survey, which was completed in July of 2000 through July of 2001 by Intermountain Resources.

The PSO Tract area and adjacent lands consist primarily of uplands. The topography is level to rolling, with some areas sloping to steeply sloping. Mixed shrub grass habitat dominates the area. This habitat is characterized by level ground to rolling hills that are well vegetated. Ponderosa pine and rough breaks habitats also occur within the general area. All streams on the study area are ephemeral or perennial. Several ponds exist on the PSO Tract, with all of them being stockponds. Ponderosa pine trees exist on the foothills and steep rocky slopes of the proposed exchange area.

3.4.10.2 Big Game

Three big game species occur in the vicinity of the PSO Tract area: pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*Odocoileus virginianus*). WGFD big game herd unit maps generally show this area is out of the normal white-tailed deer range. The WGFD has classified the tract as yearlong and winter-yearlong pronghorn range. The vast majority of the tract is classified as winter-yearlong deer range. No crucial big game habitat or migration corridors are recognized by the WGFD for this area.

Pronghorn are, by far, the most common big game species in the area. The study area is within the Clearmont Herd Unit with approximately 1,000 acres within yearlong range and the remaining 1,045 acres within winter-yearlong range. None of the study area or other areas within two miles have been classified as crucial or critical pronghorn habitat. The yearly big game monitoring surveys completed for the adjacent P&M Ash Creek Mine also covered a majority of the proposed exchange area. The Ash Creek Mine surveys indicated that pronghorn are not abundant on the area during the spring, summer, or fall but frequent the site in normal winters and move out of the area in harsh winters when deep snows accumulate on the site.

The PSO Tract area is located within the northeastern portion of the WGFD North Bighorn Mule Deer Herd Unit. The WGFD maps show the PSO Tract area is totally within winter-yearlong mule deer range. Crucial or critical mule deer ranges do not occur on or within several miles of the PSO Tract area. The P&M Ash Creek Mine survey indicated the area is a yearlong use area and mule deer are scattered throughout the site and do not concentrate on the area during any particular season.

White-tailed deer are uncommonly observed on the PSO Tract area which is within the WGFD Powder River White-tailed Deer Herd Unit. The site is generally considered out of normal white-tailed deer range but the WGFD classified the adjacent areas associated with Ash Creek and Little Youngs Creek as yearlong habitat. No crucial white-tailed deer range exists on or within several miles of the PSO Tract area.

3.4.10.3 Other Mammals

A variety of small and medium-sized mammal species occur in the vicinity of the PSO Tract area. These include predators and furbearers, such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), and raccoon (*Procyon lotor*). Prey species include rodents such as mice, voles, chipmunks, and black-tailed prairie dogs (*Cynomys ludovicianus*), and lagomorphs (jackrabbits and cottontails). These species are cyclically common and widespread throughout the region. They are important prey items for raptors and other predators. Surveys for prairie dog towns were conducted on the PSO Tract area and adjacent lands. Several small prairie dog towns were observed on the PSO Tract area. These prairie dog towns are located in the NE¼ of Section 21, the NW¼ of Section 22, the SE¼ of Section 20, the NE¼ of Section 29, and the NW¼ of Section 27, T.58N., R.84N. (Figure 3-12). Several other prairie dog towns are known to exist within several miles of the PSO Tract area (see additional discussion in Appendix E).

The black bear (*Ursus americanus*) and mountain lion (*Felis concolor*) have been recorded in the area but are not common.

3.4.10.4 Raptors

Numerous raptor species have been observed on or adjacent to the PSO Tract area. These species include the golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), northern harrier (*Circus cyaneus*), Swainson's hawk (*Buteo swainsoni*), red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk (*Buteo regalis*), rough-legged hawk (*Buteo lagopus*), prairie falcon (*Falco mexicanus*), Cooper's hawk (*Accipiter cooperii*), American kestrel (*Falco sparverius*), turkey vulture (*Carthartes aura*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*), and burrowing owl (*Athene cunicularia*). Figure 3-12 shows the locations of intact raptor nest sites that have been identified since monitoring began for PSO No. 1/P&M Ash Creek Mine, which includes most of the PSO Tract area. A total of six raptor species have been identified nesting within one mile of the PSO Tract area. These species include the great horned owl, red-tailed hawk, golden eagle, prairie falcon, Cooper's hawk, and American kestrel. In 2001, six nest sites were active and included two golden eagle nests, three red-tailed hawk nests, and one great horned owl nest. An undetermined number of American kestrel nests were active.

Only two raptor species have been recorded nesting on the actual federal coal lands being considered for trade. The red-tailed hawk and great horned owl successfully fledged young on the site in 2001.

3.4.10.5 Game Birds

Several upland game bird species have been observed on the PSO Tract area or adjacent lands, including sage grouse (*Centrocercus*

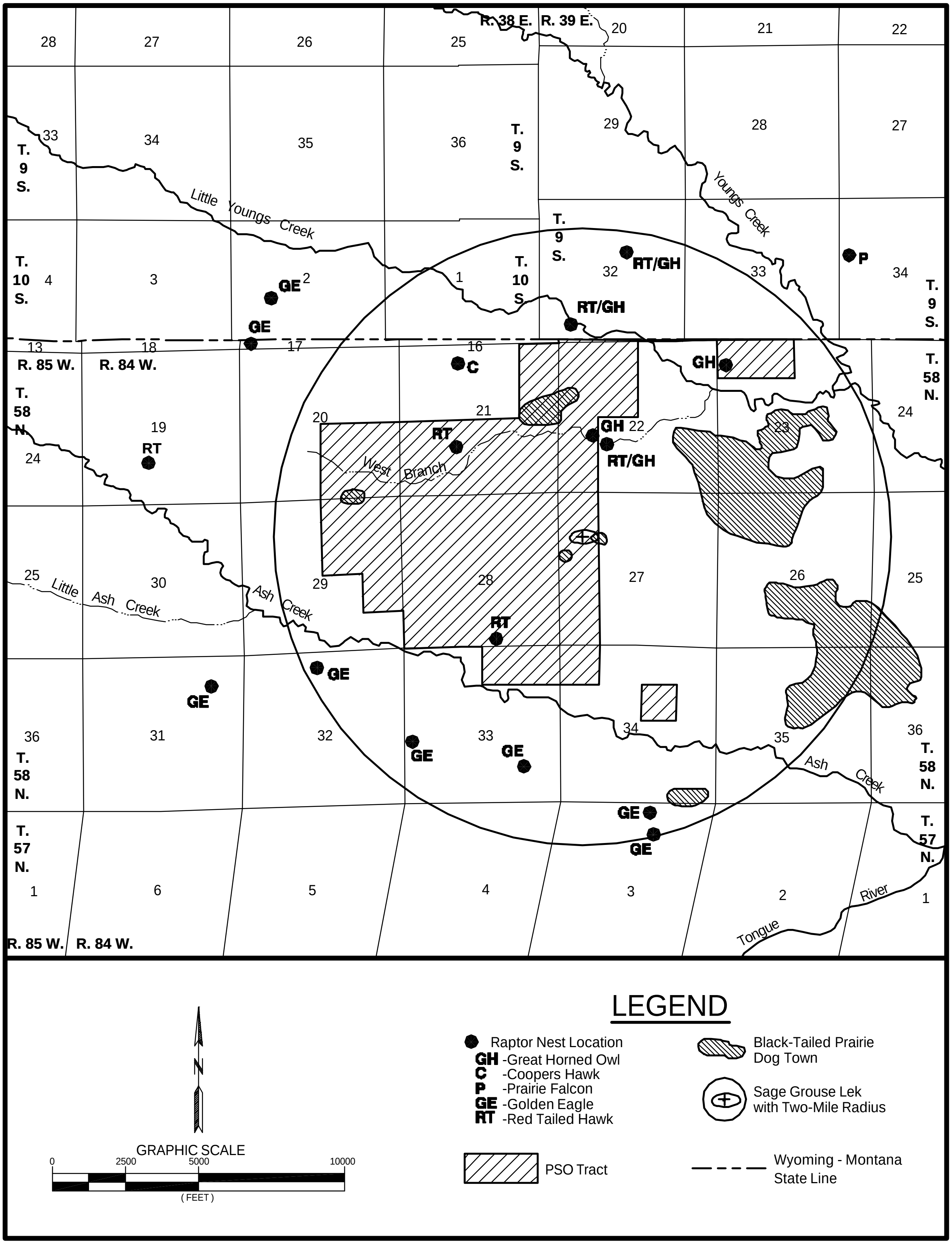


Figure 3-12. Raptor Nest Sites, Sage Grouse Leks, and Prairie Dog Towns Within and Adjacent to the PSO Tract.

urophasianus), sharp-tailed grouse (*Tympanuchus phasianellus*), migratory mourning doves (*Zenaida macroura*), wild turkey (*Meleagris gallopavo*), pheasant (*Phasianus colchicus*), and gray partridge (*Perdix perdix*). The mourning dove only inhabits the area for breeding and reproduction from late spring to early fall.

The sage grouse is a yearlong resident and has been found on the PSO Tract area. Sage grouse lek surveys in April and May of 2001 and in March and April of 2002 identified an active sage grouse strutting ground within the federal coal lands being considered for trade. Figure 3-12 shows the location of this active lek. The two-mile radius from this lek, which research identified as the area in which most hens would nest, covers most of the federal coal lands being considered for trade. The lek is located in the NW¼ of Section 27, T.58N., R.84W. This particular lek has been surveyed by Intermountain Resources since 1979 as part of the annual wildlife monitoring program for the Ash Creek Mine and the results have been submitted to WDEQ/LQD in the *Ash Creek Mine Annual Mining and Reclamation Report*. This sage grouse lek has been active intermittently since 1979, with the maximum number of males recorded at 31 in 1982. Survey data from 1987 through 1996 indicated that the lek had been abandoned. During the March and April 2002 survey, a maximum of 18 strutting males was recorded, approximately the same number that was recorded in 2001. The lek was most recently surveyed in 2003, but the results of that survey are not yet available.

The sharp-tailed grouse is a yearlong resident and was also found on the PSO Tract. Several sharp-tailed grouse lek sites have been recorded in the past but these leks were inconsistently used and none were consistently active in 2001 and 2002.

The wild turkey and pheasant were commonly encountered on the area while the gray partridge was uncommon.

<u>3.4.10.6 Migratory Bird Species of Management Concern in Wyoming</u>

Table 3-11 provides a list of the 40 Migratory Bird Species of Management Concern in Wyoming that the USFWS will use exclusively for reviews concerning existing and proposed coal mine leased land (USFWS 2002a). This listing was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2000). The regional status and expected occurrence, historical observations, and breeding records on and near the PSO Tract for each listed species are included in Table 3-11. Of the 40 species listed in Table 3-11, 13 species have historically been observed within the PSO Tract area. The species commonly observed nesting in the area include the greater sage-grouse, Brewer's sparrow, lark bunting, loggerhead shrike, vesper sparrow, and lark sparrow. The ferruginous hawk, Swainson's hawk, long-billed curlew, burrowing owl, upland sandpiper, and black-billed

Table 3-11. 40 Migratory Bird Species of Management Concern in Wyoming for Coal Mines: Their Regional Status, and Expected and Actual Occurrence on or Near the PSO Tract.

Species	**Seasonal Status/Breeding Records in Northeastern WY[1]**	**Expected Occurrence on and in Vicinity of the PSO Tract[2]**	**Historical Sighting Records and Breeding Status in Vicinity of the PSO Tract[3]**
LEVEL I (species need conservation action)			
Mountain plover	Summer/Breeder	Rare	None
Greater sage-grouse*	Resident/Breeder	Common	Common/Breeder
McCown's longspur	Summer/Breeder	Common	None
Baird's sparrow	Summer/Observed	Uncommon	None
Ferruginous hawk*	Summer/Breeder	Common	Occasional
Brewer's sparrow*	Summer/Breeder	Common	Common/Breeder
Sage sparrow	Summer/Breeder	Uncommon	None
Swainson's hawk*	Summer/Breeder	Common	Occasional
Long-billed curlew*	Summer/Observed	Uncommon	Few sightings
Short-eared owl	Summer/Breeder	Common	None
Peregrine falcon	Resident/Observed	Uncommon Migrant	None
Burrowing owl*	Summer/Breeder	Uncommon	Few sightings, Breeder
Bald eagle*	Resident/Breeder	Seasonally Common	Frequent in winter
Upland sandpiper*	Summer/Breeder	Uncommon	Uncommon/Breeder
LEVEL II (species need monitoring)			
Cassin's kingbird	Never Recorded	Rare	None
Lark bunting*	Summer/Breeder	Common	Common/Breeder
Dickcissel	Summer/Observed	Uncommon	None
Chestnut-collared longspur	Summer/Breeder	Uncommon	None
Black-chinned Hummingbird	Never Recorded	Rare	None
Pygmy nuthatch	Never Recorded	Rare	None
Marsh wren	Never Recorded	Rare	None
Western bluebird	Summer/Breeder	Uncommon	None
Sage thrasher	Summer/Breeder	Uncommon	None
Grasshopper sparrow	Summer/Breeder	Uncommon	None
Bobolink	Summer/Observed	Uncommon	None
Common loon	Summer/Observed	Uncommon	None
Black-billed cuckoo*	Never Recorded	Uncommon	Few sightings
Red-headed woodpecker	Summer/Breeder	Uncommon	None
Yellow-billed cuckoo	Summer/Observed	Rare	None
Eastern screech-owl	Never Recorded	Rare	None
Western screech-owl	Never Recorded	Rare	None
Western scrub-jay	Never Recorded	Rare	None
Loggerhead shrike*	Summer/Breeder	Common	Occasional/Breeder
Vesper sparrow*	Summer/Breeder	Common	Common/Breeder
Lark sparrow*	Summer/Breeder	Common	Common/Breeder
Ash-throated flycatcher	Summer/Observed	Rare	None
Bushtit	Never Recorded	Rare	None
Merlin	Resident/Observed	Uncommon	None
Sprague's pipit	Never Recorded	Uncommon Migrant	None
Barn owl	Summer/Observed	Very Rare	None

1 Compiled from Luce, et al. (1999), for Sheridan County.
2 Expected occurrence in the study area was based on range, history of occurrence, and habitat availability.
3 Sighting records were derived from actual occurrence on or within one-half mile of the PSO Tract.
* Species marked with an asterisk have historically been recorded during baseline or monitoring surveys for the Ash Creek Mine.

cuckoo have not been recorded nesting on the PSO Tract but were observed as transients in the area.

The bald eagle is seasonally common and most frequently observed during the winter months. The burrowing owl is uncommon and classified as a potential breeder in the PSO Tract area. Sage grouse (greater sage-grouse), recently added to the Level I list, is common in the PSO Tract area and is classified as a common breeder (see Section 3.4.10.5). Cited as the potential limiting factor, suitable nesting habitat is scarce if not absent in the PSO Tract area for many of the Migratory Bird Species of Management Concern in Wyoming. The other species that are listed in Table 3-11 have rarely or never been recorded in the PSO Tract area.

<u>3.4.10.7 Other Species</u>

Wildlife surveys completed specifically for the PSO Tract, and surveys completed for the PSO No. 1/P&M Ash Creek Mine, have documented numerous other wildlife species that inhabit the area. All of these species are generally common inhabitants of the area and none are of specific concern to state or federal agencies. The other species observed include nine carnivores, 14 rodents, two lagomorphs, 16 waterbirds, 11 raptors, 65 other bird species, 10 herptiles, and three fish species.

Under current natural conditions the PSO Tract provides limited waterfowl and shorebird habitat. This habitat is primarily provided during spring migration in the form of ponds and streams, most of which generally dry up during the summer. Ash Creek, a perennial stream adjacent to the southern part of the PSO Tract area, can sustain limited waterfowl and shorebird populations in a very wet year. Ash Creek is typically used for irrigation purposes by the local ranchers, which in turn creates limited habitat for waterfowl and shorebirds upon these irrigated hay fields. With the addition of water being produced from CBM wells in the area, an increase in habitat for waterfowl and shorebirds will occur along all stream channels. Waterfowl and shorebird species

would use the isolated ponds and drainages filled by the CBM wells if sufficient water is established.

Fish species may be found in Ash Creek, Youngs Creek, and Little Youngs Creek, as these are perennial water sources. Little Youngs Creek may go dry for prolonged periods of time during very dry years. Fish habitat may also be created and enhanced from CBM water discharges.

<u>3.4.10.8 Threatened, Endangered, Proposed, and Candidate Animal Species, BLM Sensitive Species, and State Species of Special Concern</u>

Refer to Appendix E.

<u>3.4.11 Ownership and Use of Land</u>

The surface ownership within the PSO Tract is shown in Figure 3-13. The surface is owned by the

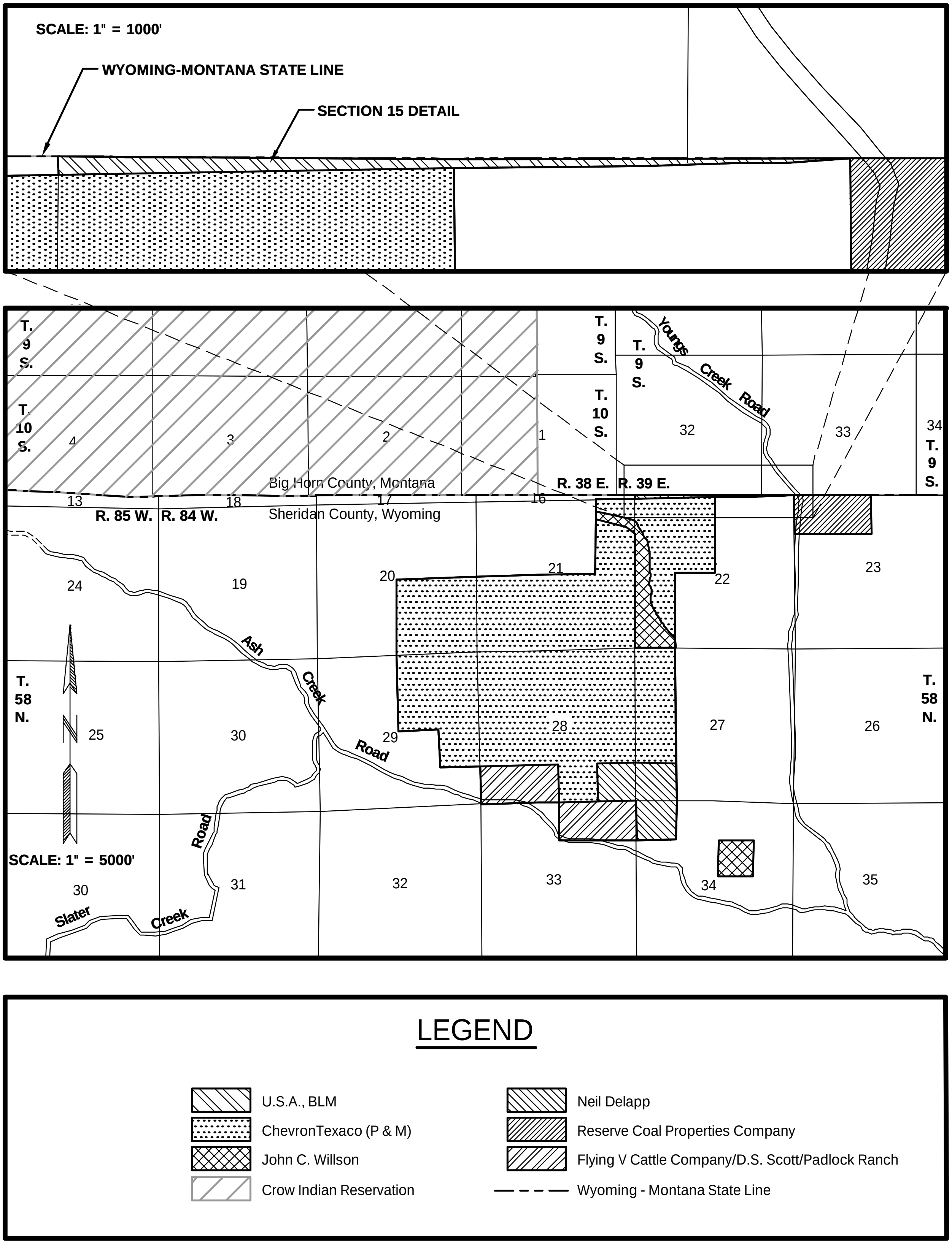


Figure 3-13. Surface Ownership Within the Boundary of the PSO Tract.

ChevronTexaco Corporation (P&M), John C. Willson, Reserve Coal Properties Company, Flying V Cattle Company / D.S. Scott / Padlock Ranch, Neil DeLapp, and the federal government. The federal government owns all of the coal estate included in the tract, but the federal surface estate, which is shown in the detail map in Figure 3-13, is 6.41 acres in Section 15, T.58N., R.84W. The principal land use within the tract is domestic grazing and wildlife habitat.

Areas of surface disturbance on the federal coal lands being considered for exchange are off road, two-track vehicle trails associated with livestock management activities and the disturbance associated with the five CBM wells that have been drilled (as of March 2003) and the potential disturbance with the 14 CBM wells that are currently permitted. The Ash Creek Road and the Youngs Creek Road, pass briefly along the edges of the federal coal lands (Figure 3-13).

The oil and gas rights within the boundary of the federal coal being considered for exchange are both federally and privately owned (Figure 3-14). The majority (about 77 percent) are private. The federally owned oil and gas rights included in the tract are leased, and a list of the lessees of record for those federal oil and gas leases is included as Table 3-12.

WOGCC records show that no conventional oil and gas wells have been completed on the federal coal lands being considered for exchange. As discussed in Section 3.4.3, there is nearby production in the Ash Creek and Ash Creek South Oil Fields, which are located in T.10S., R.38E., Section 3, Big Horn County Montana, and in T.58N., R.84W., Sections 29, 30, 31, and 32, Sheridan County, Wyoming. These two fields, which were discovered in 1952, have produced approximately 1.7 million barrels of oil and 27 million barrels of water. Most of the wells have been plugged and abandoned. Presently there are six wells completed in conventional oil reservoirs that are still producing; one in Section 29 (SW¼SW¼), two in Section 30 (SE¼SE¼ and SW¼SE¼), two in Section 31 (NE¼NE¼ and NW¼SE¼), and one in Section 32 (NW¼NW¼). No conventional oil field support facilities for the Ash Creek and Ash Creek South Oil Fields are located within the boundary of the federal coal lands being considered for exchange.

The Supreme Court has ruled that the CBM rights belong to the owner of the oil and gas rights (98-830). Therefore, the oil and gas lessees have the mineral rights to develop the CBM in the coal as well as the right to develop conventional oil and gas on the tract.

CBM is currently being produced within and adjacent to the PSO Tract. The approved well spacing pattern is one well per coal seam per 80 acres for development of CBM resources in the PRB. There would potentially be 78 CBM well locations on the federal coal lands being considered for exchange if all of the 80-acre spacing units within the tract are drilled and completed in all

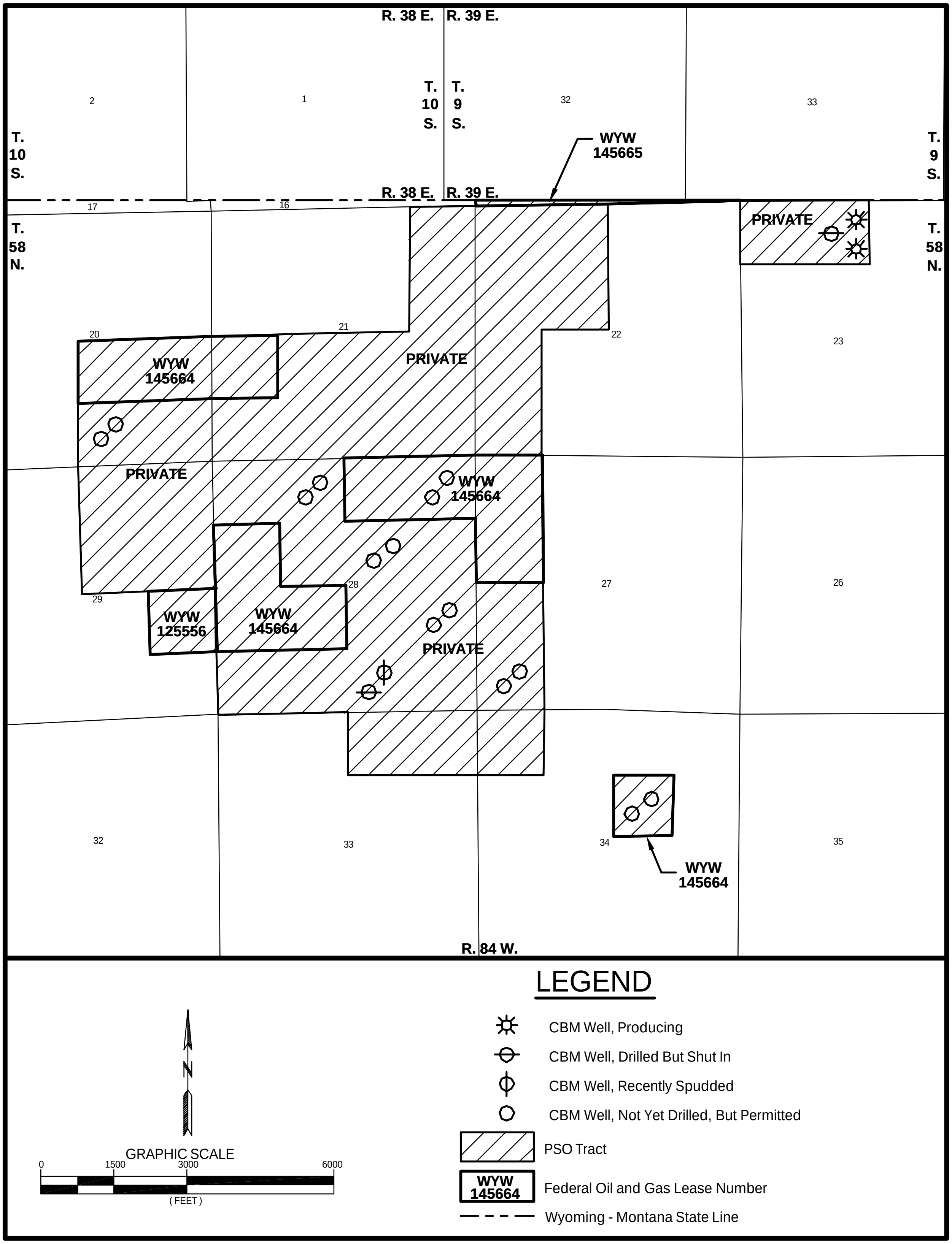


Figure 3-14. Oil and Gas Ownership Within the Boundary of the PSO Tract.

Table 3-12. Oil and Gas Ownership on the Federal Coal Lands Being Considered for Exchange.

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

Location (T.58N., R.84W.)	**Lease Number**	**Expiration Date**	**Lessees of Record**
Section 15 Lot 1	WYW 145665	7/31/2008	Louis S. Madrid Trust
Section 20 NE¼SE¼, NW¼SE¼ Section 21 NW¼SW¼ Section 27 NW¼NW¼, SW¼NW¼ Section 28 NE¼NE¼, NW¼NE¼, SW¼NW¼, NW¼SW¼, SW¼SW¼ Section 34 SW¼NE¼	WYW 145664	7/31/2008	J.M. Huber Corp.
Section 29 NE¼SE¼	WYW 125556	10/31/2001	ABO Petro Corp. Myco Industries Inc. Yates Drilling Co.

Note: For the rest of the federal coal lands being considered for exchange, the oil and gas rights (including CBM) are privately owned. All of the coal rights are federally owned.

of the potential coal beds. CBM development has been accelerating rapidly within and adjacent to the federal coal lands being considered for exchange since 1999. A search of the WOGCC records in March 2003 revealed that there were 191 CBM wells completed or permitted to be drilled within T.58N., R.84W and 106 of those wells were in production. At the time, five CBM wells had been drilled (two producing, two shut-in, and one spudded) and 14 additional wells have been permitted to be drilled within the boundary of the federal coal being considered for exchange (Figure 3-14). A concurrent search of the Montana BOGC revealed that there were no CBM wells drilled or permitted to be drilled within T.9S., R.38E. and T.10S., R.38E., but 67 CBM wells have been completed within three miles of the PSO Tract in T.9S., R.39E. Sixty of these 67 existing CBM wells are currently in production, four are shut in, and three are spudded. Nine more wells are permitted to be drilled in this same three-mile radius area. As CBM wells are drilled and completed on or adjacent to the PSO Tract, support facilities (i.e., powerlines, pipelines, and compressor stations) must be constructed to produce and transport the CBM and the associated produced water.

Coal mining has been and continues to be a significant land use in the general area of the PSO Tract. The thick Fort Union coal deposits present in the Sheridan coal field have been mined extensively by either underground or surface mining methods along the Tongue River since the late 1800s. Most of the old underground mines were located near the confluence of Goose Creek and Tongue River, roughly four miles south of the PSO Tract (Figure 3-1). Underground mining continued on a fairly large scale into the 1940s. All underground mine portals were sealed by 1953. With the introduction of heavy equipment and the advent of surface mining techniques the first strip mine, locally called the Hidden Water Pits, opened in Sheridan County in 1944. Mining was discontinued there in the early 1950s but the pits remained open until 1985 when final reclamation was completed with AML funds. This reclaimed surface mine (called “Old Surface Coal Mine” on Figure 3-1) is located about two miles southwest of the PSO Tract.

Surface mining at the Big Horn Coal Mine, located at the confluence of Goose Creek and Tongue River, about four miles south of the PSO Tract, began in 1951. Big Horn Coal Mine’s nearest pit was about two miles south of the PSO Tract. Annual coal production from the Big Horn Coal Mine peaked in 1981 at four million tons and ended in 2000 with 38,411 tons. All coal production from Sheridan County ended with the final reclamation of the Big Horn Coal Mine in 2000. As stated previously, the PSO No. 1/Ash Creek Mine was opened in 1976 and reclaimed in 1996 after producing no coal.

Two active surface coal mining operations in Big Horn County, Montana, the Decker Coal Mine and the Spring Creek Coal Mine, are located approximately six miles and seven and one-half miles, respectively, northeast of the PSO Tract (Figure 3-1). The West Decker mine was opened in 1972, the East Decker mine was opened in 1977, and the Spring Creek mine was opened in 1979. Both the Decker and Spring Creek mines are currently producing around 10 to 11 million tons of coal annually (Claudia Furiof March 2003).

According to the *Sheridan County Growth Management Plan* (City of Sheridan 2001), the designated zoning classification for the PSO Tract is agricultural. This Comprehensive Master Plan for Sheridan and Sheridan County provides no general or specific land use goals or policies for state and federal coal leases in the county.

Big game hunting is the principal recreational use in the analysis area. The surface estate within the PRB is largely privately owned (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. Others charge an access fee, and some do not allow any access. There has been a trend over the past two decades towards a substantial reduction in lands 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 to sportsmen who desire access to these animals (WGFD 1996). Due to safety concerns, public lands contained within an active mining area are often closed to the public, further limiting recreational use. In the PRB, the 20 percent of the surface estate that is administered by BLM or USFS or the State of Wyoming is generally open to hunting if legal access is available. State school sections are normally Sections 16 and 36 of each township.

The surface of all of the lands within the boundary of the federal coal being considered for exchange, with the exception of the 6.41 acres in Section 15, T.58N., R.84W., is currently privately owned (Figure 3-13) and recreational use is allowed only with landowner permission. P&M does not allow sport hunting on their surface lands within the PSO Tract.

Pronghorn, mule deer, and white-tailed deer occur on and adjacent to the PSO Tract. Sage grouse, sharp-tailed grouse, pheasant, gray partridge, mourning dove, waterfowl, rabbit, raccoon, and coyote may also be harvested in the vicinity, and some trapping of red fox may occur. No sport fisheries exist on the PSO Tract.

Specific details regarding big game herd management objectives in the project area are contained in the *Sheridan Region Annual Big Game Herd Unit Report* (WGFD 2002).

The WGFD classifies the PSO Tract as yearlong and winter-yearlong habitat for antelope with none of the tract or areas within two miles adjacent classified as crucial or critical pronghorn habitat. Big game surveys conducted for the PSO

No. 1/P&M Ash Creek Mine have indicated that pronghorn are not abundant on the area during the spring, summer, or fall, but frequent the site in normal winters and move out of the area in harsh winters when deep snow accumulates. The PSO Tract area is within pronghorn antelope Hunt Area 15, which is contained in the WGFD Clearmont Pronghorn Antelope Herd Unit.

The Clearmont Herd is not a distinct unit as antelope are able to move in and out between Wyoming and Montana, as well as neighboring herd units to the south and east. The post-season population management objective for this herd was set in 1983 at 3,000 pronghorn. While the population is currently estimated to be above this objective, it is still below historic levels. The herd suffered substantial losses during the 1993-94 and 1996-97 winters, accompanied by poor fawn production and adult recruitment in 1994, 1997, and 2001. Favorable environmental conditions and improved fawn production during 1998 through 2000 resulted in an increased population. Nevertheless, WGFD personnel, hunters, and landowners have noticed a decline in the actual number of antelope over the past decade. Landowners and hunters have expressed a desire for more antelope in this herd unit. The desired level does not necessarily correspond to the established post-season population management objective, but is indicative of landowner preference for or tolerance or pronghorn. Landowners have restricted hunter access on their own due to decreased population levels. Most of the herd unit is private land (87 percent) with limited hunter access opportunities. Most landowners who allow hunting either charge access fees or lease their property for hunting. As a result there has been a steady decline in the number of resident hunters, as they are often reluctant to pay access fees. While all 300 licenses sold for this herd unit, only 79 percent of resident license holders hunted compared to 91 percent of nonresident license holders. This suggests very restricted access for resident license holders.

In 2001, hunters experienced significantly lower success and higher effort while hunting in this herd unit. In the years 1997 – 2001, hunters on average harvested about 218 pronghorn per year, which is about 72 percent below the previous five-year mean (1991 - 1996). In 2001, an estimated 250 hunters harvested an estimated 192 antelope from this herd unit, with about 77 percent success, up slightly from 2000, but considerably below the previous five-year average of 309 antelope.

WGFD predicts that the Clearmont Herd population likely stabilized or decreased in 2002 due to the effects of drought and reduced fawn production. CBM development is occurring throughout this herd unit. Impacts are unknown at this time, although increased roads, water discharge, vegetation disturbance, and human presence could have some significant impacts to the pronghorn habitat. As of June 2002, a total of 3,795 permits had been issued for CBM wells in

Sheridan County, with 1,900 wells drilled (WGFD 2002).

The PSO Tract area is located within the northeastern portion of the WGFD North Bighorn Mule Deer Herd Unit. The WGFD maps show the federal coal lands being considered for exchange are totally within winter-yearlong mule deer range. Crucial or critical mule deer ranges do not occur on or within several miles of the PSO Tract. Big game surveys conducted for the PSO No. 1 Mine have indicated that area is a yearlong use area and mule deer are scattered throughout the site and do not concentrate on the PSO Tract area during any particular season. The PSO Tract is in mule deer Hunt Area 24, part of the North Bighorn Mule Deer Herd Unit, which also includes Hunt Areas 25, 27, 28, 50, 51, 53, and 159. The North Bighorn Mule Deer Herd Unit encompasses approximately 2,568 square miles, much of which is public land managed by the USFS and the BLM, although Hunt Area 24 contains predominantly private lands with limited hunting opportunities, especially for resident hunters. Private lands are fairly restrictive and access fees are common, resulting in high hunting pressure on public lands. A wildfire (the Thunder Child Range Fire) burned approximately 5,200 acres (roughly 4,850 acres of private land and 350 acres of public land) in Hunt Area 24 during the summer of 2001. In 2001, 1,610 mule deer were harvested from the North Bighorn Mule Deer Herd Unit by an estimated 2,736 resident and 1,666 non-resident hunters. Hunter success was 37 percent overall, down slightly from 2000. Resident hunter success (28.9 percent) was considerably less than non-resident success (49.1 percent), suggesting a decrease in deer numbers on public lands where residents generally have access to hunt.

Since 1996 the post-season population management objective for the North Bighorn Mule Deer Herd Unit has been 25,000. WGFD's 2001 post-season population estimate of 20,000 was about 20 percent below the desired objective. Management in most of the herd is to increase deer numbers, and the 2002 post-season population is estimated to increase to about 21,300 deer. Continued harvest strategies are designed to allow this population to increase toward the objective (WGFD 2002).

White-tailed deer are uncommonly observed on the PSO Tract area, which is within the WGFD Powder River White-tailed Deer Herd Unit. The site is generally considered to be out of normal white-tailed deer range, but the WGFD classified the adjacent areas associated with Ash Creek and Little Youngs Creek as yearlong habitat. No crucial white-tailed deer range exists within several miles of the PSO Tract area. The PSO Tract is in white-tailed deer Hunt Area 24, part of the Powder River White-tailed Deer Herd Unit, which encompasses a large portion of north-central Wyoming and also includes Hunt Areas 17, 19, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 163, and 169. The total area of the Powder River White-tailed Deer Herd Unit is 8,610 square miles, but only about 880 square miles (10 percent) is considered occupied habitat. Most white-tailed deer are found along riparian areas, agricultural lands, and mountain shrub communities, the majority of which are on private lands. Private lands make up about 88 percent of the delineated occupied habitat. WGFD's management strategy for white-tailed deer is to manage numbers based on landowner tolerance and access. Urban development is a major problem with white-tailed deer management in Sheridan County. Subdivisions in Sheridan County are generally in areas currently inhabited by whitetails. In 2001, 2,300 white-tailed deer were harvested from this herd unit, a decrease of about 400 animals from 2000 by an estimated 3,116 resident and 1,176 non-resident hunters. The population management objective for this herd unit is 8,000 deer. Generally, the population of white-tailed deer has been expanding during the past several years and it is estimated that the herd has exceeded the objective by as much as 100 percent during recent years. Harvest strategies are designed to limit the growth of this herd unit, although WGFD feels that they will not be able to reduce this population to objective with only harvest (WGFD 2002).

3.4.12 Cultural Resources

Cultural resources are defined as the physical remains of past human activity, generally inclusive of all manifestations more than fifty years old. Cultural resources can be classified as artifacts, features, sites, districts or landscapes. The goal of cultural resource management is the conservation of archaeological and historical remains and information for research, public interpretation and enjoyment, and for appreciation by future generations.

Prehistoric resources are physical locations with remains that are the result of human activities occurring prior to written records. Historic resources are remains left by human activity after written records were common. These resources are most commonly recorded as sites: clusters of artifacts and/or features with definable boundaries, or as isolated artifacts. Cultural resources, both historic and prehistoric, are often termed "historic properties" in regulatory literature.

Environment

The study area for heritage resources encompasses an area of approximately 3,520 acres which is privately owned by P&M. The study area is about 10 air miles north of Sheridan, Wyoming, just south of the Montana border. It is encompassed by an area about 2.25 miles north-south by 4.75 miles east-west. The study area lies within the watersheds of Ash Creek and Little Youngs Creek, both tributaries of the Tongue River. The area lies on the southern edge of what archaeologists refer to as the "Pine Breaks" region, an area which extends roughly from the Musselshell River in central Montana southeastward to the western foothills of the Black Hills.

The Pine Breaks has been distinguished from neighboring areas on the plains by its more rugged topography, a relatively abundant fuel and water supply, and by its more diverse ecology which provides a variety of opportunities for resource procurement (Fredlund 1981a). The drainages have riparian environments with a wide variety of flora. The uplands area includes patches of open grassland and ponderosa pine forest. A geological phenomenon, important to archaeology in the Pine Breaks, is the abundance of the lithic material *porcellanite*, created by underground coal fires which thermally metamorphosed surrounding shales and sandstones. Porcellanite is by far the most abundant lithic material encountered in the region and was widely used for stone tool manufacture.

Sandstone from the Tongue River member of the Fort Union Formation is exposed in several places within the project area. The sandstone outcrops commonly form small bluffs along the steeper slopes. In places, cavities have been weathered into the sandstone, creating small shelters. Sandstone outcrops in the area are also associated with prehistoric rock art, including petroglyphs (carvings) and pictographs (paintings).

Existing Cultural Resources Inventory

A Class III cultural resources 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 in the NRHP. That determination is made by the managing federal agency in consultation with SHPO. Consultation with SHPO must be completed prior to approval of the MLA mining plan.

Once a Class III survey is completed, site-specific testing or limited excavation is utilized, if necessary, to gather additional data which would: 1) determine the final evaluation status of a site and/or 2) form the basis of additional work that would 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.

The goal of the inventory was to locate and evaluate for the NRHP all cultural resources 50 years and older within the study area.

A comprehensive investigation of the cultural resources within the study area which surrounds and encompasses the APE has recently been completed (Ferguson and

Meyer 2001). This includes a review of cultural inventories conducted previously in the region as well as a review of pertinent literature and records on the history and prehistory of the area. A great number of cultural resource studies have taken place in the surrounding Pine Breaks Region, primarily in conjunction with coal mining. These studies, undertaken since the 1970s, include a number of inventories very near or intersecting the current study area, along with several studies conducted a few miles to the north, associated with coal mine development near Decker, Montana. Major archaeological reports from the surrounding area which contain information relevant to the context of local historic and prehistoric resources include: Brumley and Dickerson 2000; Carmichael et al. 1979; Fox 1977; Fredlund 1977, 1979, 1981b; Gregg 1977a, 1977b, 1978; Haberman 1973; Larhen 1977; Munson 1990; Munson et al. 1992; Munson and Ferguson 1998; and Taylor et al. 1984.

Additionally, five regional archaeological overviews have been written which provide a generalized background for the area prehistory. Although the current body of archaeological data has rendered some of these overviews somewhat dated, they are presented as general references to the archaeology of the region and include: Beckes and Keyser 1983; Deaver and Deaver 1988; Fredlund 1981a; Frison 1991; and Wettstaed 1989.

Despite the great volume of work that has been done, no overviews adequately synthesize currently available data. Beckes' and Keyser's (1983) overview of the Custer National Forest includes a section on the Ashland Ranger District within the Pine Breaks. However, the incorporated data is confined almost exclusively to National Forest land. Deaver and Deaver's (1988) overview of southeastern Montana includes general information on the Pine Breaks area, with a chronological overview. Both of these studies are somewhat dated in light of subsequent investigations. Fredlund's (1981a) dissertation deals explicitly with the Pine Breaks area, but concentrates only on the Late Prehistoric Period. Benson's Butte is a multicomponent site excavated between 1972 and 1978 and located about 2.2 miles north of the current study area. The results of the excavations are summarized in Fredlund (1979). The site includes components dating from the late Paleoindian to the Late Prehistoric periods. Again, subsequent investigations have rendered some of Fredlund's findings at Benson's Butte out of date.

More recent excavations in the area are reported in Munson (1990), Brumley and Dickerson (2000), and elsewhere. Large scale inventory projects have been conducted immediately north of the current study area in Montana, including Fredlund (1981b) and Gregg (1977a). The reader is referred to the studies referenced above for additional background information.

Cultural resource inventory work, in compliance with regulations established in the 1966 National Historic Preservation Act, 36 CFR Part 800 (BLM Class III level), was conducted in the PSO Tract area, including the APE, in August 2000 (Ferguson and Meyer 2001). The pedestrian inventory covered the terrain at intervals of about 30 meters. Twenty-one sites and 14 isolated artifacts were located and recorded in the approximately 3,520 acres study area. Two prehistoric sites, 48SH1127 and 48SH1134, found during this inventory are recommended as eligible for the NRHP under Criterion D. Temporal-cultural affiliations of the recorded sites range in age from Paleoindian to Historic.

3.4.12.1 Prehistoric Resources

Prehistoric sites are classified into cultural/temporal periods based on the types of artifacts, generally projectile points, recovered on-site, and the chronometric dating of the site through techniques such as radiocarbon dating of bone or charcoal extracted from buried features at the sites. Site types are indicative of function or prehistoric activity which occurred at the site and are based on site location, types of artifacts remaining on the site and types of features observed. Cultural periods are given a temporal span, but because of the range and variation of radiocarbon dates, the dates for the beginning and end of a period may vary by several hundred years depending on the researcher and the geographic location of the site. Those given below pertain generally to the Northwestern Plains area as defined by Frison (1991), and may not strictly apply to the Pine Breaks area *per se*. For example, no diagnostic artifacts or radiocarbon dates have been documented in the Pine Breaks for the earliest portion of the Paleoindian period. Late Paleoindian components are present here, but are rare, as they are elsewhere on the Northwestern Plains.

Paleoindian Period

Occupation of the Pine Breaks area has been documented as early as 9,000 years ago (Brumley and Dickerson 2000); however, on adjacent areas of the Northwestern Plains occupation extends back some 12,000 years. This initial settlement of the high steppe environment, the Paleoindian period (12,000 - 8,500 years BP/10,000 BC - 6,500 BC), is characterized by the use of large, well-made lanceolate projectile points and the hunting of large, now-extinct bison, mammoths and other large fauna. Through time the point styles changed and, with the changing climate, the subsistence strategies of the early hunters and gatherers changed as well. The earliest dated human occupation in Wyoming is the Colby site in the Big Horn Basin, which contained Clovis points in association with at least seven mammoths which dated at ca. 9,250 BC. The Hell Gap site is a stratified Paleoindian site in the North Platte drainage which dates from 9,000 BC to 5,500 BC and exhibits changing point types from Goshen through Folsom, Midland, Agate Basin, Hell Gap, Alberta, Cody, and Frederick, and ends with a point type known as Lusk. The Carter-Kerr McGee, Agate Basin, Medicine Lodge Creek, Casper, and Sister's Hill sites and others are known Paleoindian sites in the Powder River and Bighorn Basins. Paleoindian sites are uncommon due to the passage of time and the erosional and depositional effects of various climatic changes. They are most likely to occur as out-of-context surface finds on stable landforms such as ridgetops, or deeply buried in depositional settings.

A few Paleoindian manifestations are known in the area. A Hell Gap point was collected from the Chuggy Site, 48SH1134, during the inventory of the current study area (Ferguson and Meyer 2001). Gregg (1977b) reports an isolated Hell Gap projectile point fragment found about six miles to the northeast of the study area in the Squirrel Creek watershed. Fredlund (1979) reported Eden, Browns Valley, Frederick, and "Agate Basin-like" projectile points recovered from various contexts at the Benson's Butte site, located about 2.2 miles north of the current study area.

The Archaic Period

The Archaic period (8,500 - 1,500 BP/6,500 BC- 500 AD) begins at a time when the climate was becoming generally drier than the present and ends with the climate relatively similar to the climate of today. Few sites are known in the Pine Breaks (Brumley and Dickerson 2000) and adjacent areas that date to the Early Archaic, and these few are characterized by large side-notched dart points (Deaver and Deaver 1988). As the climate stabilized around 3,500 BC, McKean lanceolate points became popular and the overall number of sites in this area increases considerably. This probably reflects a human population increase accompanying a relatively stable climatic cycle and a subsistence base and settlement pattern that changed relatively little over the next 4,000 years. Stone ring features have been dated to this time. Middle Archaic sites seem to be found in all environments. A McKean-Middle Archaic point was found at site 48SH1124 during the Ferguson and Meyer (2001) study.

The Late Archaic appears to mark another increase in the human population. The number of sites known from this period is large and there is a reliance on bison obtained in sophisticated communal kills. Three point types and three cultural complexes characterize this period: Powers-Yonkee, Pelican Lake, and Besant. Besant may be a terminal Late Archaic manifestation (i.e., associated with atlatl darts) or Late Prehistoric I manifestation (i.e., associated with the bow and arrow). In addition, Woodland ceramics are occasionally found with Besant, but no pottery is associated with the Powers-Yonkee or Pelican Lake assemblages. Pelican Lake sites are associated with arroyo bison kills and jumps while the Besant people tended to rely on corral systems. Powers-Yonkee points are associated with all three bison procurement methods (Ferguson 1993). Late Archaic sites are generally associated with high landforms with diverse vegetation (ecotones) to maximize the species in the immediate area. A Late Archaic corner-notched point was found at site 48SH1119 during the Ferguson and Meyer (2001) study.

Prehistoric and Protohistoric Periods

The Late Prehistoric period is associated with the common use of the bow and arrow and an increasing use of ceramics by the local inhabitants. It is also characterized by another increase in the number and size of sites and a wide variety of cultures moving into the area, particularly during the latter part of the period. During the early part of the Late Prehistoric (LPI), small corner-notched points and small, well made, side-notched points called Avonlea are found in the Pine Breaks and extend north from eastern Wyoming into Canada. During the latter part of the Late Prehistoric (LPII), a greater variety of point types and evidence of numerous incursions by other cultural groups into the region appears to be the norm. LPI dates from AD 500 to AD 1,100, and LPII from AD 1,100 to ca. AD 1,800 or upon evidence of Euroamerican contact. A LPI point was found at site 48SH1121 during the Ferguson and Meyer (2001) study.

Whether the increasing number of bison or socio-economic pressures from various geographic areas on the plains was the cause of the influx of tribal groups into the plains, LPII appears to be marked by northern Athabascan groups moving south, Plains Woodland and Upper Republican people moving into the plains from the east and Shoshone moving from the southwest and west. Ethnohistoric and ethnographic information suggests the presence of several tribal groups in the general area at some time during LPII: Crow, Northern Cheyenne, Shoshone, Kiowa, and Kiowa Apache. Correlating historical tribes with archaeological phases or complexes is difficult because of the widely fluctuating character of tribal territories. Reher (1979) developed an elaborate model for the changing cultural history of the area from ca. AD 1,400 to historic times, which provides more detail on historically known tribal use of the area. An isolated LPII point was found during the Ferguson and Meyer (2001) study.

Prehistoric Site Types

Prehistoric site types represented in the archaeological literature as common to the surrounding region include: lithic workshops; campsites (including the sub-types of open camp, stone circle [tipi ring] site, and rock shelter); rock art sites; bison processing sites; kill sites; lithic quarries; surface stone features (including rock alignments, cairns, etc.); vision quest/fasting beds; and fortification structures. Of greatest importance to the interpretation of sites (and most difficult to obtain) is information on subsistence, intra-site patterns, seasonality and exact dates of various activities, and occupations.

3.4.12.2 Historic Resources

Seven sites with historic components were recorded in the study area during the baseline inventory (Ferguson and Meyer 2001). The historic components are related to homesteading or stockherding and date to the period after ca. 1900. Sites with historic components include two homesteads, two cairns, two panels of graffiti, and the remains of a log structure, or possibly a tent platform, associated with either small scale logging or stock herding. The homesteads were claimed in 1909 and 1916, and neither was occupied for more than a few years (GLO Post-1908 General Land Entry Files; States 2000). No significant historic resources occur within the proposed mine plan area.

Historic Context

The study area is located on the northern edge of Sheridan County, Wyoming, approximately 10 miles north of Sheridan, historically the biggest town in the northern part of the state and the commercial center for the region. Coal mining has long been a central facet of the region's historical development. The study area is about five miles north of the vanished coal mining camps of Monarch, Carneyville (later Kleenburn), and Acme; the interurban railway that connected them in the 1910s and 1920s; and the railway main line of the historic Burlington Route (still operated by BNSF Railroad).

Several geographical contexts apply to the region – the town of Sheridan, the coal mining district, and the county – after the arrival of the railroad in 1892, which led to the period of major settlement, agricultural development, and industrial growth. Previous historical events, such as those related to the Bozeman Trail, the Indian wars of the 1860s and 1870s, and open-range livestock grazing, left few surviving marks on the landscape. Historic resources specific to the study area are limited to agricultural development, ca. 1910s-1940s.

While the arrival of the railroad made the 1890s a time of major change, the following decade saw even greater growth. Between 1900 and 1910 the population of the county more than tripled, from 5,122 to 16,324 (USDC, BC 1913). Coal mining boomed. In the corridor from six miles north to 15 miles northwest of Sheridan, operators opened several new mines and adjacent camps between 1903 and 1907. To carry passengers and express between Sheridan and the several coal mine camps, an electric interurban railway was built from Sheridan to Monarch, a distance of 11 miles. Completed in 1912, it lasted for 14 years until replaced by busses (Kuzara 1977). Coal mining provided income to the area’s farmers. Some found occasional work at the mines or sold timber to the mines for use as props underground.

Agriculture in Sheridan County rapidly expanded from 1900 to 1910. The improved land in farms grew 70 percent, from 55,567 to 95,368 acres. Sheridan County led the state in production of wheat and barley. The harvest of wheat grew 60 percent during the decade and the output of barley tripled (USDI, Census Office 1902; USDC, BC 1913). The growth continued through the 1910s. The major agricultural commodities consisted of livestock (cattle, sheep, and horses), feed crops (hay, oats, and barley), wheat, and sugar beets. Farmers in the study area could, with one day's round trip travel by team and wagon, easily reach the coal camps along the interurban and Burlington main line, and with a longer day on the road, get to the town of Sheridan (USDA 1925).

Industrial facilities in Sheridan processed some of the crops grown locally. Of several flour mills, the last and largest ground wheat from 1921 until 1972. A sugar beet refinery operated between 1915 and 1947 (Popovich 1997).

The historic economic activities of the railway and coal mines, with many employees and extensive works, lasted into 1950s. On the railway, the replacement of steam locomotives by diesel-electrics and other modernization greatly reduced the workforce in Sheridan, while traffic actually grew. The last underground coal mine, at Monarch, closed in 1953 (Kuzara 1977). Open-pit mining, begun in 1943, needed far fewer workers to produce greater amounts of coal (Kuzara 1977). The changing economics of agriculture resulted in fewer, larger farms, shipping products to distant plants for processing. While the area still hosts the three economic activities that began on a large scale in the early 1890s – railroading, coal mining, and agriculture – they operate with technology, labor practices, and physical properties that are very different from the historic period.

Vern States first came to this area in 1934 and began buying land here in 1940. He bought three homesteads, including two found in the study area: Baker, Stringary (Negri), and Charles Monsini. His holdings included the whole of the study area. He operated a cattle ranch here until he sold out to an energy developing company in the mid-1970s. Mr. States was interviewed on August 8, 2000, by David Ferguson and provided the following information about the property.

The Monsini place is where Vern built his house (there is no trace remaining of the original homestead). The Monsini family lived in a dugout and had a shack and a hand dug well. Mr. States filled in these features long ago, which were about where the corrals are now. The Frank Baker Place (48SH1138) was bought by Mr. States in the early 1940s. Vern remembers that the Bakers had lived there from about 1905 to 1910, then moved to town after "proving up". The house was burned down to make more room for the hay field. Only the dugout and granary remain. The Stringary place (48SH1130) was abandoned prior to 1934. Stringary proved up and moved to town as well. Vern said it looked about the same then (in the 1940s) as it does now. Vern thought they homesteaded around 1905 but were long gone by 1934.

Mr. States recalls that when he came to this country there were almost no deer at all, as they were heavily hunted to feed the mining community of Acme, as well as the local homesteaders, who he describes as "terribly poor". He recalled that a deer was reported in the area in 1934, and several cow hands from neighboring ranches turned out on horse back to ride out to try to see it. Merriam's turkeys, now plentiful along the creeks, were introduced in the 1950s. Logging was done on State's property in 1936 and 1937. Logs were skidded by horse team (Ferguson and Meyer 2001).

Table 3-13 summarizes the Class III cultural resource inventory of the PSO Tract study area.

Data recovery plans are required for those sites recommended eligible to the NRHP following testing and consultation with the SHPO. Until consultation with SHPO has occurred and agreement regarding NRHP eligibility has been reached, all sites should be protected from disturbance. Full consultation with SHPO would be completed prior to approval of the mining plan by WDEQ. Those sites determined to be unevaluated or eligible for the NRHP through consultation would receive further protection or treatment.

3.4.13 Native American Consultation

Any effects the Proposed Action might have on traditional use and traditional cultural sites of Native Americans must be considered as directed by the National Historic Preservation Act, the American Indian Religious Freedom Act, PL 95-341 and the Archaeological Resources Protection Act of 1979.

Native American heritage sites can be classified as prehistoric or historic. Some may be presently in use as offering sites, fasting or vision quest sites, and selected rock art sites. Other sites of cultural interest and importance may include rock art sites, stone circles, and various rock features, fortifications or battle sites, burials, as well as locations which are sacred or part of the oral history and heritage that have non man-made features. No Native American heritage sites have been identified to date.

There are presently no documented Native American sacred sites in the general analysis area. However, the position of the area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west and the Black Hills and Devil’s Tower to the east) creates the possibility of existing locations which may have special religious or heritage significance to Native American groups.

The Northern Cheyenne Indian Reservation is located approximately 25 miles north of the PSO Tract, and the Crow Indian Reservation is located less than a mile northwest of the tract in Montana. Both groups favored this region in the Protohistoric Period. It is believed that these groups entered the area in the protohistoric period as a result of population movements and technological change. By the time of the earliest Euro-American contacts, horse dependent tribes such as Crow, Sioux, and Cheyenne dominated the region although

Table 3-13. Summary of Class III Cultural Resource Inventory of the PSO Tract Study Area.

Smithsonian Number	Site Type, Temporal Associate, and Description	NRHP status and Criteria
48SH1119	Prehistoric campsite, rockshelter with extensive lithic scatter; Late Archaic projectile collected. Historic graffiti also present.	Not eligible
48SH1120	Stone circle, prehistoric campsite.	Not eligible
48SH1121	Lithic scatter, a Late Prehistoric corner-notched projectile point was collected.	Not eligible
48SH1122	Lithic scatter.	Not eligible
48SH1123	Lithic scatter.	Not eligible
48SH1124	Prehistoric cairn and lithic scatter. Middle Archaic Duncan projectile point collected.	Not eligible
48SH1125	Historic graffiti.	Not eligible
48SH1126	Stone circle, surface lithic, source, lithic scatter, prehistoric campsite.	Not eligible
48SH1127	Lithic scatter, prehistoric campsite, Late Plains Archaic bifacial knife collected. Historic debris and possible tent platform also present.	Eligible under Criterion D
48SH1128	Surface lithic source.	Not eligible
48SH1129	Prehistoric campsite, stone ring, and lithic scatter.	Not eligible
48SH1130	Negri/Stringary homestead.	Not eligible
48SH1131	Prehistoric cairn.	Not eligible
48SH1132	Lithic scatter.	Not eligible
48SH1133	Historic cairn.	Not eligible
48SH1134 Chuggy Site	Prehistoric campsite, prehistoric rock art panel, lithic scatter and rockshelter, Paleoindian Hell Gap projectile point.	Eligible under Criterion D
48SH1135	Historic cairn.	Not eligible
48SH1136	Surface lithic source, lithic scatter.	Not eligible
48SH1137	Prehistoric campsite, stone circle, lithic scatter, surface lithic source.	Not eligible
48SH1138	Baker homestead.	Not eligible
48SH1139	Surface lithic source, lithic scatter.	Not eligible

Shoshonean groups also existed in the region.

Crow emigration from Hidatsa occupations on the Middle Missouri to the upper Yellowstone is well documented (Beckes and Keyser 1983). By the nineteenth century the Crow occupied much of southeastern Montana and northcentral Wyoming. Vision quest structures and other traditional sites are known in the Pine Breaks. A variety of plant species of ethnobotanical importance are currently harvested in the general area.

No traditional use sites were positively identified during the archaeological inventory. Several stone circle sites (48SH1120, 48SH1126, 48SH1129, and 48SH1137) and two probable prehistoric cairns (48SH1124 and 48SH1131) were found during the baseline inventory. While these sites can offer little archaeological information, they may be of interest to Native Americans.

Native American tribes were consulted at a general level in 1995-1996 as part of an effort to update the BLM *Buffalo Resource Management Plan*. An executive summary of the cultural resources identified on the PSO Tract has been sent to tribes known to have an interest in the region. While only the Crow and Cheyenne River Sioux Tribes have visited or expressed an interest in visiting the area, BLM will work with interested tribes to provide tours of the area and specific resources.

3.4.14 Paleontological Resources

The sedimentary rocks exposed on the surface of the PRB are the Eocene age Wasatch Formation and Paleocene age Fort Union Formation, both of which are known to contain fossil remains. Some paleontological surveys have been conducted in the PRB. Vertebrate fossils that have been described from the Wasatch Formation in the PRB include fish, turtle, champosaur, crocodile, alligator, and mammal specimens. The Fort Union also contains fossils of plants, reptiles, fish, amphibians, and mammals. No Wasatch Formation occurs within the PSO Tract area. No vertebrate-bearing localities have been reported from the Fort Union Formation of the Sheridan Coal Field or adjacent areas (Lillegraven 1981).

Invertebrate fossils recorded from the vicinity of the Sheridan Coal Field within the Fort Union Formation appear to be restricted to the Mollusca (Lillegraven 1981). These include freshwater clams (Pelecypoda) and, more commonly, freshwater snails (Gastropoda). Glass' (1975) detailed measured sections of the Fort Union Formation in the Sheridan Coal Field found no invertebrates.

A paleontological survey of the potential for vertebrate and invertebrate fossils was conducted in 1981 throughout much of the Big Horn Coal Mine area south of the PSO Tract area by Jason A. Lillegraven (Professor, Department of Geology and Geophysics, and Curator, Geological Museum, University of Wyoming). The surveyed lands included approximately 3,280 acres in T.57N., R.84W., Sections 4, 9, 10, 13, 14, and 22-27. At its closest point, Lillegraven's field investigation was less than two miles south of the PSO Tract area. Lillegraven reported that only two localities with vertebrate remains were discovered during his survey of the Big Horn Coal Mine area. Both contained only isolated gar pike scales and are without scientific consequence. Only one complete invertebrate fossil was discovered, that being an isolated shell of a snail. The same general area had some poorly-preserved bits of clam shells. There were no indications of abundant accumulations of molluscan fossils, and the few specimens found were judged to be of no taxonomic, stratigraphic, or ecologic consequence. Within his conclusion, Lillegraven stated that there is little probability that important vertebrate or invertebrate paleontological resources exist in the area.

3.4.15 Visual Resources

Visual sensitivity levels are determined by people's concern for what they see and the frequency of travel through an area. The landscape within the general analysis area is described as somewhat rugged topography consisting of dissected uplands created by the Ash Creek and Youngs Creek drainages. The ephemeral tributaries of these perennial streams have formed numerous, steeply sloping ravines that are separated by rounded uplands. The ravines are forested with scattered ponderosa pine and juniper trees, and the gently-rolling upland benches are covered with patches of open grassland and sagebrush. Small bluffs and ledges of resistant sandstone and scoria outcrops occur intermittently along the steeper slopes of the ravines and the sides of the larger valleys. The drainages of Ash Creek and Youngs Creek have relatively lush riparian environments. This type of topography is common within the Pine Breaks region of the PRB.

None of the existing or reclaimed surface mines in the Sheridan Coal Field are visible from the general analysis area. Major man-made intrusions include ranching activities (i.e., fences, ranch houses and associated structures, homesteads, livestock), transportation facilities, electrical power lines, and recent CBM development activities. The Ash Creek oil field is nearby and accessed by the Ash Creek Road, although the rugged topography, forested ravines, hay meadows, and deciduous trees in the Ash Creek valley block the view of the oil field from the road.

The PSO Tract area is only partially visible from Wyoming State Highway 338 and a high percentage of people traveling this highway are commuting to work at the Decker and Spring Creek Coal Mines. However, during periods of peak recreational activity, primarily to and from the Tongue River Reservoir, this highway receives higher traffic volume. The PSO Tract area lies adjacent to the Ash

Creek and Youngs Creek roads (Figure 3-15) and is therefore plainly visible to passers-by. Those traveling these improved, aggregate-surfaced roads are typically local residents and the traffic volume is light. The natural scenic quality of the general analysis area is fairly high due to the relatively unaltered condition of the rugged topography and native vegetation, yet it is predominantly hidden from the view of the general public.

For management purposes, BLM evaluated the visual resources on lands under its jurisdiction in the *Buffalo Resource Management Plan*. A VRM inventory identifies, sets, and meets objectives for the maintenance of scenic values and visual quality based on research designed to objectively assess aesthetic qualities of the landscape. The VRM classification ratings range from I to V 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 federal coal lands being considered for exchange are generally classified as VRM Class II. After the surface has been reclaimed the visual impact of coal mining would not likely be discernible to the average observer.

<u>3.4.16 Noise</u>

An individual's judgment of the loudness of a noise correlates well with the A-weighted sound level, or A-scale, system of measurement. Figure 3-16 presents dBA readings for some commonly heard sounds of daily life.

Existing noise sources in the vicinity of the PSO Tract area include activities associated with agriculture, CBM development, local traffic on the Ash Creek and Youngs Creek Roads, intermittent oil well servicing associated with the Ash Creek and Ash Creek South oil fields, and birds and animal life. The distance to State Highway 338 is in excess of three miles; therefore, highway traffic noise is very slight or non-existent. Due to the isolated, remote nature of the area, the current noise level from all these

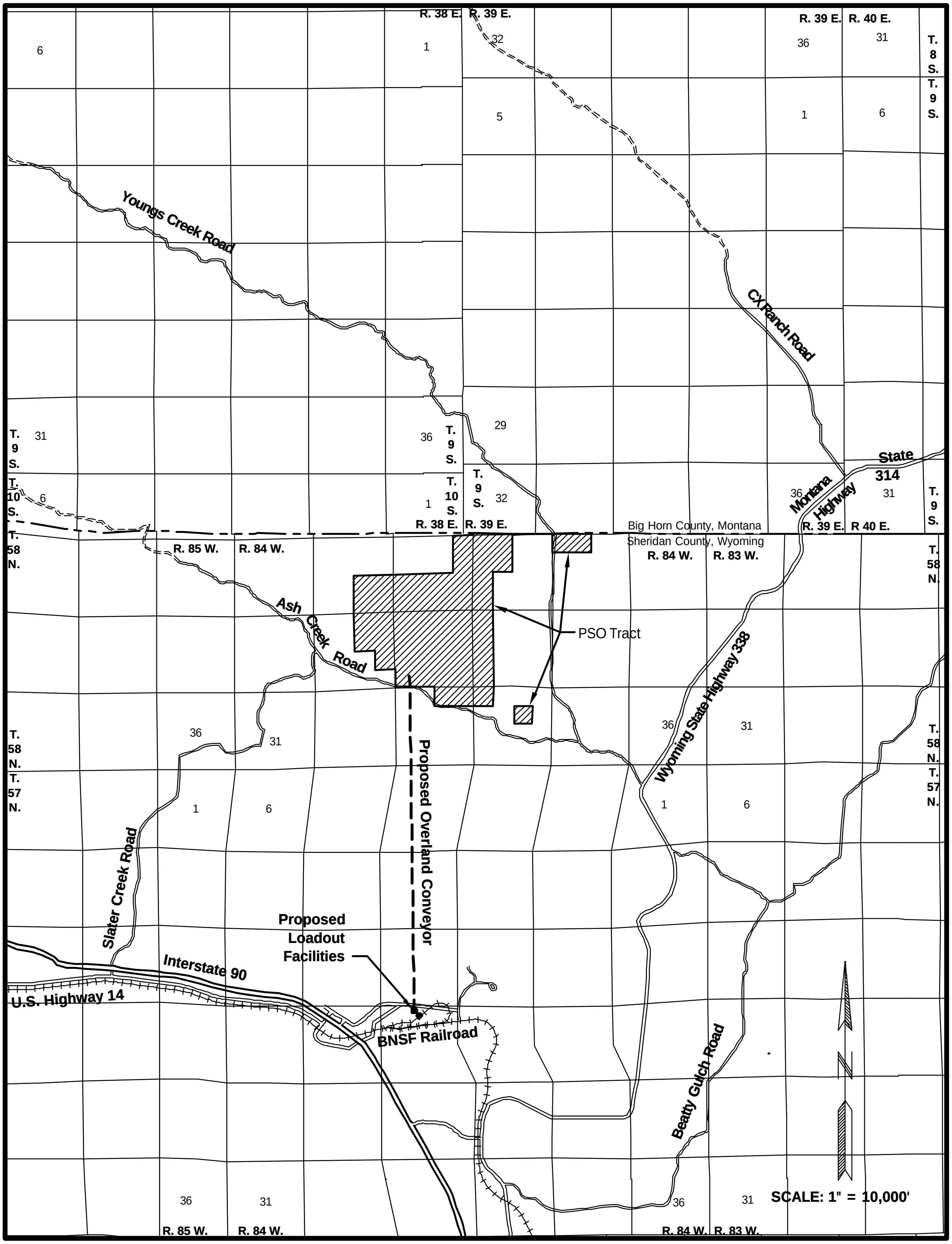
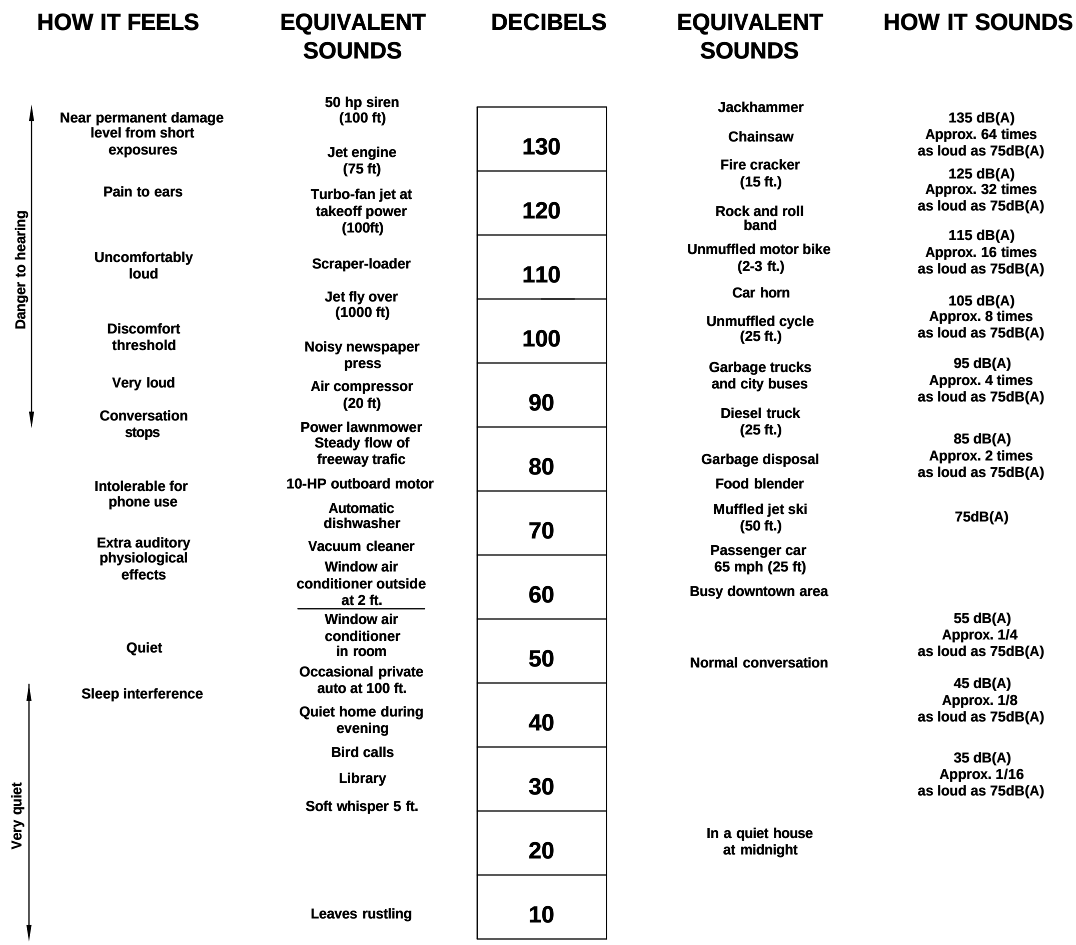


Figure 3-15. Transportation Facilities Within and Adjacent to the PSO Tract.



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

Figure 3-16. Relationship Between A-Scale Decibel Readings and Sounds of Daily Life.

sources in the PSO Tract area is probably in the range of 30 to 50 dBA.

Mining activities are characterized by noise levels of 85-95 dBA at 50 ft from actual mining operations and activities (BLM 1992). The nearest occupied dwellings are all located at a distance of approximately one-quarter mile outside of the boundary of the federal coal being considered for exchange. Two of these nearby dwellings are in Montana; one being in the SE¼SE¼ of Section 1, T.10S., R.38E., the other being in the NW¼SE¼ of Section 33, T.9S., R.39E. Three of these nearby dwellings are in Wyoming; one being in the SE¼NW¼ of Section 23, T.58N., R.84W., another being in the NW¼NW¼ of Section 33, T.58N., R. 84W., and the third dwelling being in the NE¼SW¼ of Section 29, T.58N., R.84W.

3.4.17 Transportation Facilities

The transportation facilities that exist in the vicinity of the PSO Tract area include the BNSF Railroad; Wyoming State Highway 338; improved county roads, including Youngs Creek Road (a.k.a. County Road 1237); improved local roads, including Ash Creek and Slater Creek Roads; unimproved local roads and two-track trails related to ranching and oil and gas activities; and numerous pipelines associated with both the conventional Ash Creek oil fields and CBM development.

Current transportation facilities within and adjacent to the PSO Tract area are depicted on Figure 3-15. Since the development of the Ash Creek Mine would require a coal transportation facility, the proposed 24,000-ft long overland conveyor running due south from the mine to a loadout facility on the BNSF mainline is also depicted on this figure. As indicated in Chapter 2, the location of the conveyor line is conceptual. If the exchange is completed and if P&M proceeds with plans to open a new surface coal mine, they would have to acquire rights-of-way for the proposed conveyor and loadout facility as well as the required construction permits before construction activities for the conveyor and loadout facility could begin. The actual location of the conveyor and loadout facility could change based on a number of factors including costs, rights-of-way negotiations, and requirements imposed by the construction permits.

3.4.18 Socioeconomics

The social and economic study area for the proposed project involves primarily Sheridan County and the City of Sheridan. The community of Sheridan and nearby communities of Ranchester and Dayton would most likely attract the majority of any new residents due to their current population levels and the availability of services and shopping amenities.

3.4.18.1 Population

According to 2000 census data, Sheridan County had a population of 26,560, with Sheridan accounting for 15,804 of the county's residents, Ranchester 701, and Dayton 678

(USDC 2001). The 1990 population of Sheridan County was 23,562. Thus there was an increase of 2,998 persons or 12.7 percent over the 10-year period. Sheridan County's population change from 1990 to 2000 ranked 1,158 out of 3,141 counties in the U.S. (U.S. Census Bureau 2001b).

Sheridan County is an area of relatively low growth (one to two percent per year), and facilities (hospitals, schools, etc.) are adequate. School enrollment is actually declining due to an aging population. The median age in Sheridan County is 40.6 years, compared to a state-wide median of 36.2 years (Wyoming Department of Administration and Information July 2001). The rate of population growth in Sheridan County has increased somewhat since 2000 due to the current CBM boom. This has contributed to both a low housing vacancy and an overcrowded jail system in Sheridan, although enrollment in schools has not increased due to a relatively young, transient work force.

3.4.18.2 Local Economy

Although the State's coal production is increasing, as reported by the Wyoming State Inspector of Mines, Sheridan County's last remaining coal mine, Big Horn Coal Company, closed down and began final reclamation in 2000. Big Horn's production in 2000 was only 38,411 tons and it employed just 11 persons that year. Coal production in Sheridan County ended by 2001 (Wyoming State Inspector of Mines 2000, 2001).

The national economy grew rapidly through the 1990s and is currently in a period of slower growth, due to a variety of factors complicated by higher energy prices. Higher prices for commodities such as coal, oil and gas, and agricultural goods have helped Wyoming's economy as they have hurt the national economy. Recent increases in coal, oil, and gas prices have provided significant increases to state revenues in the form of increased severance taxes, royalties, sales and use taxes, and employment. The mining employment sector, including the oil and gas extraction sub-sector, is expected to remain strong through at least 2009 (Wyoming Department of Administration and Information April 2001).

Total mineral income to the State of Wyoming in 2002 was $1,182,329,122, an all-time high. This income was comprised of ad valorem taxes ($423,636,794 or 35.8 percent), royalty returns ($271,751,837 or 23.0 percent), severance taxes ($381,978,701 or 32.3 percent), and sales and use taxes, state rent, state royalties, and filing fees ($104,961,790 or 8.9 percent) (Wyoming Business Council 2003).

The 2002 valuation on minerals produced in Wyoming in 2001 was $6,738,726,062. This is 60 percent of the state's total valuation and places Wyoming among the top ten mineral producing states in the nation. The 2002 valuation on minerals produced in Sheridan County in 2001 was only $35,851,556, a fraction of a percent of the state's total (Wyoming Business Council 2003). Minerals (coal, oil, and gas) accounted for only 1.2 percent of Sheridan County's total assessed valuation in 2000 of $145,093,161 (Wyoming Department of Revenue 2001). In 2002, minerals (just oil and gas) accounted for 22.3 percent of Sheridan County's total assessed valuation of $225,468,629 (Wyoming Department of Revenue 2003).

3.4.18.3 Employment

As of December 2002, the total labor force in Sheridan County stood at 14,288 with an unemployment rate of 4.8 percent, compared to a total labor force of 14,216 and an unemployment rate of 4.5 percent in December 2000 (Wyoming Department of Employment 2003). The annual average employment in Sheridan County has generally increased since 1990, when it stood at 11,416 persons. In 2002, the annual average was 13,745 employed persons in the county (Wyoming Department of Employment 2003).

In 2000, the largest employment sector in Sheridan County was the service sector, with 2,695 employees. This was followed by retail trade (2,410), local government (1,850), construction (936), and federal government (600). Together, these sectors accounted for nearly 80 percent of the county's employment. Mining, which includes oil and gas, employed only 55 persons in Sheridan County in 2000 (Wyoming Department of Employment 2003).

The preceding statistics obviously do not account for employees at the Decker and Spring Creek Coal Mines. These mines are located in Montana, which receives the payroll taxes, royalties, and production taxes, but most of the employees reside in Sheridan County. In 2002, the Decker and Spring Creek mines employed 225 and 126 people with estimated payrolls of $10,000,000 and $6,715,000, respectively (Montana Coal Council 2003). Decker Coal Company reduced nearly 20 percent of its workforce in March 2003 due to plans to reduce production.

Large gains in the oil and gas industry were responsible for 4,800 new jobs in Wyoming in April 2001, a growth rate of 21 percent, and the largest state employment gains were in the mining industry with a 12.9 percent increase in jobs from April 2000 to April 2001 (Sheridan County Roundup August 2001). The most notable new business formation in the state was in the mining industry in 2001. After five years of steady increase (18.6 percent average annual rate), the mining industry experienced a 50 percent increase in new firms. The large gain may in large part reflect CBM development. In 2000 and 2001, about 33 percent of the new mining firms were located in Campbell County, 10 percent in Natrona County, nine percent in Johnson County, and eight percent in Sheridan County (Department of Employment 2003).

From November 2001 to November 2002, Wyoming employment grew by 1,200 jobs, or 0.5 percent.

Construction posted especially strong gains, followed by the services and government sectors. During this same time frame, coal mining increased by 200 jobs and oil and gas extraction fell by 1,100 jobs (Department of Employment 2003).

Employment in northeastern Wyoming has certainly been affected by the recent CBM development, although state employment experts say it's difficult to track the impact on employment in Sheridan County.

3.4.18.4 Housing

In 2000, Sheridan County contained 12,577 housing units. Of these, 7,413 were in Sheridan, 304 in Dayton, and 290 in Ranchester (U.S. Census Bureau 2001a). Of Sheridan County's 12,577 housing units in 2000, 11,167 were occupied and 1,410 were vacant for seasonal use. Of the 11,167 occupied units, 7,689 were owner occupied and 3,478 were renter occupied. Similar low vacancy rates were seen for the city of Sheridan and the towns of Dayton and Ranchester. According to Census 2000 data, rental vacancy rates were 4.7 percent for the entire county, 4.5 percent for the City of Sheridan, 7.9 percent for the town of Dayton, and 1.3 percent for the town of Ranchester. Very few residential building permits were issued for Sheridan County in the 1980s, but reached a high of 172 in 1996, then declined to 90 in 1999 (Wyoming Department of Administration and Information July 2001).

Sheridan County had the second highest cost of living index in the state as of January 2003. It ranked highest of all the counties for food, fourth in housing and apparel, tenth in transportation, third in medical, and sixth in recreation/personal care. Housing rental rates are rising much faster than the general consumer price index. Comparing the fourth quarters of 2002 and 2001, rental rates in Sheridan County had risen 5.8 percent for apartments, 28.4 percent for mobile home lots, 6.9 percent for houses, and 41.6 percent for mobile homes. This compares with a statewide overall inflation rate of 3.7 percent (Wyoming Department of Administration and Information April 2003).

According to the Department of Employment, the population in Wyoming's northeast area grew by 12.7 percent over the past decade, but housing stock only increased by 6.2 percent (Sheridan County Roundup August 2001). Campbell, Johnson, and Sheridan Counties all have housing costs at or above the statewide average as a result of the sustained energy development activity in the region. Housing cost would be expected to decrease if natural gas or coal extraction activities suffered a prolonged decline (Wyoming Department Administration and Information April 2003).

3.4.18.5 Local Government Facilities and Services

Most of the tax revenues in Sheridan County come from sales and use taxes and property taxes.

Mineral production provides a minor source of revenues to local governments in Sheridan County. This is a change from the 1980s, before the Big Horn Coal mine began to close down their operations and prepare for final reclamation. Production at Big Horn Coal peaked at four million tpy in 1981 and declined steadily after a long-term contract with Chicago's Commonwealth Edison expired in 1988. During the peak production years, Big Horn Coal accounted for nearly half the county's assessed valuation (Sheridan Press, March 12, 1994). In 2000, the mine produced only 38,400 tons and employed just 11 persons, and by 2001 the mine had been completely reclaimed and no longer had any employees (Wyoming State Inspector of Mines 2000, 2001). State-wide, the assessed valuation for minerals was 60.0 percent of the total assessed valuation in fiscal year 2002. In Sheridan County, the total assessed valuation for 2002 was $225 million, up 32.5 percent from the prior year. $35.9 million of that was from mineral production, up from just $1.8 million in 1999 due to a significant increase in natural gas production. Residential property is currently the largest source of assessed valuation for the county. Total 2002 property taxes levied in Sheridan County were $15.3 million, up 31.0 percent from the prior year (Wyoming Taxpayers Association 2003). Minerals are taxed at 100 percent of assessed valuation, while industrial property is taxed at 11.5 percent of assessed valuation and all other real and personal property at 9.5 percent.

Most of Wyoming's property taxes fund education (about 69.7 percent), with the remainder going to county governments (20.6 percent), special districts (4.0 percent), community college (3.8 percent), and municipalities (1.9 percent). Because minerals are taxed at full valuation, counties vary in property tax wealth. For example, in Niobrara County one mill raises $39,843 in taxes, while in mineral-rich Campbell County one mill raises $2.2 million (Wyoming Taxpayers Association 2003).

In Sheridan County there are 17 jurisdictions levying property taxes. These include five municipalities, three school districts, two recreation districts, one community college, one weed and pest control district, and five fire districts.

Public facilities and services in Sheridan County are meeting current needs. School enrollment is declining due to the aging population. Memorial Hospital of Sheridan County, owned by the county, recently underwent a major expansion, funded in large part by AML funds.

3.4.18.6 Social Conditions

Sheridan County is experiencing a relatively stable social setting. Coal mining is no longer a major force in the local economy as it once was, but employees of the Spring Creek and Decker mines in Montana reside primarily in Sheridan County. The Decker mine was forced to reduce about 20 percent (approximately 40 people) of its workforce in March 2003 due to plans to reduce nearly one-third of its annual production (Sheridan Press 2002).

There is interest in CBM development in Sheridan County. The most significant challenge CBM companies will be faced with on the western side of the PRB will be the issue of split estate. More than 60 percent of the mineral estate is federally owned, yet the surface is owned largely by private surface owners. Landowners have expressed that they are concerned about how they will be able to coexist with the development. The aesthetics of the land in Sheridan County are considered by many to be a commodity as much as the minerals below it. To avoid potential clashes, CBM operators will need to thoughtfully include the landowners in the early planning stages of development.

Most residents have lived in the area for a number of years, social ties are well established, and residents take great pride in their communities. Many of the people place a high priority on maintaining informal lifestyles and small town traditions, and there are some concerns that the area could be adversely affected by more than a modest growth in population. At the same time, there is substantial interest in enhancing the economic opportunities available in the area and a desire to accommodate reasonable levels of growth and development.

Wyoming's economy reached the bottom of an energy bust in 1987 and started to recover. That recovery began to slow in 1996, due to low prices for coal, oil, and gas. In 1999, for the first time since 1977, minerals comprised less than half of the state's total assessed valuation. Since then energy and fuel prices have risen, and this trend is expected to continue. The forecast is for slow growth through 2009; Wyoming's population is projected to increase at 1.0 percent per year. Non-agricultural employment is projected to increase by 10.2 percent by 2009, increasing 1.1 percent per year. Mining employment (including oil and gas) is projected to grow by 7.5 percent by 2009, mostly within the oil and gas sector (Wyoming Department of Administration and Information April 2001). In 2001, there were 19,500 jobs in the mining sector in Wyoming. This number was up 13 percent from the 17,160 mining jobs in 2000. This large increase was almost entirely attributed to increases in oil and gas jobs, from 9,400 in 2000 to 11,800 in 2001. Despite a loss of about 1,100 jobs in the oil and gas sector in 2002 (Department of Employment 2003), continued development of CBM resources in Wyoming may cause greater increases in the mining sector through 2009 than previously estimated.

3.4.18.7 Environmental Justice

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 Sheridan County, Wyoming and Big Horn County Montana; the Crow Reservation; entities with interests in the area; and individuals with ties to the area all may have concerns about the presence of a new coal mine within the area. Communities potentially impacted by the presence or absence of a coal mine have been identified in this EIS. 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 the consultation and coordination described in Section 1.5 of this document. This EIS and contributing socioeconomic analysis provide a consideration of impacts with regard to disproportionately adverse impacts on minority and/or low-income groups, including Native Americans.

3.4.19 Hazardous and Solid Waste

Potential sources of hazardous or solid waste on P&M's proposed Ash Creek Mine would include spilling, leaking, or dumping of hazardous substances, petroleum products, and/or solid waste associated with mineral, coal, oil and/or gas exploration, and development of agricultural or livestock activities. No such hazardous or solid wastes are known to be present on the tract at this time. All wastes produced by the reclaimed PSO No. 1/Ash Creek Mine were disposed of according to WDEQ-approved disposal plans. Wastes produced by the proposed Ash Creek Mine would also be handled according to the procedures described in Chapter 2.