

## ES.1 EXECUTIVE SUMMARY

This Task 1D Report for the Powder River Basin (PRB) Coal Review describes the existing environmental conditions in the PRB study area, with the exception of air quality, water resources, and social and economic conditions, which are presented in individual baseline (Task 1) reports. The descriptions of current environmental conditions in this report are based on published and unpublished information; information obtained from local, state, and federal agencies and industrial companies; and a compilation of past and present actions in the Wyoming PRB developed for the Task 2 Report for the PRB Coal Review. The past and present actions summarized in the Task 2 report include surface coal mines (currently 12 are active and 1 is temporarily inactive), power plants, railroads, coal technology facilities, major transmission lines, other mines, oil and gas development, major pipelines, reservoirs, and other industrial and non-industrial developments. Descriptions of the past and present activities identified in the Task 2 report were based on the most recent data available at the end of 2003.

For the purpose of this study, the Wyoming PRB study area comprises all of Campbell County, all of Sheridan and Johnson counties less the Bighorn National Forest lands to the west of the PRB, and the northern portion of Converse County. It includes all of the area administered by the Bureau of Land Management (BLM) Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the Thunder Basin National Grasslands (TBNG), which is administered by the U.S. Forest Service (USFS). State and private lands also are included in the study area. The area of potential effect for the physical, biological, and human resources analyzed in this study varies by resource and in some cases extends outside of this study area, as appropriate.

## **ES.2 CURRENT CONDITIONS**

### **ES.2.1 Topography, Geology, Minerals, and Paleontological Resources**

The study area for topography, geology, minerals, and paleontological resources generally includes all or portions of Campbell, Johnson, Sheridan, and Converse counties. It includes all of the area administered by the BLM Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the TBNG, which is administered by the USFS. State and private lands also are included in the study area. It should be noted that some historical predictions of mineral production came from documents (BLM 1981, 1996) that analyzed mineral production in project areas defined differently from this study area. Some information concerning the mineral production history occurred outside of the defined study area; however, this information is presented because of the relevance to the study area. In addition, certain aspects of general geology (stratigraphy, structural geology) are discussed for the entire PRB, including Montana.

#### **ES.2.1.1 Topography, Geology, and Minerals**

The description of existing conditions in the PRB study area for topography, geology, and minerals primarily was based on the Final Environmental Impact Statement and Proposed Plan Amendment for the PRB Oil and Gas Project (BLM 2003a). The information presented in that document was updated based on other information sources, including Wyoming Oil and Gas Conservation Commission (WOGCC) on-line production data, public BLM documents, IHS Energy Services™ (IHS) well data, Wyoming State Geological Survey and United States Geological Survey (USGS) publications, other published documents, and the past and present action descriptions presented in the Task 2 Report for the PRB Coal Review (ENSR 2005a).

The PRB is located within the Upper Missouri Basin Broken Lands physiographic subprovince that includes northeastern Wyoming and eastern Montana to the Canadian border. The topography generally is of low to moderate relief with occasional buttes and mesas. The general topographic gradient slopes down gently from southwest to northeast with elevations ranging from 5,000 to 6,000 feet above mean sea level (amsl) on the southern and western portions of the basin to less than 4,000 feet amsl on the north and northeast along the Montana state line. The major drainages in the basin are the Tongue, Powder, Belle Fourche, and Cheyenne rivers. Most of the drainages in the area are intermittent and have flows during high precipitation events or during periods of snowmelt. The drainages are part of the upper Missouri River Valley drainage basin.

The PRB contains Phanerozoic rocks (younger than Precambrian) over 17,000 feet in thickness. These rocks range in age from Cambrian to Tertiary. In addition, there are unconsolidated alluvial and surficial deposits. Most of the rocks older than Tertiary outcrop along edges of the study area and also are found in the subsurface of the structural basin or are exposed along the margins of the basin. Unconsolidated Quaternary deposits consist of alluvium, terraces, colluvium, gravels, and pediments. Alluvial deposits generally are associated with alluvial valleys of the major rivers and tributaries.

The PRB is one of a number of structural basins in Wyoming and the Rocky Mountain area that were formed during the Laramide Orogeny. The basin is asymmetric with a structural axis that generally trends northwest to southeast along the western side of the basin (Flores et al. 1999). From the eastern margin of the basin, the rocks dip from 2 to 5 degrees to the structural axis. In addition to the major structural elements that define the basin, there are a number of folds on the western and southern margins of the basin. Much of the basin has very little internal structure, and the large area of west-dipping rocks east of the basin axis contains few, if any, major folds or dislocations. Earthquakes, landslides, and subsidence do not present a hazard in the PRB based on the lack of active faults in the study area (USGS 2004); the low risk of ground shaking in the region if a maximum credible earthquake were to occur (Frankel et al. 1997); and lack of evidence of subsidence, landslides, or other geologic hazards in association with coal bed natural gas (CBNG) production.

Most of the coal resources of the basin are found in the Fort Union and Wasatch formations. Although coals are present in the Wasatch, they are not as economically important as the coals in the Fort Union. The Tongue River Member of the Fort Union Formation contains most of the economically important coal zones. A number of coal seams have been identified and mapped in the Wyoming portion of the PRB. Coal stratigraphy is complex because of the nature of the environments in which coal was originally deposited. The Wyodak-Anderson coal produces from over 20 mines in the PRB (Stricker and Ellis 1999). Coal quality data from the Wyodak-Anderson coal indicate that the coal is subbituminous, generally low sulfur, and has low concentrations of metallic constituents. The low sulfur nature of the coal has made it valuable because of its cleaner burning characteristics for power generation. Often utilities will blend PRB coal with higher sulfur coals in order to achieve air quality emissions compliance.

Drilling for conventional (non-coal bed natural gas [non-CBNG]) hydrocarbon resources has declined considerably in the last 15 years (from a high of 199 in 1990 to 32 in 2003) averaging 100 wells per year for all categories of wells (production, injection, wildcats) (IHS 2004). However, there remains potential for locating and developing conventional oil and gas production in the deeper areas of the basin. The USGS (2002) estimates that the PRB (Wyoming and Montana) may have undiscovered hydrocarbon resources (mean) of 1.5 billion barrels of oil and 1.2 trillion cubic feet of gas (non-CBNG). Much of this resource may be in the deeper sparsely drilled parts of the basin.

Waning interest in oil can be seen in the decline of oil production. In 2003, conventional oil and gas production from the PRB was approximately 19.5 million barrels of oil and 47 billion cubic feet (BCF) of gas (WOGCC 2004). That compares with a production of 50.5 million barrels of oil and 64.4 BCF of gas in the PRB in 1989; CBNG production in 1989 was insignificant. Non-coal bed hydrocarbon production from the PRB study area in 2003 was 12.9 million barrels of oil and 41 BCF gas. There were approximately 3,500 active conventional oil and gas wells at that time in the PRB (not counting seasonally produced wells) (ENSR 2005a).

Total production for 2003 was 346 BCF, or 88 percent of the total gas production from the basin (WOGCC 2004). From 1987 to 2003, the total cumulative gas production from PRB coals was over 1.2 trillion cubic feet, and the total cumulative water production was approximately 2.3 billion barrels (ENSR 2005a). Annual CBNG production has increased rapidly from 1999 through 2002 and appears to have started to level off in 2003. Annual water production increased between 1999 and 2002, but started to decrease slightly in 2003.

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Surface coal mining alters the topography in mining areas by causing changes in slope, lowering the general land surface, and changing the physical nature of the surficial materials and overburden. The topography is affected only where mining occurs. Oil and gas exploration and development alter the landscape through leveling the land surface for drilling pads and cutting and filling during road construction. Oil and gas development affects topography to a much lesser degree than coal mining; however, it is more widespread than coal mining.

Other mineral resources in the PRB study area include uranium, bentonite, clinker, and aggregate. Uranium is found in the Wasatch, Fort Union, and Lance formations. There are three defined uranium districts in the PRB: Pumpkin Buttes, Southern Powder River, and Kaycee (BLM 2003a). Numerous uranium mining sites were present in these districts, but were mined out or uneconomic. Uranium currently is mined in the Southern Powder River District at Smith Ranch and Highland/Morton Ranch. Uranium is produced by the in situ leach method at both locations (Harris 2003). Wyoming produced 1.6 million pounds of yellowcake (the raw uranium production material) in 2002. There are several bentonite localities in the PRB, and bentonite in the study area is mined at Kaycee, Wyoming (Wyoming Mining Association 2004). Clinker is formed when coal beds burn, and the adjacent rocks become baked. Clinker is used as road surfacing material and is found in extensive areas in the study area (BLM 2003a). Terrace and alluvial deposits associated with the larger streams in the study area are mined for sand and gravel. The more important aggregate mining localities are in Johnson and Sheridan counties (USGS 2003b).

### ES.2.1.2 Paleontological Resources

Scientifically significant paleontological resources, including vertebrate, invertebrate, plant, and trace fossils, are known to occur in many of the geologic formations within the study area. These fossils are documented in the scientific literature, in museum records, and are known by paleontologists and land managers familiar with the area.

Most of the geologic formations exposed at the surface within the study area are exposed only along the margins of the PRB. The most widely distributed units are the Wasatch and Fort Union formations. The Morrison and Lance formations outcrop in the western portion of the basin; however, in the vicinity of the coal mines and CBNG activity in the eastern portion of the basin, these formations occur at depth. Within the study area, the highly fossiliferous White River Formation occurs only on Pumpkin Buttes in southwestern Campbell County.

The Wasatch Formation is the most geographically widespread formation in the study area and is the bedrock geologic formation exposed at the surface in most of the basin. Because surface exposures are mostly vegetated, the formations within the PRB historically have not been perceived to be as rich in fossils as nearby basins, such as the Bighorn and Wind River, which have extensive badland exposures. Nevertheless, the ubiquitous anthills in the basin contain locally abundant remains of small animal fossils (mouse to rabbit sized), which can be successfully sampled even in vegetated areas.

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

No fossil localities in the Fort Union Formation within the study area were identified during the museum record search for this analysis; however, they do occur nearby in Montana.

## **ES.2.2 Soils and Alluvial Valley Floors**

### **ES.2.2.1 Soils**

The study area for the soils and alluvial valley floors (AVFs) resources includes all or portions of Sheridan, Johnson, Campbell, and Converse counties. It includes all of the area administered by the BLM Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the TBNG, which is administered by the USFS. Soils in the PRB study area can be classified into three main soil orders: Entisols, Aridisols, and Mollisols. The most extensive soils are Entisols, which are recent soils occurring mainly on sloping topography where geologic erosion outpaces soil profile development or organic matter accumulation. They generally are low in plant nutrients and commonly have clay textures. Aridisols occur on extensive areas of gently sloping to nearly flat, more stable, topography. These soils commonly have low to moderate organic matter content and plant nutrients in the surface layer. They also have moderate to strong structural development within the surface and subsoil layers. Carbonates and salts generally have been leached by water to depths of 1 to 2 feet or more; this process produces a more fertile rooting zone, particularly when soil textures are loamy rather than sandy or clayey.

The least extensive group of soils is the Mollisols. These soils are the most fertile and have higher levels of organic matter and nutrients, particularly in the surface layer. Small areas of fluvial soils also occur in the PRB. These soils are located on gently sloping to flat drainage bottoms, and vary considerably in fertility depending on the source of alluvium. Fluvial soils low in salts and sodium tend to be very fertile and are the most productive in the basin. The maintenance of long-term soil productivity is a primary soil resource issue.

Survey information is available, at different levels of intensity and scales of mapping, for soils in the PRB. Order 3 county surveys have been completed by the Natural Resources Conservation Service (NRCS) for all counties except northern Johnson County, which currently is being mapped. More detailed soils information is available for all coal mine permit areas in the basin. This mapping was done at a more detailed Order 1-2 level of intensity and included substantial soil sampling for laboratory analysis and interpretation. These surveys were reviewed and approved by the Wyoming Department of Environmental Quality (WDEQ) as part of the mine permitting process. More general soils information is available from the STATSGO mapping for the State of Wyoming. STATSGO provides an all-inclusive, general description of soils in the basin, but it is too general for use in project-specific impact evaluations. Soil associations are used in the STATSGO mapping. This NRCS product is being used for this study because of the basin's large size and the lack of complete coverage by the county soil surveys.

Based on the dominant soil series for each STATSGO map unit in the PRB study area and their associated soil characteristics, as identified in published and unpublished NRCS surveys, areas with severe wind and water erosion hazards, severe shrink swell potential, high salinity and sodicity, poor revegetation potential, and prime or otherwise valuable agricultural soils were identified in the basin as follow (BLM 2003a).

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- Soils with severe wind erosion hazard are present from the Wyoming/Montana state line south down the center of Campbell County to approximately 14 miles south of Gillette and along the Little Powder River. They also are present in much of Converse County.
- Severe and moderate water erosion hazard soils occur primarily along the southwestern corner of the basin in Johnson County where slopes of 25 to 40 percent and greater occur. These soils also occur along the northern and eastern borders of the basin as well as down the center along the Powder River and into Converse County.
- Soils with severe shrink/swell potential occur along the northern and western borders of the basin, on both sides of the Powder River, down the center of Sheridan and Johnson counties, in the eastern portion and entire southern half of Campbell County, and in small scattered areas of Converse County.
- Approximately 40 percent of the soils in the PRB study area are considered saline and/or sodic. Saline soils are located near the confluence of the Powder River and the South Fork of the Powder River and along the Belle Fourche River, Black Thunder Creek, and Little Black Thunder Creek.
- Soils often are not recommended for salvage on slopes greater than 40 percent. Soils with moderate and severe slope hazards (25 to 40 percent slopes and slopes greater than 40 percent, respectively) occur primarily along the southwestern corner of Johnson County and as small scattered areas throughout the basin.
- Soils with poor revegetation potential are located throughout the PRB study area except in the central portion of Campbell County.
- Portions of Sheridan County, Converse County, and the central portion of Campbell County contain prime agricultural soils. These soils also extend into Johnson County along the Powder River and Clear Creek.

Based on GIS analysis, as of the end of 2003, the existing development-related soil disturbance in the PRB study area was approximately 121,890 acres, of which approximately 51,107 acres of disturbance was related to coal mining activity (see **Table ES.2.2-1**). The primary soil associations impacted as a result of coal mine development have included the Renohill – Bidman – Ulm, Hiland – Vonalee – Maysdorf, Kishona – Shingle – Theedle, Bidman – Parmleed – Renohill, Wibaux – Rock Outcrop – Shingle, Shingle – Tassel – Rock Outcrop, and Haverson – Glenberg – Bone.

### ES.2.2.2 Alluvial Valley Floors

AVFs consist of unconsolidated stream-laid deposits where water availability is sufficient for subirrigation or flood irrigation activities (Public Law 95-87). The WDEQ administers these AVF regulations for coal mining activities in Wyoming. Before leasing and mining can proceed, AVFs must be identified, because their presence can restrict mining activities. Coal mine-related impacts to designated AVFs generally are not permitted if the AVF is determined to be significant to agriculture. Conversely, 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 Surface Mining Control and Reclamation Act date,

the AVF can be disturbed during mining but must be restored to essential hydrologic function during reclamation. Currently identified AVFs are described for all coal mines in the PRB study area, based on individual mine State Decision Documents.

**Table ES.2.2-1  
Existing Soil Disturbance in the PRB Study Area<sup>1</sup>**

Subwatershed	Total Disturbance <sup>2</sup>	Coal Mine-related Disturbance
Antelope Creek	19,807	13,785
Clear Creek	4,405	0
Crazy Woman Creek	494	0
Dry Fork Cheyenne River	1,684	0
Lightning Creek	2,900	0
Little Bighorn River	64	0
Little Missouri River	163	0
Little Powder River	17,896	8,018
Middle North Platte River	561	0
Middle Powder River	2,297	0
Middle Fork Powder River	259	0
North Fork Powder River	0	0
Salt Creek	1,225	0
South Fork Powder River	313	0
Upper Belle Fourche River	37,148	15,578
Upper Cheyenne River	16,656	13,726
Upper Powder River	12,444	0
Upper Tongue River	3,574	0
<b>Total</b>	<b>121,890</b>	<b>51,107</b>

<sup>1</sup>Based on GIS analysis of existing development-related disturbance as of end of 2003.

<sup>2</sup>Inclusive of coal mine-related disturbance.

Source: ENSR 2005b.

For this study, Wyoming coal mines were grouped into four areas based on geographic distribution within the basin, including: 1) Subregion 1, mines near Gillette and extending to the north; 2) Subregion 2, mines south of Gillette and north of Wright; 3) Subregion 3, mines east of Wright and extending to the south into the northern part of Converse County; and 4) Subregion 4, mines historically operating north of Sheridan to the Wyoming/Montana state line.

AVF areas were identified on mines in Subregion 1 including the Buckskin Mine, Eagle Butte Mine, former Fort Union Mine (now part of Dry Fork Mine), and Rawhide Mine. AVFs were not identified on the Hay Creek Amendment Area of the Buckskin Mine or on the Wyodak Mine permit area. Mine plan and reclamation features to prevent long-term impacts and the maintenance of essential hydrologic function for declared AVF areas are contained in various sections of each mine's permit document.

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AVF areas were identified on mines in Subregion 2 including the Belle Ayr Mine, Caballo Mine, and Caballo Rojo portion of the Cordero-Rojo Mine. No AVFs were identified on the Cordero portion of the Cordero-Rojo Mine, or on the Coal Creek permit area.

AVFs were identified on mines in Subregion 3 including the Antelope Mine, Black Thunder Mine, Jacobs Ranch Mine, and North Antelope/Rochelle Mine. No AVFs were identified on the North Rochelle Mine or the former Dave Johnston Mine, which is located to the southwest of Subregion 3.

AVFs were identified in the permit areas for all of the former surface coal mines in Subregion 4, including Public Service Company of Oklahoma's Ash Creek Mine, Big Horn Coal Mine, and the Welch No.1 North Mine.

## **ES.2.3 Vegetation Including Wetlands and Riparian Areas**

### **ES.2.3.1 General Vegetation**

The study area for vegetation (including wetlands and riparian areas) includes all or portions of Sheridan, Johnson, Campbell, and Converse counties. It includes all of the area administered by the BLM Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the TBNG, which is administered by the USFS. State and private lands also are included in the study area.

The PRB study area is characterized as a mosaic of general vegetation types, which include prairie grasslands, shrublands, forested areas, and riparian areas. These broad categories often represent several vegetation types that are similar in terms of dominant species and ecological importance. Wyoming Game and Fish Department (WGFD) land cover classifications mapping and Gap Analysis Project resources generated by the USGS Biological Resources Division were used to identify specific vegetation types within the PRB study area. Fourteen vegetation types were identified, of which 10 primarily consist of native vegetation and are collectively classified as rangeland. These vegetation types include short-grass prairie, mixed-grass prairie, sagebrush shrubland, other shrubland, coniferous forest, aspen, forested riparian, shrubby riparian, herbaceous riparian, and wet meadow. The remaining vegetation types support limited or non-native vegetation and include cropland, urban/disturbed, barren, and open water.

The short-grass prairie vegetation community accounted for 41 percent of the pre-disturbance vegetation in the PRB study area. This vegetation community represents very sparse, sparse, and thin dry herbaceous rangeland types, as defined by WGFD. Short-grass prairie occurs on drought-prone, mildly alkaline, medium- and fine-textured soils. Few shrubs grow consistently in short-grass prairie, because the soils are too dry and compacted to support them. The mixed-grass prairie vegetation community accounts for 20 percent of the pre-disturbance vegetation in the PRB study area. This vegetation community is a combination of low, medium, and high herbaceous rangeland types, as defined by WGFD.

The sagebrush shrubland vegetation community accounted for 28 percent of the pre-disturbance vegetation in the PRB study area. This vegetation community includes a combination of sparse,

moderately dense, and dense Wyoming big sagebrush with a variety of understory grasses and forbs. The sagebrush shrubland is widely distributed and occupies a large proportion of the PRB study area. The other shrubland vegetation type accounts for 2 percent of the pre-disturbance vegetation in the PRB study area. This vegetation type is composed of three distinct shrub-dominated plant communities: mountain-mahogany shrubland, mixed foothill shrubland, and greasewood shrubland.

The coniferous forest vegetation community accounted for 2 percent of the pre-disturbance vegetation in the PRB study area. Juniper and pine forests tend to be lower in elevation, while spruce and fir forests occur at higher elevations. This vegetation community occurs primarily along the western edge of the PRB study area, where the upper-elevation conifer species are more common and in the northeastern corner where the lower elevation species are more common.

The aspen vegetation community accounted for less than 1 percent of the pre-disturbance vegetation in the PRB study area. Aspen communities typically occur in depressions, ravines, valley bottoms, or on the lee sides of ridges. Aspen seedlings are intolerant of drier conditions, and, therefore, this community distribution typically is dictated by the availability of soil moisture. The understory of the aspen vegetation community has greater productivity and species diversity than any other forested upland vegetation type in the PRB study area (Mueggler 1985). Many stands of aspen are a seral (i.e., transitional) community that would have conifers of various ages growing within them. In the PRB study area, this vegetation type is limited to the Big Horn Mountains.

The agricultural vegetation type accounted for 1 percent of the vegetation cover in the PRB study area. This land cover type is defined as croplands that are plowed or planted. These areas also may include wooded or shrubby draws and riparian areas. Agricultural areas are most common along the eastern edge of the Big Horn Mountains, along the major drainages, and near Wright and Gillette.

The urban/disturbed category accounted for less than 1 percent of the surface area in the PRB study area. This category includes lands covered by homes, businesses, streets, and a portion of the unvegetated surface mining areas present in the PRB. It is most common around cities and towns and along the eastern edge of the PRB study area where many coal mines are located.

The barren category accounted for 1 percent of the surface area in the PRB study area. This cover type includes rock outcrops, roads, sandbars, eroded gullies, and areas with less than 10 percent ground cover and perennial snow and ice areas, as defined by WGFD. It occurs as small, scattered areas throughout the PRB study area, and as several large blocks in the southwest portion.

The water category accounted for less than 1 percent of the surface area in the PRB study area. This category includes lakes, ponds, streams, and open water in wetlands, as defined by WGFD, and is scattered throughout the PRB study area.

Wetland and riparian areas are highly important water-related features in the arid landscape of northeastern Wyoming. Wetland and riparian areas occur throughout the PRB study area in all 18 subwatersheds and typically are restricted to the lands immediately surrounding major and minor rivers, streams, creeks, draws, topographical depressions, lakes, and ponds. Four riparian and wetland vegetation types have been identified in the PRB study area, including forested riparian, shrubby riparian, herbaceous riparian, and wet meadow.

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The forested riparian vegetation community accounted for less than 1 percent of the vegetation in the PRB study area. This vegetation community is characterized by a variety of deciduous and coniferous tree species that occur along riparian areas, as defined by WGFD. Coniferous forested riparian areas are rare, occurring only in the foothills of the Big Horn Mountains along the western edge of the PRB study area. Deciduous forested riparian areas are much more common and occur throughout the PRB study area.

The shrubby riparian vegetation community accounted for less than 1 percent of the vegetation in the PRB study area. This vegetation community includes a variety of shrubs and herbaceous plants that exist adjacent to draws, gullies, and streams.

The herbaceous riparian vegetation community accounted for less than 1 percent of the vegetation in the PRB study area. This vegetation community consists of a variety of riparian moist grasses, sedges, and rushes. Herbaceous riparian vegetation occurs near drainages including rivers, streams, and creeks.

The wet meadow vegetation community accounted for 2 percent of the vegetation in the PRB study area. This vegetation community is a combination of green and very green herbaceous rangeland types, as defined by WGFD. Wet meadow is a grassland vegetation community that typically occurs on fine-textured soils in valley bottoms where the water table is high enough to saturate the soil during a portion of the growing season. In addition, this vegetation community commonly occurs where springs emerge, along reservoirs, and in irrigated pastures (Knight 1994).

Based on GIS analysis, as of the end of 2003, the existing development-related disturbance to vegetation communities (less riparian and wetland vegetation) in the study area was 119,800 acres, of which 50,790 acres of disturbance was related to coal mining activity (see **Table ES.2.3-1**) (ENSR 2005b). The primary vegetation communities impacted as a result of coal mine development have included mixed-grass and short-grass prairies and sagebrush shrublands. The existing development-related disturbance to wetland and riparian areas in the study area, as of the end of 2003, was 2,090 acres, of which 317 acres of disturbance was related to coal mining activity (see **Table ES.2.3-1**) (ENSR 2005b). The primary wetland/riparian communities impacted as a result of coal mine development have included shrubby riparian and wet meadows. Based on the Task 2 database, as of the end of 2003, approximately 127,495 acres of previously disturbed vegetation had been reclaimed, inclusive of approximately 21,238 acres of vegetation disturbance in previously mined areas (ENSR 2005a). It is assumed that the species composition on reclaimed land is different than surrounding undisturbed lands, particularly in regard to the percent of woody shrub species during the early years following reclamation.

### ES.2.3.2 Invasive and Non-native Species

Once established, invasive and non-native plant species can outcompete and eventually replace native species, thereby reducing forage productivity and the overall vigor of existing native plant communities. Noxious weeds occur throughout the PRB study area. Their occurrence, distribution, and density are variable and are influenced by many factors, including disturbance type and frequency, climatic conditions, soil conditions, and local management efforts. Noxious weed lists are maintained by the Wyoming Department of Agriculture and by county weed and pest districts. Data relative to known noxious weeds or species of concern occurrences are scarce. A total of

22 noxious weed species and invasive species of concern are known to occur in the PRB. Although data relative to known occurrences of noxious weeds in the PRB study area are scarce, the actual occurrence potential is assumed to be commensurate with the type and frequency of disturbance and the site-specific reclamation and weed control measures that currently are or would be implemented.

**Table ES.2.3-1  
Vegetation Disturbance in the PRB Study Area<sup>1</sup>**

<b>Vegetation Community</b>	<b>Total Disturbance<sup>1</sup></b>	<b>Coal Mine-related Disturbance</b>
Cropland	750	12
Aspen	0	0
Barren	2,634	1,678
Coniferous Forest	584	299
Forest Riparian	13	0
Herbaceous Riparian	71	0
Mixed-grass and Short-grass Prairie <sup>3</sup>	70,735	29,117
Other Shrublands	253	0
Sagebrush Shrublands	42,770	19,213
Shrubby Riparian	404	212
Urban/Disturbed	19	0
Open Water	2,055	471
Wet Meadow	1,602	105
<b>Total</b>	<b>121,890</b>	<b>51,107</b>

<sup>1</sup>Based on GIS analysis of existing development-related disturbance as of end of 2003.

<sup>2</sup>Inclusive of coal mine-related disturbance.

<sup>3</sup>The GIS files do not distinguish between mixed-grass and short-grass prairie communities; they are combined.

Source: ENSR 2005b.

### ES.2.3.3 Special Status Species

A total of eight special status plant species were identified as potentially occurring within the PRB study area, including one federally threatened species, six BLM sensitive species, and one USFS sensitive species. No WGFD sensitive species were identified in the PRB study area.

Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is listed as federally threatened (USFWS 1992). In Wyoming, the Ute ladies'-tresses orchid is known from the western Great Plains in Converse, Goshen, Laramie, and Niobrara counties. Rangewide, the Ute ladies'-tresses orchid occurs primarily on moist, subirrigated, or seasonally flooded soils in valley bottoms, gravel bars, old oxbows, or floodplains bordering springs, lakes, rivers, or perennial streams at elevations between 1,780 and 6,800 feet above mean sea level (Fertig 2000a). In Wyoming, this species is known from four occurrences, all discovered between 1993 and 1997 (Fertig 2000b). As reported by Fertig (2000b), the only population known to occur within the PRB study area is located in Converse County, along a tributary of Antelope Creek. The BLM Casper Field Office administers the land at this location. This population is characterized as stable, with the number of observed individual plants varying between 11 and 35 during the period between 1990 and 1994.

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The Laramie columbine (*Aquilegia laramiensis*) is a BLM sensitive species. Although no documented occurrences within the PRB study area have been identified, this species may occur in the area within suitable habitats.

The Porter's sagebrush (*Artemisia porteri*) is a BLM sensitive species. The species is endemic to Wyoming and is restricted to the Wind River and Powder River basins in Fremont, Johnson, and Natrona counties (Fertig 2000a). One of the documented populations in southwestern Johnson County is within the PRB study area. This species also may occur in other suitable habitats within the PRB study area.

The Nelson's milkvetch (*Astragalus nelsonianus*) is a BLM sensitive species. Three populations are known from Johnson County, two of which are located in the eastern portion of the county and within the PRB study area. This species also may occur in other suitable habitats within the PRB study area.

The many-stemmed spider-flower (*Cleome multicaulis*) is a BLM sensitive species. This species is known from a single extant site in Natrona County (Fertig 2000f). Based on the species distribution, it is not expected to occur within the PRB study area.

The Williams' wafer-parsnip (*Cymopterus williamsii*) is a BLM sensitive species. This species is known from 23 extant populations found in the limestone or talus outcrops of the Big Horn Mountains (Fertig 2000g). It may occur in suitable habitats in Johnson County and other suitable habitats within the PRB study area.

The Laramie false-sagebrush (*Sphaeromeria simplex*) is a BLM sensitive species. All of the known populations in Converse County occur in the southern portion of the county and south of the southern extent of the PRB study area. Based on the species distribution, it is not expected to occur within the PRB study area.

Barr's milkvetch (*Astragalus barrii*) is a USFS sensitive species. Twelve known populations occur in the PRB study area. Based on its distribution, the species may occur in suitable habitats within the PRB study area.

## ES.2.4 Wildlife, Fisheries, and Habitat-related Values

The study area for wildlife and fisheries and related habitat values includes all or portions of Sheridan, Johnson, Campbell, and Converse counties, including BLM-administered and USFS-administered lands and state and private lands.

### ES.2.4.1 Wildlife

#### General Wildlife

Wildlife habitat has been affected by past and present activities in the PRB study area. These disturbances include, but are not limited to, agriculture, mining, roads and railroads, urban development, oil and gas well pads, compressor sites, and other ancillary facilities. Key issues for wildlife, fisheries, and related habitat values in the PRB study area as a result of mineral and

industrial development can be classified as short-term and long-term. Potential short-term impacts arise from habitat removal and disturbance associated with a project's development and operation (e.g., coal mines, CBNG wells, etc.) and would cease upon project completion and reclamation in a given area. Long-term impacts consist of permanent changes to habitats and the wildlife populations that depend on those habitats, irrespective of reclamation success, and habitat disturbance related to longer term projects (e.g., power plant facilities, rail lines, etc.). Direct impacts to wildlife populations as a result of development could include limited direct mortalities, habitat loss or alteration, habitat fragmentation, and animal displacement. Indirect impacts could include increased noise, additional human presence, and the potential for increased vehicle-related mortalities. The severity of both short- and long-term impacts would depend on factors such as the sensitivity of the species impacted, seasonal use patterns, type and timing of project activities, and physical parameters (e.g., topography, cover, forage, and climate).

Habitat fragmentation effects have resulted from long-term surface disturbance activities in the study area. Indirect effects from human presence, dispersal of noxious and invasive weeds, and dust effects from unpaved road traffic potentially have further reduced habitat quality and wildlife utilization in the study area. Collectively, it is conceivable that these effects have resulted in overall changes in habitat quality, habitat loss, increased animal displacement, reductions in local wildlife populations, and changes in species composition to some degree. However, as discussed above, the severity of these effects on terrestrial wildlife depend on factors such as sensitivity of the species, seasonal use, type and timing of project activities, and physical parameters (e.g., topography, cover, forage, and climate).

**Table ES.2.3-1** summarizes the existing development-related disturbance to vegetation communities as of the end of year 2003. Based on this GIS analysis, the existing development-related disturbance to associated wildlife habitats in the PRB study area totaled 121,890 acres, of which 51,107 acres of disturbance was related to coal mining activities (ENSR 2005b). The primary habitats impacted as a result of coal mine development have included mixed-grass and short-grass prairies and sagebrush shrublands. Lesser amounts of coniferous forest, riparian/wetland, and aquatic habitats also have been disturbed. Based on the Task 2 database, as of the end of 2003, approximately 127,495 acres of previously disturbed wildlife habitat had been reclaimed, inclusive of approximately 21,238 acres of habitat in previously mined areas (ENSR 2005a).

Big game species that occur in suitable habitats throughout the PRB study area include pronghorn, white-tailed deer, mule deer, elk (*Cervus elaphus*), and moose (*Alces alces*). The PRB study area includes crucial winter yearlong and severe winter range for pronghorn; crucial winter range, crucial winter yearlong range, and parturition areas for elk; and crucial winter yearlong and crucial yearlong areas for moose. No crucial or severe winter ranges have been identified within the PRB study area for white-tailed deer or mule deer. No big game migration corridors are recognized by the WGFD in this area.

Of the 13 pronghorn antelope heard units that are entirely or partially within the PRB study area, the overall population trend within 12 of the heard units has been stable to increasing. One herd unit exhibited a decreasing trend; this most likely is a result of bad winter weather causing high fawn mortality. Extensive on-going and planned future energy development are considered potential management concerns for some herd units. For example, increased road density, produced water

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discharge, loss of vegetation, and increased human presence have had the potential to adversely affect herd units subject to CBNG development.

White-tailed deer population trends have been stable or increasing within the PRB study area. Increasing population levels can be accredited to the inaccessibility of habitat in the northwestern part of the PRB study area, which primarily consists of private land tracts.

For mule deer in the PRB study area, two out of the seven herd units in the PRB study area are exceeding population goals; the remaining five herd units are below their goal. Overall, the mule deer population trend is relatively stable to decreasing. Among those units that were below their goal, poor weather conditions, high fawn mortality, and lack of reliable population estimates are most likely responsible. Specific impacts on mule deer populations are unknown; however, it is assumed that increased road density, produced water discharge, loss of vegetation, and heightened human presence may cause stress to the herd units in areas that are subject to considerable development.

Elk in the PRB study area are exhibiting a stable to increasing population trend. However, some herd units have declined in response to management actions taken to decrease populations. Similar to mule deer, increased road density, produced water discharge, loss of vegetation, and increased human presence have the potential to negatively affect elk herds.

There is little suitable moose habitat within the PRB study area. Based on seasonal range maps from the WGFD, moose primarily are restricted to areas along the study area's western boundary in the Big Horn Mountains. There currently are no existing disturbances to moose habitat associated with energy development, agriculture, or urban development within the study area.

There are several raptor species that have the potential to occur within the PRB study area. These include: northern harrier, golden eagle, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk, ferruginous hawk, American kestrel (*Falco sparverius*), prairie falcon, short-eared owl, and great horned owl (*Bubo virginianus*). Both the bald eagle and rough-legged hawk (*Buteo lagopus*) are common winter residents in the study area. Less common raptors in the study area include: osprey, merlin, and burrowing owl (*Athene cunicularia*). Habitat is relatively limited for raptor species that nest exclusively in trees or on cliffs. Some nests have been removed by mining activities, and it has been necessary to relocate others to avoid destruction. As mitigation, new nests have been created to replace some of the nests that have been removed. It is estimated that the PRB study area yields 2,690 to 4,410 active nests annually, with a total count of 12,360 nests (active and inactive).

Several species of upland game birds may occur within the PRB study area, including ring-necked pheasant (*Phasianus colchicus*), gray partridge (*Perdix perdix*), wild turkey (*Meleagris gallopavo*), mourning dove (*Zenaida macroura*), greater sage-grouse (*Centrocercus urophasianus*), and sharp-tailed grouse (*Tympanuchus phasianellus*) (Luce et al. 1999). The greater sage-grouse is discussed under Special Status Species. Mourning doves are abundant in a variety of habitats that occur in the study area. Both the gray partridge and ring-necked pheasant occur locally near agricultural lands and along river bottomland. Wild turkeys occur locally in ponderosa pine and shrubby or forested riparian areas. None of these species, with the exception of the greater sage-grouse, is specifically monitored or managed other than through normal hunting seasons.

Suitable waterfowl habitats within the PRB study area include major rivers, streams, creeks, draws, lakes, and ponds. There is no existing information on the specific impacts of existing oil and gas development on waterfowl. Existing impacts that may have occurred also are related to the various methods of CBNG water handling. At present, much of the CBNG produced water is discharged to surface drainages. Although much of this water evaporates or infiltrates, substantial quantities remain on the surface and have resulted in the expansion of wetlands, stock ponds, and reservoirs, potentially increasing waterfowl breeding and foraging habitats. Produced water in some parts of the study area is disposed of in containment reservoirs, which also may provide waterfowl habitats, although in many cases appropriate vegetative cover and foraging areas have not developed around these reservoirs. It is possible for salts to accumulate in some CBNG water containment reservoirs. As water evaporates, salinity increases and may result in mass production of salt tolerant invertebrates such as brine shrimp, a major food source attractive to birds (Pennak 1989; Tribbey 1988). Waterfowl mortalities resulting from salt crystallization and/or toxicity have been documented in hypersaline wetlands in North Dakota and California, where sodium concentrations exceeding 17,000 mg/L were reported and alternative freshwater sources were not available nearby (Gordus et al. 2002; Windingstad et al. 1987). Similarly, in Canada, lake concentrations of sodium in excess of 30,900 mg/L were reported to cause mortality in some Canada geese. Moving salt-stressed geese to freshwater resulted in full recovery (Wobeser and Howard 1987).

The median sodium concentration of Fort Union Formation CBNG produced water is 270 mg/L (BLM 2003a). If sodium concentrations are maintained below 17,000 mg/L in the evaporation ponds, the potential for adverse effects to waterfowl would be minimal. Further, presence of freshwater sources within the study area, including the Upper Tongue River; Upper, Middle, and Little Powder Rivers; and Crazy Woman Creek, would decrease the potential for sodium toxicity to migratory waterfowl (Kantrud and Stewart 1977; Swanson et al. 1983).

A wide variety of neotropical migrants use the PRB study area during migration or the breeding season. Few data are available on population numbers of these species; however, Breeding Bird Survey data can be used to determine population trends in a geographic area. Much of the recent energy development is too recent to have had a measurable effect on populations of migratory birds. Loss and degradation of habitats likely has occurred, as has disturbance-related effects to individual birds resulting from construction and production activities. In areas of concentrated development, the breeding density of some species may have been reduced due to these and other effects. Species that are specific to grassland and shrub-steppe habitats, and that are sensitive to disturbance and habitat fragmentation, likely have been the most affected.

### **Special Status Species**

The PRB study area for special status species and related habitat values includes all or portions of Sheridan, Johnson, Campbell, and Converse counties including BLM- and USFS-administered lands and state and private lands.

Impacts to special status species have paralleled those discussed above for wildlife. A total of 2 federally listed species, 22 BLM sensitive species, 29 USFS sensitive species, and 24 WGFD native sensitive species were identified as potentially occurring in the PRB study area.

Federally Listed and Federal Candidate Species. No black-footed ferrets (federally endangered) currently are known to occur outside of reintroduced populations in Montana, South Dakota, Utah,

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Arizona, and Carbon County in Wyoming. Consequently, no known populations of black-footed ferrets have been identified within the PRB study area.

The bald eagle (federally threatened) is a documented breeder and winter resident of suitable habitats within the PRB study area. Twelve active nests are known from within the study area, with seven nests within the Buffalo Field Office area and one within the Casper Field Office area. The remaining four nests are on non-BLM-administered land. WGFD also has identified numerous winter roosts in the study area.

The Preble's meadow jumping mouse (federally threatened) has been documented in two counties in Wyoming: along Crow Creek on the F.E. Warren Air Force Base (Laramie County), and in the Lodgepole Creek drainage within the Medicine Bow National Forest (Albany County). No known populations of Preble's meadow jumping mouse have been identified within the PRB study area.

The boreal toad (federal candidate) occurs in two distinct populations in Wyoming. The northern population, not listed as a federal candidate species, ranges from mid to higher elevations in Yellowstone and Grand Teton national parks and the Bridger-Teton, western Shoshone, and Targhee national forests. The southern population is restricted to a few isolated areas of the Medicine Bow National Forest. Current distributions of the Medicine Bow population are not known north of Carbon County. As a result, this species is not expected to occur within the PRB study area.

U.S. Forest Service Sensitive Species. The tiger salamander, Northern leopard frog, milk snake, American bittern, osprey, ferruginous hawk, merlin, long-billed curlew, upland sandpiper, mountain plover, black tern, western yellow-billed cuckoo, western burrowing owl, Lewis' woodpecker, loggerhead shrike, pygmy nuthatch, Baird's sparrow, fox sparrow, fringed-tailed myotis, Townsend's big-eared bat, black-tailed prairie dog, and swift fox are expected to occur in suitable habitats throughout the PRB study area.

The common loon and white-faced ibis are not expected to nest in the PRB study area, but may be observed in suitable habitats during migration. The greater sandhill crane is an uncommon breeding resident and migrant.

The Black Hills redbelly snake, flammulated owl, olive-sided flycatcher, and purple martin are not expected to occur within the PRB study area.

Wyoming BLM Sensitive Species. The spotted frog, trumpeter swan, northern goshawk, greater sage-grouse, sage thrasher, Brewer's sparrow, sage sparrow, and long-eared myotis are expected to occur in suitable habitats throughout the PRB study area.

The greater sage-grouse is highly dependent on sagebrush communities. Based on GIS data (BLM 2003a; Christiansen 2005), there are 385 lek sites in the study area. Although the range of this species is relatively unchanged, the population numbers have been trending downward in recent years. This decrease has been associated with the disturbance and destruction of suitable grouse habitats.

The peregrine falcon is not expected to nest in the PRB study area, but may be observed in suitable habitats during migration.

The spotted bat and white-tailed prairie dog are not expected to occur within the PRB study area.

See the USFS sensitive species subsection relative to the northern leopard frog, white-faced ibis, ferruginous hawk, long-billed curlew, western yellow-billed cuckoo, western burrowing owl, loggerhead shrike, Baird's sparrow, mountain plover, Townsend's big-eared bat, black-tailed prairie dog, and swift fox.

Wyoming Game and Fish Department Sensitive Species. The long-legged myotis, little brown myotis, big brown bat, and western small-footed myotis are expected to occur in suitable habitats throughout the PRB study area.

The American white pelican, black-crowned night heron, and snowy egret are not expected to nest in the PRB study area, but may be observed in suitable habitats during migration.

### **ES.2.4.2 Fisheries**

#### **General Fisheries**

The project study area for fisheries consists of perennial streams and standing water environments (ponds, lakes, and reservoirs) within 18 fourth order watersheds (subwatersheds). The subwatersheds are part of eight basins: Powder River, Little Powder River, Tongue River, Cheyenne River, Belle Fourche River, North Platte River, Cheyenne River, Little Bighorn River, and Little Missouri River. Fish resources within the project area water bodies include a mixture of coldwater and warmwater species. Species that are managed by the WGFD include game or sport fish and special status species. Seventeen game fish species representing four families (trout, perches, catfishes, and sunfishes/bass) occur in one or more of the project area subwatersheds.

The Powder River and its tributaries support 28 known fish species of which 20 are native. Most of these species are tolerant of widely fluctuating environmental conditions, such as turbidity, salinity, and water temperature. The common species in the river include flathead chub, sturgeon chub, goldeye, river carpsucker, stonecat, common carp, longnose dace, and channel catfish. The game species in the Powder River and its tributaries include black bullhead, channel catfish, stonecat, smallmouth bass, rock bass, green sunfish, sauger, and walleye. Trout species such as brook trout and brown trout are found in the headwaters of the South Fork Powder River, Middle Fork Powder River, North Fork Powder River, Upper Powder River, Crazy Woman Creek, Clear Creek, Willow Creek, and Sanchez Creek. Standing waters in the Powder River Basin mainly consist of relatively small (less than 10-acre) reservoirs and farm ponds. Various trout species, channel catfish, and largemouth bass are the primary stocked species. Since 1995, most of the stocking has been done by private landowners.

The Little Powder River drainage basin contains the entire Little Powder River subwatershed. Flowing water in this basin is restricted to three stream reaches, all of which are on private land. The Little Powder River and a short reach of the Dry Fork of the Little Powder River below its confluence with Moyer Springs Creek are perennial. The only coldwater habitat in the drainage is Moyer Springs Creek, a 0.5-mile reach of stream that contains a wild brook trout population. There is no perennial water in any of the other tributary streams in the drainage. Only one small standing lake, Weston Reservoir (Little Powder Reservoir) is suitable for game fish and is on accessible

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public land. Warmwater game fish species that occur in stream segments with more persistent flow include brown bullhead, channel catfish, green sunfish, and largemouth bass. Fish numbers are limited due to the relatively small size of the stream segments and low water levels.

The water bodies in the Upper Tongue River consist of headwater tributary streams, mainstem portion of the Upper Tongue River, and privately owned ponds. Aquatic habitat quality varies throughout the subwatershed. Although coldwater habitat is provided in the headwater tributaries, an absence or scarcity of deep pools in some of the streams limits the development of larger fish. Irrigation diversions reduce flows on many streams and form barriers downstream of Interstate (I)-90 that impede seasonal upstream fish movements. Game fish species include the Snake River cutthroat trout and Yellowstone cutthroat trout and rainbow, brown, and brook trout, which inhabit headwater tributaries. The lower portion of the Upper Tongue River also supports sauger and smallmouth bass. Some of the ponds contain warmwater game species such as brown bullhead, channel catfish, green sunfish, white crappie, and rock bass.

Most of the streams in the Upper Belle Fourche River subwatershed are unsuitable for coldwater fish due to higher water temperatures. None of the streams located in the Upper Belle Fourche subwatershed support self-sustaining trout populations. Habitat for warmwater fish also is limited as a result of water diversions and the relatively small size of the water bodies. Private farm ponds and reservoirs represent the primary type of warmwater habitat. Limited information is available for fish occurrence in the privately-owned water bodies. Game fish species likely inhabiting many of the ponds and reservoirs include black bullhead and green sunfish. The Belle Fourche River below Keyhole Reservoir is dominated by native nongame fish species but also contains game species such as channel catfish and smallmouth bass.

Subwatersheds in the Cheyenne River Basin include Antelope Creek, Upper Cheyenne River, Dry Fork Cheyenne River, and Lightning Creek. Approximately 45 percent of the basin is located on public land managed by the BLM, USFS, or the state. However, most of the bottomland and riparian areas of the Cheyenne River are privately owned. Streams in these subwatersheds are considered unsuitable habitat for game fish species by the WGFD as a result of intermittent flows and relatively high summer water temperatures. Standing waters in the basin consist of reservoirs and ponds, most of which are less than 10 surface acres. WGFD stocks privately owned farm ponds based on their potential to support game fish species and access to public fishing. Green sunfish and black bullhead are known to be abundant in some water bodies. Channel catfish and largemouth bass may be present in low numbers in some water bodies.

The Middle North Platte Casper subwatershed is contained within a small portion of this basin (northwest corner) and includes watercourses such as Sage Creek and Sand Creek. The area on the north side of the North Platte River is arid with typical plains streams. The streams within this basin generally are small, and flows are intermittent or low throughout the year. They flow through low-gradient sandy and silty soils that generally are not suitable habitat for game fish species.

Within the project study area, the Little Bighorn subwatershed contains a few perennial streams such as Elkhorn, Gay, East Pass, West Pass, Twin, and East Twin creeks. The Little Bighorn River basin is a tributary to the Yellowstone River and historical range for native Yellowstone cutthroat trout. Due to the remoteness of part of the drainage basin, especially the West Fork of the Little Bighorn River Basin, fishery surveys have been limited, and data are lacking to evaluate the presence of endemic populations of Yellowstone cutthroat trout. Various trout species occur in

Elkhorn, East Pass, West Pass, and East Twin creeks. Flow in Twin Creek, a tributary to East Pass Creek, is insufficient to support trout.

The majority of the drainage basin is contained within Crook County except for some very small sections in Campbell County. These small sections within Campbell County contain the Little Missouri River subwatershed within the study area. Small stock water ponds and irrigation reservoirs in the Hattie Creek, Switzer Draw, Cracker Creek, and Flat Creek drainages provide the majority of fisheries habitat. WGFD listed the majority of the water bodies in this drainage basin as unsuitable for sustaining a fishery.

Sufficient information is not available to make statements about trends in fish populations or aquatic habitat in the PRB study area. Stream segments on public-administered land exhibit varying habitat conditions that range from low to quality. Fish population numbers are not monitored or censused on a frequent basis.

### **Sensitive Fish Species**

Eleven fish species that potentially occur in the project area subwatersheds have special status designations. No federally listed, proposed for listing, or candidate fish species occur in the project study area. However, 11 species have special status by the BLM, USFS, or WGFD. Yellowstone cutthroat trout is considered a sensitive species by the BLM, while the flathead chub and plains topminnow are considered USFS sensitive. All 11 species have one of the three highest priority designations (SSC1, SSC2, and SSC3) by the WGFD. The following information summarizes the occurrence and habitat used by these species within the PRB study area.

- Flathead chub – It is known to occur in the Powder River, Little Powder River, Tongue River, Cheyenne, Little Bighorn, and Little Missouri basins and 11 subwatersheds within the study area. Surveys conducted in 2002 collected this species in the mainstem portion of the Powder River and several tributary draws. The preferred habitat for this species is relatively large rivers and streams in areas with swift currents and sand or gravel substrates.
- Plains Topminnow – This species is known to occur in Sage Creek, a small tributary located in the upper Cheyenne River subwatershed. In Wyoming, the plains topminnow's characteristic habitat is clear, sand or gravel-bottomed streams with considerable vegetation. It often is collected in streams inhabited by plains killifish. Spawning occurs in late spring or early summer in habitat with aquatic macrophytes.
- Yellowstone Cutthroat Trout – This species may occur in suitable aquatic habitats of the Upper Tongue and Little Bighorn subwatersheds within the study area. Suitable habitats include coldwater rivers, creeks, beaver ponds, and large lakes.
- Goldeye – This species occurs in the Upper Powder River, Crazy Woman Creek, Clear Creek, and Middle Powder River subwatersheds in the Powder River Basin and the Little Powder River subwatershed. It occurs in lake and stream habitats and can tolerate turbid conditions.
- Lake Chub – The lake chub inhabits foothill streams and lakes in the Upper Tongue and Little Powder River, and Upper Belle Fourche River subwatersheds. Lake populations usually show movements in the spring to tributary streams where they utilize rocky substrates.

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- Mountain Sucker – Six subwatersheds are inhabited by mountain sucker: Upper Tongue River, Middle Fork River, South Fork Powder River, Crazy Woman Creek, Middle Powder River, and Little Powder River. The mountain sucker utilizes a variety of habitats such as larger streams, rivers, lakes, and reservoirs with sand, gravel, or mud substrates. The species usually is associated with undercut banks, eddies, and pools with moderate current.
- Silvery Minnow – This species occurs in the Middle Powder River and Little Powder River subwatersheds where it prefers relatively large clear streams. This species often occurs in the same streams as flathead chub.
- Sturgeon Chub – Within the study area, the Upper Powder River is the only subwatershed inhabited by sturgeon chub, where it has been collected in the mainstem portion of the Powder River and several tributary draws. This species prefers swift currents in large, turbid rivers with sand or gravel-dominated bottoms.
- Plains Minnow – This species occurs in nine of the project area subwatersheds (Upper Tongue River, Upper Powder River, South Fork Powder River, Salt Creek, Clear Creek, Middle Powder River, Little Powder River, Upper Cheyenne River, and Upper Belle Fourche River). Plains minnow prefers slower-moving water and side-pools in turbid streams.

### ES.2.5 Grazing

The study area for grazing includes all or portions of Sheridan, Johnson, Campbell, and Converse counties. Livestock grazing is one of the primary land uses within the PRB study area since the majority of the area consists of rangeland, most of which is privately owned. Livestock grazing occurs on lands administered by the BLM, USFS, and State of Wyoming. BLM-administered rangeland within the study area is managed by the Buffalo Field Office (Sheridan, Johnson, and Campbell counties) and Casper Field Office (northern portion of Converse County). USFS-administered rangeland within the study area is part of the TBNG, which is managed by the Douglas Ranger District.

**Table ES.2.5-1** summarizes livestock grazing on federal lands in the study area. Livestock grazing that occurs on BLM-administered rangeland in the Buffalo Field Office area includes 470 grazing allotments, which cover approximately 798,000 acres with an associated 398 lessees and 420 grazing leases. The majority of BLM grazing allotments that occur in the study area are leased by one lessee, although several allotments are leased by two or more lessees.

The majority of ranch operations consist of cow/calf pairs (approximately 90 percent) and yearlings, and the remainder consists of sheep operations. Authorized livestock use within these grazing allotments total 105,152 animal unit month (AUMs).

Livestock grazing that occurs on BLM-administered rangeland in the Casper Field Office area includes 50 grazing allotments, which cover approximately 73,000 acres with an associated 51 lessees and 51 grazing leases. All of the ranch operations consist of cow/calf pairs or sheep operations. Authorized livestock use within these grazing allotments total 27,623 AUMs.

**Table ES.2.5-1  
Rangeland Summary for Federal Lands in the Study Area**

<b>Allotments, Lessees, and AUMs</b>	<b>BLM-administered Rangeland</b>	<b>USFS-administered Rangeland</b>	<b>Total</b>
Number of Grazing Allotments	520	75	595
Acres of Rangeland	871,000	266,000	1,137,000
Number of Lessees	449	48	497
Number of Grazing Lessees	471	74	545
AUMs	132,775	51,373	184,148

Sources: Medders 2004; Nelson 2004; Schmitt 2004; and Stanton 2004.

Livestock grazing that occurs on USFS-administered rangeland in the southern portion of the TBNG includes entire or partial portions of 60 grazing allotments, which cover approximately 174,000 acres with an associated 34 lessees and 60 grazing leases. The majority of USFS grazing allotments that occur in the study area are leased by one lessee, although several allotments are leased by two or more lessees (i.e., community allotments). The majority of ranch operations consist of cow/calf pairs and yearlings, and, to a lesser extent, sheep. Authorized livestock use on the grazing allotments total 37,573 AUMs.

Livestock grazing that occurs on USFS-administered rangeland in the northern portion of the TBNG (i.e., Spring Creek Unit north of Gillette, Wyoming) includes entire or partial portions of 15 grazing allotments, which cover approximately 92,000 acres with an associated 14 lessees and 14 grazing leases. The majority of USFS grazing allotments that occur in the study area are leased by one lessee, although several allotments are leased by two or more lessees (i.e., community allotments). The majority of ranch operations consist of cow/calf pairs (89 percent) and sheep (10 percent). Horses also utilize rangeland within this area but only comprise 1 percent of all grazing within the area. Authorized livestock use on the grazing allotments total 13,800 AUMs.

Based on GIS analysis, the existing surface disturbance associated with development activities in the study area (as of the end of 2003) has resulted in the loss of approximately 56,788 acres of rangeland, 36,265 acres of which occur on BLM-administered allotments and 20,523 acres of which occur on USFS-administered allotments. Approximately 1,912 acres of the existing disturbance on the BLM-administered allotments is related to coal mine development (ENSR 2005b). The majority of surface disturbance in the study area has occurred on private property. Based on an average stocking rate of 6.0 acres per AUM on BLM-administered allotments in the study area and an average stocking rate of 4.0 acres per AUM on USFS-administered allotments, past and present development has resulted in the loss of 6,044 and 5,130 AUMs, respectively.

## **ES.2.6 Cultural Resources and Native American Concerns**

The study area for cultural resources includes all or portions of Sheridan, Johnson, Campbell, and Converse counties. It includes all of the area administered by the BLM Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the TBNG, which is administered by the USFS.

### ES.2.6.1 Cultural Resources

The majority of data on cultural resources in the PRB study area is based on a file search conducted through the Wyoming Cultural Records Office database in late March 2001. The file search covered Campbell, Converse, Johnson, and Sheridan counties through the year 2000. The database of cultural resource survey reports, cultural resource sites, and isolated finds contained 8,120 sites and 2,831 isolated finds. At the time of the file search, approximately 10 percent of the study area had been inventoried at the Class III level for cultural resources. Inventory coverage was strongly concentrated in the eastern half of the study area. This concentration of coverage was a result of nearly all of the cultural resources work being done in relation to coal development.

Currently, the Wyoming State Historic Preservation Officer (SHPO) is preparing a regional database of all recorded cultural resources located in the PRB. The database includes, but is not limited to, the number of sites and their location, site types, recordation date, report author, and each site's National Register of Historic Places (NRHP) eligibility status. Information obtained from the database indicates that a total of 1,339,122 acres (17 percent) of the study area has been inventoried to Class III standards. Similar to the file search results, inventories are concentrated in the eastern half of the study area as a result of cultural work conducted for coal development.

According to the SHPO database, 10,795 cultural sites have been identified in the study area. Of these, 5,871 (54 percent) are prehistoric sites, 2,664 (25 percent) are historic sites, 167 (1.6 percent) are multi-component sites, 51 (less than 1 percent) are sites of unknown cultural affiliation, unknown use, or with no information, and 2,042 (19.0 percent) sites are labeled as "not encoded." The SHPO defines "not encoded" as those sites that have no field value entered in the database.

#### Prehistoric Sites

All recognized prehistoric cultural periods, from Clovis through Protohistoric (about 11,500 to 200 years ago), are represented in the study area. The earliest prehistoric cultural periods, Paleoindian through Early Plains Archaic, are represented by only a small number of sites. Archaic and later prehistoric period sites (Archaic to Protohistoric) are represented in increasing numbers as a result of higher populations through time and better preservation of more recent sites.

Artifact scatters, camps, habitation features, rock features, and lithic sources are the predominate prehistoric site type in the study area. Prehistoric site densities vary from extremely high in some settings, such as certain ridgetops and areas near larger, more reliable drainages, to nonexistent in other settings. The factors affecting these differences in density are not always readily apparent. If a location is used by a large number of people or repeatedly over a long period, lost or discarded cultural materials would accumulate. If the landform remains stable over time and is not degraded, deeply buried, or mechanically disturbed, the site would remain visible. Site density is influenced by the size and number of groups that used the area and the availability or density of resources. High site densities often are associated with locations that have a predictable abundance of particular resources, locations that have a moderate abundance of several distinct resources, or locations that have access to several resource areas. Another factor that is frequently noted in site location is proximity to a reliable source of water. Other factors may be responses to seasonal conditions, such

as winter camps with minimal snow accumulation that are sheltered from the wind, or summer camps on higher benches away from swarming bugs.

### Historic Sites

Historic site categories documented for the study area are based on broad historic themes. The site categories are Rural, Urban, Mining, Transportation, Military, Exploration, and Communication. Rural/agrarian sites dominate known historic sites because that is where the majority of systematic surveys have been conducted. These include homesteads, farms, ranches, agrarian and ranching features, irrigation features, and rural residences. The principal exception is the Upper Tongue River subwatershed, in which a large number of urban buildings and structures have been documented in Sheridan. The next most common site type is transportation features, which include trails, roads, bridges, railroads, stage stations, railroad stations, and related structures or features. Where historic military sites, early exploration sites, and early transportation sites have been recognized and documented, most are considered significant because of their associations with significant historic events. The Bozeman Trail, its several variants, and related sites, were highly significant in western history and retain a large number of well preserved segments. The Outlaw Cave/Red Wall area of the Middle Fork Powder River is rich in prehistoric caves and rockshelters, premiere prehistoric rock art sites, prehistoric stone features, and historic sites that figure prominently in Western lore.

### ES.2.6.2 Native American Concerns

The 1992 National Historic Preservation Act (NHPA) amendments place major emphasis on the role of Native American groups in the Section 106 review process. Subsequent revisions to the regulations of the Advisory Council on Historic Preservation (Council) published May 18, 1999, incorporate specific provisions for federal agencies to involve Native American groups in land or resource management decisions and for consulting with these groups throughout the process. Before making decisions or approving actions that could result in changes in land use, physical changes to lands or resources, changes in access, or alienation of lands, federal managers must determine whether Native American interests would be affected, observe pertinent consultation requirements, and document how this was done. The consultation record will be the federal agency's basis for demonstrating that the responsible manager has made a reasonable and good faith effort to obtain and consider appropriate Native American input in decision making.

Under Native American Consultation:

- The federal agency must consult with any Native American group that attaches religious and cultural significance to historic properties that may be affected by an undertaking regardless of location (Section 101[d][6][b]). Such Native American group is a consulting party.
- The federal agency must make a reasonable and good faith effort to identify Native American groups to be consulted.
- The federal agency must be respectful of tribal sovereignty in conducting consultation.
- The federal agency must recognize the government-to-government relationship.

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- Historic properties of religious and cultural significance may be located on ancestral, aboriginal, or ceded lands of Native Americans.
- The Native American groups may enter into agreement with the federal agency regarding any aspect of tribal participation in the Section 106 review process. The agreement may provide the Native American groups with additional participation or concurrence in agency decisions under Section 106 provided that no modification may be made in the roles of other parties without their consent.

As a formal participant in the national historic preservation program, a tribe may assume official responsibility for a number of functions aimed at the preservation of significant historic properties. Those functions include identifying and maintaining inventories of culturally significant properties, nominating properties to national and tribal registers of historic places, conducting Section 106 reviews of federal agency projects on tribal lands, and conducting educational programs on the importance of preserving historic properties.

When an undertaking occurs on or affects historic properties on tribal lands, federal agencies must consult with a representative designated by the tribe, the Tribal Historic Preservation Officer (THPO). In some cases, the THPOs have formally assumed the responsibilities of the SHPO on their tribal lands. Whether or not the THPO has formally assumed SHPO responsibilities, they must be consulted when an undertaking occurs on tribal lands.

While the THPO must be consulted when a project occurs or affects historic properties on tribal lands, many historic properties of religious and cultural significance to Indian tribes are not located on tribal lands. Section 101(d)(6) of the NHPA states that properties of traditional religious and cultural importance to tribes can be eligible to the NRHP. This section goes on to require that agencies consult with any Indian tribe that attaches religious and cultural importance to such properties. This consultation requirement applies regardless of whether such properties are on or off tribal lands.

In accordance with Section 106 of the NHPA and the Native American Graves Protection and Repatriation Act (NAGPRA), Native American consultation would be conducted as part of National Environmental Policy Act (NEPA) compliance for future federally permitted projects.

## ES.2.7 Land Use and Recreation

The study area for land use issues includes all or most of Campbell, Converse, Johnson and Sheridan counties. A somewhat larger perimeter around this primary study area was considered for wilderness issues.

### ES.2.7.1 Land Use, Access, and Easements

The PRB study area is a predominantly rural, wide open landscape. A substantial majority (77.8 percent) of the surface ownership in the study area is privately owned. Approximately 14.2 percent is federal with the BLM managing 11.0 percent and the USFS overseeing 3.2 percent. The State of Wyoming owns approximately 7.9 percent of the study area, mostly state trust lands.

In contrast to the surface ownership, mineral rights in much of the study area are in “split-estates.” In much of the study area, the surface is privately owned but the mineral rights are at least partly federally owned. Although the federal government owns all mineral rights on large portions of the study area, there also are sizable areas where it owns only the coal rights and somewhat smaller areas where it owns only oil and gas rights. The State of Wyoming typically owns the mineral rights for a majority of the state trust lands.

Climate and soil conditions in the study area dictate that the predominant use of land is for grazing; nevertheless, there is a range of other uses in the area. The major categories include agriculture, forested, mixed rangeland, urban, water, wetlands, coal mines, and barren land. **Table ES.2.7-1** shows approximate acreages for each of the land uses.

**Table ES.2.7-1**  
**Land Use by Surface Ownership**  
**(acres)**

Use Category	BLM	USFS	State	Private	Total	
					Acres	Percent
Agriculture	2,627	14,197	13,770	472,811	503,405	6.3
Barren	165	205	187	9,396	9,953	0.1
Forested	137,555	14,604	48,645	332,062	532,866	6.7
Mixed Rangeland	732,014	218,156	561,363	5,271,644	6,783,177	86.0
Urban	893	17	1,039	25,469	27,418	0.3
Water	35	73	334	4,773	5,215	<0.1
Wetlands	0	104	559	1,566	2,229	<0.1
Coal Mines	149	7,236	2,805	40,917	51,107	0.6
<b>Total</b>	<b>873,438</b>	<b>254,592</b>	<b>628,702</b>	<b>6,158,638</b>	<b>7,915,370</b>	<b>100.0</b>

Note: Based on land use categories in the land use GIS file, which differ in areal extent from the categories in the vegetation GIS file.

Source: ENSR 2005b.

Agricultural land uses in the study area include cropland and pasture, confined feeding operations, and other agricultural uses. Most of the cropland is not irrigated. Rangeland is primarily used for livestock grazing, which is the dominant land use in the study area on private and public lands. Urban land uses in the study area are mostly located in or immediately adjacent to incorporated communities. There are several large to very large coal mines in the study area. There also are existing and historic mines in the study area that have produced coal, uranium, bentonite, and aggregate materials (sand and gravel).

As of the end of 2003, approximately 14,785 CBNG wells and 6,846 conventional oil and gas wells existed on federal, state, and private lands within the study area. The wells and ancillary facilities have resulted in approximately 40,042 acres of disturbance to existing land uses (ENSR 2005a).

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### **Land Use Planning and Management**

Lands administered by the BLM in the study area are managed under the guidance of adopted Resource Management Plans (RMPs) for the Buffalo and Casper field offices. Several BLM Special Management Areas (SMAs) that provide recreational opportunities are located within the study area. These areas include wilderness study areas (WSAs) and other special areas. Oil and gas leases prohibit surface occupancy in WSAs in order to preserve wilderness values. Surface disturbances also are restricted within Recreational Areas (RAs) and Wildlife Habitat Management Areas.

Most of the BLM and USFS lands in the study area are used for livestock grazing under permitted grazing allotments, which are classified based on productivity.

The USFS administers land use on National Forest System lands based on multiple use principles. The TBNG, makes up the bulk of USFS-administered land in the study area. Guidance is provided by the Land and Resource Management Plan (LRMP) for the Medicine Bow National Forest and TBNG (USFS 2001a, 2001b, 2002). Most of the USFS-administered land in the study area is managed for livestock grazing.

Wyoming established the State Land Use Commission in 1975 to guide land use planning in the state. The Office of State Lands and Investments is responsible for all leases, easements, and temporary uses on state lands, including mineral and agricultural leasing, timber leasing and sales, and public recreation. The WOGCC regulates drilling and well spacing, regardless of land ownership, including wells on federal lands.

The City of Gillette and the Town of Wright have zoning ordinances and land use plans for the incorporated areas. The City of Gillette/Campbell County Comprehensive Planning Program addresses potential future land use. The Converse County Land Use Plan describes the current land use in the study area as primarily agriculture and dryland grazing. Mineral extraction, the second most prominent use, is exempted from local regulations by state law. Johnson County promulgated a Draft Comprehensive Land Use Plan in June 2004. The communities of Buffalo and Kaycee have land use plans for their urban areas. The Sheridan County Zoning Resolution and Growth Management Plan (Sheridan County 2001a,b) guide development in unincorporated areas of the county. Zoning for most of the county is agricultural.

### **ES.2.7.2 Recreation**

With nearly 80 percent of the PRB study area privately owned, the public lands provide important open space and recreation resources including both developed recreation facilities and areas to pursue dispersed recreation activities. The private sector contributes commercial recreation opportunities and tourism services such as motels and restaurants. Some private landowners also allow hunting with specific permission, often for a fee.

Major attractions include the TBNG, several state historic sites, and the historic Bozeman Trail. Formal recreation opportunities are most prevalent in the western portion of the study area, near the foothills of the Big Horn Mountains and in the Powder River Breaks.

The primary developed recreational sites on BLM lands, all in the Buffalo Field Office area, include the South Big Horns Area, in southwest Johnson County; the Middle Fork Recreation Area (RA), along the Middle Fork of the Powder River; and the Dry Creek Petrified Tree Environmental Education Area, near Buffalo. The Mosier Gulch RA, west of Buffalo, and the Weston Hills RA, in the eastern part of the study area, provide additional recreational opportunities. Historic sites associated with the Bozeman Trail provide recreational opportunities through interpretive programs.

The TBNG provides a variety of recreational opportunities to local residents and visitors on USFS-administered land.

Dispersed recreational opportunities in the study area include hunting, fishing, sightseeing, off-road vehicle (ORV) use, and camping. Hunting is a major recreation use of federal and state lands in the study area; various big game and upland game bird species are hunted in the region. Mule deer and pronghorn hunting are by far the most popular hunting activities in the study area, accounting for 35,529 and 21,304 hunter days, respectively, in 2003 (Stratham 2005). The next highest were cottontail rabbit (2,348 hunter days) and elk (2,055 hunter days), followed by wild turkey (1,019), sharp-tailed grouse (508), and sage grouse (38). Consistent trends in hunter activity over the past decade are not discernible from the WDFG data. All of the most prominent species hunted in the study area have had high years and low years; pronghorn hunting, for example, was greatest from 1993 to 1996, while elk hunting was at its peak in 2001 and 2002. Mule deer hunting has been the most consistent ranging from a low of 28,311 hunter days in 1996 to a high of 37,307 hunter days in 2002.

Recreational use of public lands in the study area has increased substantially over the past two decades, and is expected to continue to increase by about 5 percent every 5 years for most recreational activities (BLM 2001a). ORV use in the study area is allowed on most BLM lands. Nearly all of the TBNG also is available for ORV use. Some private landowners in the study area receive supplemental income from providing public access for hunting and fishing.

There has been a trend toward a reduction in private land available for public hunting in recent years (Shorma 2005). WDFG attributes much of the change to the expansion in CBNG development in the PRB (Shorma 2005; Jahnke 2005). Several factors may be involved including the spacing of CBNG wells and the associated network of roads and support facilities that create both real and perceived safety problems, especially for rifle hunters; mineral royalties and surface reclamation reimbursements reduce a landowner's need for revenue from hunting; and the activity levels associated with CBNG development may displace wildlife from their traditional ranges (Shorma 2005). Coal development is not considered to be a major factor in the reduced hunting access, because it is much more localized with disturbed acreage concentrated in a few areas (Jahnke 2005). Reclaimed mine lands may or may not be available for hunting and other recreational activities depending on site-specific constraints.

CBNG development has had the effect of degrading the hunting experience for those who do hunt in the PRB, resulting in a substantial number of adverse comments in the WDFG's hunter harvest surveys (Jahnke 2005). The loss of hunting land also has created problems for the WDFG, making herd management more difficult and reducing revenues from hunting (Shorma 2005). The reduced access to private land has substantially increased pressure on public lands and has tended to concentrate hunting activity (Jahnke 2005).

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### **Recreation Planning**

The goals of recreation management for all BLM-administered lands in the study area are to provide outdoor recreational opportunities while also protecting resources, providing visitor services, and protecting the health and safety of public land visitors. Details on recreation objectives and standards for BLM lands in the study area can be found in the Buffalo and Casper Field Office RMPs (BLM 1997b, 2001b).

The Medicine Bow-Routt National Forest LRMP addresses recreation in the TBNG (USFS 2001a). National Forest System lands are inventoried and mapped by Recreation Opportunity Spectrum class to identify the opportunities for recreation activities.

The Wyoming Department of State Parks & Cultural Resources has promulgated rules and regulations governing state parks. There is no provision in the rules and regulations governing the development of mineral or other industrial developments within state parks.

Land use plans of the four counties in the study area all address recreation activities and facilities to varying degrees. All consider recreation as an important community asset.

### **ES.2.7.3 Wilderness and Roadless Areas/ Wild and Scenic Rivers**

There are no designated wilderness areas in the PRB study area. There are three BLM WSAs in the study area: the Fortification Creek WSA, the North Fork WSA, and the Gardner Mountain WSA. The WSAs await Congressional action before they can be designated or released from consideration.

There is a USFS “inventoried roadless” area within the TBNG. It was not recommended for wilderness designation but, as with the WSAs, it will not be released from consideration until, and unless, Congress acts on it.

The BLM has identified public lands along four waterway segments in the study area that were determined to meet the eligibility criteria for Wild and Scenic River (WSR) designation. Of the four, only the Middle Fork of the Powder River was determined to be “suitable” for addition to the WSR System.

## **ES.2.8 Noise and Visual Resources**

The study area for noise and visual resource issues primarily is focused on Campbell, Converse, Johnson and Sheridan counties.

### **ES.2.8.1 Noise**

Ambient noise is generally a function of land use and density, although other environmental factors also often play a significant role. Wind, precipitation, wildlife, and insects substantially can increase ambient noise.

Land uses in the PRB study area range from sparsely populated rural ranching areas to more densely populated urbanized areas and industrial areas including coal mining and oil and gas operations. Major sources of noise are larger towns; industrial facilities, such as coal mines and gas compressor stations; and major transportation facilities, particularly higher volume roadways (I-90, I-25, and State Route [SR] 59) and railroad corridors. Frequent high winds raise noise levels well above the ambient levels observed when it is not windy.

Background noise measurements have not been conducted in the study area; however, noise in rural areas away from industrial facilities and transportation corridors is likely to be in the range of 30 to 40 decibels on the A-weighted scale (dBA) when the wind speeds are low. Levels of noise close to industrial facilities and transportation corridors are likely to be in the range of 50 to 70 dBA or more, depending on the source and proximity to the source. The greatest noise from CBNG operations results from operation of multi-engine compressor stations moving gas from gathering facilities to high-pressure transmission pipelines. Noise from compressor stations has been estimated at 55 dBA at 600 feet from the compressor station (BLM 2000b).

The potential effects of noise depend on the spatial relationship between a noise source and noise-sensitive receptors. Noise attenuates over distance; the rate of attenuation also depends on the ground surface, atmospheric conditions, and topography, which either can block or reflect noise transmission. Consequently, effects of noise are site-specific and generalizations over an area as large and diverse as the study area may be misleading if not carefully qualified.

### **ES.2.8.2 Visual Resources**

The PRB study area is in the Great Plains physiographic province; it is bordered by the Big Horn Mountains to the west and the Black Hills to the east. The landscape is composed of open grasslands, low rolling hills, and unobstructed views over many miles in most places. Most of the area is covered with dryland vegetation consisting of grasses and shrubs. Large portions of the northeast quarter of the study area are ponderosa pine forest. Outside the urban centers of Sheridan, Gillette, Buffalo, and Douglas, the study area is characterized by a rural landscape that has been modified by oil and gas field development, coal mines, grazing, and small towns. Portions of the study area remain natural and undeveloped in character despite widespread mineral development and grazing.

Most of the higher quality scenery is found in the western part of the study area. The South Big Horns Area along the Middle Fork of the Powder River has unique scenic resource values. The Powder River Breaks in eastern Johnson County, the Fortification Creek SMA and WSA, and the Weston Hills RA in the eastern part of the study area also provide higher quality scenic settings.

Oil and gas pumping units and associated well pads and access roads are evident in much of the study area. Well development is most evident in Campbell County between Gillette and Wright, and north and west of Gillette. The wells are readily visible and visually dominant in foreground views from roads and trails. At greater distances, oil and gas facilities are less visually prominent; exposed soils of well pads and associated access road clearings are the most obvious features.

The most prominent natural gas features are the large compressor stations. Although colors are usually selected to blend with the surroundings, the scale and character of the structures typically is

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larger and appears more industrial than the agricultural landscape and facilities common to the area. Oil development generally entails the use of pumping "mules" on oil wells and tanks to store the oil awaiting shipment. Though typically smaller than the compressor stations, these facilities are more widely dispersed in the landscape and sometimes exhibit greater color contrast.

Coal mining occurs primarily in the east-central part of the study area, east and south of Gillette. Twelve open-pit coal mines are actively producing coal in Campbell County; one coal mine in Campbell County is temporarily inactive. Open-pit mining results in landscapes that have been altered considerably from their natural character while mines are active. Landscape disturbance from coal mines persists until reclamation has been accomplished.

The BLM is responsible for identifying and protecting scenic values on public lands under several provisions of the Federal Land Protection and Management Act and NEPA. The BLM Visual Resource Management (VRM) system was developed for that purpose. The VRM system includes an inventory process, and a "contrast rating" procedure for evaluating the potential visual effects of a proposed project or management activity.

Four VRM classes have been identified in the study area. Class IV lands encompass 77.8 percent of the study area, Class III 13.7 percent, and Class II applies to 7.2 percent of the area. Class V, Rehabilitation, applies to active coal mines and to certain areas near the larger communities in the study area. Class V is applied to 1.4 percent of the study area.

The Medicine Bow-Routt National Forest inventoried visual resources under the new Scenery Management System, which parallels the BLM VRM system with some variations in application and terminology. Scenic Integrity Objectives (SIO) were assigned to each management area based on the applicable goals for the area. TBNG lands in the study area have been inventoried with two of the possible five SIOs: Low, where the landscape character appears moderately altered by development, and Moderate, where the valued landscape character appears slightly altered.

Three of the four counties in the study area consider the importance of scenic resources through their land use planning policies; Converse County does not.

Most of the study area is not considered visually sensitive because of its remoteness from viewpoints used by the public. Portions of the area that have relatively higher levels of sensitivity to landscape modification occur near communities, along highway corridors, and at recreation-use areas.

## **ES.2.9 Transportation and Utilities**

The study area for transportation and utilities includes all or portions of Sheridan, Johnson, Campbell, and Converse counties. It includes all of the area administered by the BLM Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the TBNG, which is administered by the USFS. State and private lands also are included in the study area.

### **ES.2.9.1 Transportation**

In keeping with the low density of population in the study area, the major road network is quite sparse. In the approximately 120-mile by 140-mile study area, there are only two major north-south highways, I-25 and SR 59, and one major east-west route, I-90. Two additional primary highways, U.S. Highway 14-16 and SR 387, cross the study area from east to west. Several short segments of U.S. highways and secondary state roads and numerous county roads also provide local access to public and private lands in the study area. In addition, there is a complex network of essentially unimproved and only minimally maintained backcountry roads serving the area, some of which are not open to public access without landowner permission.

Traffic volumes on the road network in the study area are highly variable. The highest volume counts are found on major roadways in or near the largest communities. In rural areas, I-90 and I-25 carry by far the largest traffic loads. Current traffic loads are well within the capacity of major highways in the study area. The only discernible pattern of change in traffic volumes over the past 5 years is a relatively large increase in traffic in or near the larger communities. Rates of change in traffic volumes elsewhere in the study area have varied greatly from moderate decreases to sizeable increases. The percent changes in traffic volumes were larger from 1998 to 2003 than from 1994 to 1998, primarily in the Gillette and Sheridan areas. This change in traffic growth rates tracks with the increased population growth rates in Campbell and Sheridan counties in the latter half of the past decade, which have been driven by increases in coal and CBNG employment.

BLM transportation planning for the study area is discussed in the updated RMPs, for the Buffalo and Casper field offices (BLM 1997b; 2001b). New roads across non-federal lands would have to comply with requirements of the state or local jurisdictions, mainly counties. The four counties in the study area have given varying degrees of attention to planning for transportation improvements. Campbell and Converse counties have transportation elements in their comprehensive plans; Johnson and Sheridan counties do not have formal transportation plans. Many of the existing roads within the study area need repairs or improvement. Planned major improvements are addressed in the Wyoming Department of Transportation (WYDOT) 2005 Surface Transportation Improvement Program (WYDOT 2004).

One major railroad, the Burlington Northern/Santa Fe Railroad (BNSF), enters the study area from Montana north of Sheridan, runs southerly through the city, and then southeast through Gillette to South Dakota. A joint BNSF and Union Pacific route, primarily serving coal trains from PRB mines, heads south from Gillette toward Douglas where it splits into southerly and easterly branches. There is a major marshalling yard and repair facility about 5 miles south of Bill. Several spur lines connect directly to mines in the area.

Current coal train traffic averages approximately 144 coal unit trains (loaded and empty) per day, 110 on the southern route and 34 on the northern route (Bartlett 2004; Roark 2004). The number of trains is very close to the number predicted for 1995 in the Powder River FEIS Coal (BLM 1981). The volume of coal shipped is greater than predicted, however, because trains today range from 118 to 135 100-ton cars, rather than the 100 100-ton cars predicted in 1981. Over 75 percent of the coal trains currently head south out of the PRB, compared to a nearly even north-south split predicted earlier. The difference has been accommodated by upgrading the line south of Bill, Wyoming to a triple track configuration.

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Three public airports exist in the study area (AirNav.com 2001); the Gillette-Campbell County Airport northwest of Gillette, Sheridan County Airport southwest of Sheridan, and Johnson County Airport northwest of Buffalo. Federal Aviation Administration regulations require a 2-mile radius safety zone around airports and restrict height of construction within 5 miles to reduce the potential for safety hazards near airports.

### **ES.2.9.2 Utilities**

There are two major electric power line corridors through the study area, both running in a generally north-south direction, both containing 230-kilovolt power lines. The westerly corridor parallels the I-90 corridor from the Montana border to Buffalo, then follows the I-25 corridor through Casper, Douglas, and south to Wheatland. The second major corridor runs along the east side of the study area paralleling SR 59 from the Montana border through the 500-megawatt (MW) Wyodak/Neil Simpson/Wygen Power Plant complex near Gillette to the 750-MW Dave Johnston Power Plant near Glenrock.

The PRB study area is crossed by an extensive network of oil and gas pipelines due to its history of oil and natural gas production. Among the major crude oil lines are the 18-inch Belle Fourche pipeline running northeast from a junction near Kaycee to the Montana state line near the Campbell – Crook County line, and the 18-inch Rocky Mountain Pipeline System line running south to Casper from the same junction northeast of Kaycee.

The gas collection network is expanding as new areas are being developed for CBNG production. There are numerous large diameter natural gas pipelines carrying gas from the gathering lines to markets outside the basin, mainly to the south. There are a pair of parallel 24-inch Fort Union Gas Gathering system lines running south from near Gillette to the I-25 corridor west of Douglas. There is a 24-inch Thunder Creek Gas Services line also running south from fields northwest of Gillette to the I-25 corridor. There are two 16-inch lines running southerly from the Western Gas Resources processing plant near Wright to Douglas.

### **ES.2.10 Hazardous Materials and Wastes**

The study area for hazardous materials and wastes includes all or portions of Sheridan, Johnson, Campbell, and Converse counties. It includes all of the area administered by the BLM Buffalo Field Office, a portion of the area administered by the BLM Casper Field Office, and a portion of the TBNG, which is administered by the USFS. State and private lands also are included in the study area.

As industrial development in the PRB has increased, so too has the use of hazardous materials. Air, water, soil, and biological resources potentially could be affected by an accidental release or misuse of hazardous materials that could occur during transportation, storage, or use for various industrial activities.

In most cases, the regulated materials consist of products and materials that are used and consumed during industrial activities. Examples of such materials could include cement, fuel, solvents, acids, and a myriad of other chemicals and products. Often the hazardous constituents comprise a small percentage of the product being used, the rest of the material in the product being

inert or not defined as hazardous under any of the programs listed above. If these materials are not consumed during ordinary use and are regarded as waste, and if a waste is determined to be a hazardous waste, it must be handled and disposed of according to strict rules under the Resource Conservation and Recovery Act (RCRA). The RCRA program in Wyoming is delegated to the Hazardous and Solid Waste Division of the WDEQ. If the material to be discarded is determined not to be a hazardous waste, the material must be disposed of or recycled in a manner according to the statutes and regulations.

The primary hazardous materials that are consumed during coal mine operations include petroleum fuels and lubricants. The amounts of these materials would vary considerably from mine to mine based on production methods and overall output from the mine. The primary fuel used is diesel for excavators, heavy equipment, and haul trucks. The fuels are stored at the various mines in tanks (whether aboveground or underground) that have release containment systems and spill contingency plans to handle leaks and larger spills.

In addition to storage of fuels and lubricants in stationary tanks, mobile tanker trucks are used to provide fuel for excavators, haul trucks, and other equipment. Portable tanks and drums also are stored in a manner to prevent spills from reaching soils or water. Used oil is recycled to a licensed used oil recycler during the life of the mine.

During the operational lives of the mines, the probability of minor spills of materials such as fuel and lubricants would be relatively high. These releases could occur during fueling operations or from equipment failure (e.g., hydraulic hose failure). Spills of this nature would be localized, contained, and disposed of in accordance with the applicable laws and regulations. Accidents involving other hazardous materials also could occur during mine operation. The mines are required to develop and maintain a site-specific Spill Prevention, Control, and Countermeasure (SPCC) Plan to deal with unplanned releases of petroleum products. They also have prepared Emergency Response Plans that establish procedures for responding to accidental spills or releases of hazardous materials to minimize health risks and environmental effects. The plans include procedures for evacuating personnel, maintaining safety, cleanup and neutralization activities, emergency contacts, internal and external notifications to regulatory authorities, and incident documentation. Proper implementation of the SPCC and Emergency Response plans has reduced the potential for major impacts associated with potential releases of hazardous materials.

Some of the materials listed above may become hazardous wastes (i.e., spent solvents). Materials that are considered hazardous must be accumulated, transported, and disposed of under very specific requirements. A review of the U.S. Environmental Protection Agency's Enforcement and Compliance History Online database indicates that the coal mines in the PRB do not generate large amounts of hazardous waste, and most of the mines are classified as Small Quantity Generators or Conditionally Exempt Small Quantity Generators.

Drilling operations for conventional oil and gas, and CBNG are very similar. Many of the potentially hazardous materials used in drilling the wells are the same. However, the amounts of material for CBNG wells are somewhat less, because the wells generally are much shallower. The materials used in these industries include fuels, lubricants, additives, and explosives. In addition to materials used in the drilling of wells, there are materials that are used and consumed in the production operations of oil and natural gas wells. Some materials may be used exclusively for oil well

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operations and others used exclusively for gas wells and associated gas processing and compression.

Oil and gas well operators also must comply with requirements for the transportation, storage, use, and disposal of potentially hazardous materials. In addition, certain wastes derived from oil and gas drilling and production operations are exempt from regulation as hazardous wastes. Instead, these waste materials must be disposed or recycled according to applicable rules and regulations either under the jurisdiction of WDEQ or WOGCC. Examples of wastes that are exempt include produced water, drilling mud and cuttings, and completion and workover fluids.

In addition to the potentially hazardous materials that would be used and generated during oil and gas drilling and production operations, the products derived from these operations are considered hazardous. Oil, condensate, natural gas liquids, and methane can be considered hazardous materials either because of their volatility or explosive nature. There are standards and regulations that apply as well to the storage and transportation of these products.

Natural gas pipelines also would use potentially hazardous materials. Materials typically used in the construction and operation of transportation pipelines includes fuels (diesel, gasoline, methane), lubricants, water treatment chemicals, ethylene glycol, propylene glycol, methanol, sand blast media, and acids.